

For Appropriate Maintenance of Anchors in Dams

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1. Introduction

Of the dams under the administration of the Ministry of Land, Infrastructure and Transport (MLIT), those that have passed over 30 years since the start of operation account for about 40%, and many anchors have been installed to date. Maintenance of dam facilities has been appropriately performed in accordance with the dam maintenance standards prepared in each dam and safety and functions of dams have never been affected by deterioration of anchor, etc. However, deterioration of anchors has become apparent in some of them.

In maintenance of anchors in existing dams, there are such issues that main structures are located in invisible areas and that the inspection procedure for ground anchors is referred to but inspection procedures and frequency greatly differ according to each dam site. Then, we are studying methods for desirable inspection in order to maintain anchors appropriately and keep their functions.

2. Points of attention in maintenance of anchors in dams

The subject of this study is what is essential for safety and functions of dams, such as anchors, etc. used in the fixed part for transmitting the load acting on dam gate, etc. to the dam body concrete etc. or constructed to reinforce the dam foundation rock.

We also organized the results of surveys on the literature concerning anchor maintenance in and outside the country and on the cases of deterioration / repair of anchors used in domestic dams and the results of field trial inspections. Main points of attention in maintenance obtained as a result of such work are as follows.

(1) Appearance and anchor head: More than half of the past cases of anchor fracture occurred in the anchor head. Therefore, maintenance of the head part is the most important. Attention should also be paid to corrosion in the back of the head and ensuring the waterproof function. A method of checking the back of the head with an industrial endoscope is being developed.



Figure 1. Example of Anchor Used to Reinforce the Dam Foundation Rock



Figure 2. Lift-off Test Conducted in Trial Inspection

(2) Prestressing / anchoring: For unbond-type anchors, which do not fix tendon area with grout, periodically check the residual prestressing force with lift-off test, etc. For bond-type anchors, which fix tendon with grout, it is difficult to measure prestressing force but there is an approach for checking prestressing force with a survey method using supersonic waves.

(3) Corrosion / rust prevention: Attention to corrosion is required for the old type anchor (not covered by the Guidelines of Japanese Geotechnical Society revised in 1988), which is inferior in corrosion protection function. For tendon, attention should also be paid to "delayed fracture" a phenomenon that a minor damage suddenly expands to a major fracture, which occurs even when it seems sound in appearance.

3. Future schedule

We plan to organize the results of literature survey, case studies, and actual condition surveys as "Inspection Manual for Anchors Used in Dams" for the purpose of more appropriate and reasonable maintenance and ensure that it will be utilized in practical operation of dam maintenance.