

An Experimental Work employing Bon Terrain Method to cope with channel clogging in Imokawa River

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1. Preface

Niigtaken-Tyuetu Earthquake which took place on 23 October, 2004 had hit hard the area closer to the epicenter and caused a lot of landslides, slope failures and blockage of river channels.

The blockage in the reach of Imokawa river at Higashi-takezawa district was, among many other cases, the largest in terms of the thickness of the earth materials in the channel.

The earth mound was very much prone to crumble in case flood water overtopped it and as a result, potential disasters due to mudflow were expected.

In order to prevent potential disasters due to overtopping, it was decided that, while lowering water levels in the reservoir by means of drainage pumps, emergency drainage channels be set up.

The working conditions at the site was so bad because the soil materials derived from landslide were extremely soft and, after a rain fell, got much more muddy in one's knee-high boots.

In order to secure smooth implementation of the drainage works, it was urgently needed to harden the muddy soil. The Bon-terrain method was therefore employed in order to consolidate the ground to be used for stock yard as well temporary road. The results were favorable.

2. Outline of the Bon-Terrain method

The Bon Terrain method aims at soft-ground stabilization by mixing soft sludge from construction sites with shredded waste paper. Shredded waste paper is effective to reduce water content of soft sludge and to increase shearing resistance of the soil.

Cement or fixation agent can be added in order to increase dynamic strength of the soil.

Bon Terrain Method has the advantages as follows;

- 1) shredded waste paper, chiefly wasted newspaper, contains no pollutant since the ink used for printing is made from vegetable oil,
- 2) soft sludge from construction sites and dredged spoil of which water content is more than 500 % can be solidify into crumbled structure. It requires no dehydration process and the products are easy to convey as soon as finishing.
- 3) the time required for processing is approximately half an hour,

4) a simple machinery such as a backhoe equipped with mixing machine is enough.

3. Application of the method for stabilization of the sites for stockyard and temporary road

The area in which the Bon Terrain Method has applied was the stockyard located on the sliding mass and the temporary road. The total area is as wide as 1,600 m² and the thickness is 50 cm. The quantity of the earth material stabilized is as much as 800 m³. (Photograph 1)

The soil of the sliding mass was so much blunged due to excess rainfall and as a result of frequent move of heavy-duty machines that The condition of the soil at the work site was very bad. Workers were obliged to work in the knee-deep mud. The water content of the soil was estimated as much as 90 %.(Photographs 2)



Photo.1: Blockage of river channels in Higashi Takezawa



Photo.2: The soil (mud) state before the work

Photograph 3 shows the backhoe and its attachment which agitate the sludge mixed with mud and paper.

As a result of the stabilization work, water content of the soil reduced dramatically and it was confirmed that the soil took aggregated structure. Cement was added, as much as 50 kg/m³ for the stockyard and 70 kg/m³ for the temporary road, in order to increase compression strength of the soil. (Photograph 4)



Photo.3: Mixed with mud and paper



Photo.4: Mixed cement

The stabilization work was so successful that, after 3 or 4 hours, the soil of the yard and road grew tough enough to accept larger dump trucks and backhoes as shown in the Photographs 5 and 6.



Photo.5: A larger dump truck running state



Photo.6: A backhoe running state

The surface of the yard and the road got solid enough and corn penetrometer could no longer penetrate into the soil.

As much as 60 m³ of soil was stabilized in a day in this case, this time, but the efficiency can be increased up to 100 to 150 m³ a day using a backhoe of which mixing attachment is as large as 0.7 m³, if wide free space could be available.



Photo.7: Examination which used corn penetrometer

4. Conclusion

It was proved that the Bon Terrain Method was quite effective to stabilize muddy soil, and it took only half a day to have the effects of the work.

The work area has been expanded to the areas out of Higashi Takezawa. Furthermore, spoil with high water content could be used as filling materials of a cell-type dam if it is stabilized using this method.

Useless muddy soil featured by high water content rate can be used as the material for emergency works by applying Bon Terrain Method.