Bending Test for Liquefied Stabilized Soil with Steel Rebar

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ABSTRACT

Thrust force is generated at pipeline bends due to internal pressure. The thrust forces can induce joint separations of the pipelines. In Case of high internal pressure, effective methods for thrust restraint are required. Methods for thrust restraint using liquefied stabilized soil reinforced with geosynthetics are proposed in this paper. The behavior of the bends backfilled with liquefied stabilized soil is not cleared. We expect that the liquefied stabilized soil is an effective backfill material against the thrust force. In addition, the geosynthetics contributes to restrain the failure of the liquefied stabilized soil.

In this paper, bending tests of the liquefied stabilized soil in order to verify the effect of the proposed methods for thrust restraint are discussed. The liquefied stabilized specimen was cured for 7 days in a mold having a length of 1000 mm, a width of 150 mm, and a depth of 150 mm. The geosynthetics were changed in various ways. After cured, the bending tests were carried out. The liquefied stabilized specimen was vertically loaded at 1 mm/min, using a jack to simulate the thrust force. The load and the vertical displacement of the loading plate were both measured.

The results show that the bending stiffness in case using the liquefied stabilized soil with geosynthetics was increased. It is verified that the proposed method is extremely effective against thrust restraint.

KEY WORDS: Buried pipelines; Thrust force; Bending test, Liquefied Stabilized Soil, Steel rebar

INTRODUCTION

Generally pipeline for irrigation is subjected to internal water pressure. In bend in such pressure pipeline, thrust force is generated depending on the pressure level and bending angle. This thrust force tends to move the bend of underground pipeline outward. Commonly, the thrust force is resisted by the passive resistance acting on the pipe bend. A concrete block is installed at the pipe bend when the thrust force is larger than the passive resistance. However, it is expected that such heavy concrete block becomes a weak point during earthquake because the concrete block moves largely due to inertia.

For these problems, authors proposed a lightweight thrust restraint using a geosynthetics as shown in Figure 1.

In this method, pull-out resistance of geogrid and passive resistance acting on bend can be expected to counterwork against the thrust force. In addition, authors conducted model tests, large scale tests, and numerical analyses to investigate the effect of the proposed method. As the results, it was verified that the proposed method was extremely effective against the thrust force.

In this paper, methods for thrust restraint using liquefied stabilized soil with reinforcement were discussed. The liquefied stabilized soil has been used as the backfill material of the pipelines recently, but it has been unknown how the bends of the pipelines behave when backfilled with the liquefied stabilized soil. We expect that liquefied stabilized soil is an effective backfill material against the thrust force. Liquefied stabilized soil is brittle material, so reinforcements contribute to restrain this failure of liquefied stabilized soil.

This paper discuss bending tests of the liquefied stabilized soil with reinforcement in order to verify the effect of the proposed methods for thrust restraint.