Field Test on Lightweight Thrust Restraint for Buried Bend

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ABSTRACT

Thrust forces are generated at bend pipes caused by internal pressures. Generally concrete blocks were installed at bends to resist thrust forces. However, it was reported that concrete blocks were one of weak points during earthquake. In our previous study, lightweight thrust restraint using geogrid was proposed. In this study, the field test on the lightweight thrust restraint for buried bend pipe was carried out to examine the behavior of the bend pipe with the proposed method on field. From the result, it was found that the steel bend pipe with the proposed method was stable in the irrigation pipe.

KEY WORDS: Buried bend; Field Test; Geogrid; Lightweight.

INTRODUCTION

Generally, pipelines for irrigation are subjected to internal water pressure. In bend pipes in such pressure pipelines, unbalanced forces, which are called thrust forces, act on depending on the magnitude of internal pressure and the bending angle. Thrust forces act on bend pipes outward and tend to move the bend pipes. Passive earth pressures acting on the bend pipes resist thrust forces. If thrust forces are larger than passive forces, thrust restraints are required. Commonly, concrete blocks are usually installed at bend pipes.

However, it was reported that concrete blocks were one of weak points in earthquake. In the Hokkaido-Nansei-Oki earthquake in Japan in 1993, the concrete block at a bend was largely moved in liquefied ground due to thrust force and an adjacent pipe was slipped out as shown in Fig. 1 (Mohri et al, 1995).

In our previous study, a thrust restraint using geogrid was suggested as shown in Fig. 2(a) (Kawabata et al, 2005). Geogrid was connected with a back of a bend pipe. In the proposed method, the tensile force in the geogrid was generated with the movement of the bend pipe. It was considered that thrust force was supported by passive earth pressure, pull out resistance and passive resistance in the proposed method as shown Fig.2(a). In order to verify the effectiveness of the proposed method as thrust restraint, laboratory model tests, large-scale tests (Sawada et al, 2008), numerical analysis and shaking table tests (Kawabata et al, 2008) were carried out. From these results, it was