NEW THRUST PROTECTING METHOD FOR BURIED PIPE USING GEOGRID GABION

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BACKGROUND

On the bend of a buried water supply pipeline, the thrust force is applied to the ground. A concrete block is typically installed at the bend section of the pipeline as a thrust protection measure (Fig. 1a). However, a concern exists that the stability of the concrete block might not be maintained when the ground around the concrete block liquefies during an earthquake.

NEW THRUST PROTECTION

New thrust protection using a geogrid gabion as a pressure-receiving structure to protect against thrust force is proposed. The geogrid gabions, consisting of a geogrid basket and gravel (Fig. 2), are installed in the passive area (Fig. 1b).

- Using gravel material of high permeability as the filling material, the excess pore water pressure around the buried pipe is expected to be dispersed to retain effective stress during an earthquake.
- The gabion is not expected to significantly deform by the thrust force because the gravel material is confined by the geogrid basket.

These mechanisms might ensure resistance to the thrust force without increasing the weight of the bend.

THE EFFECTS OF NEW THRUST PROTECTION

The effects of the proposed method are evaluated by conducting model experiments. In the model experiments, a constant load was applied laterally to a buried pipe model in the model ground where the internal effective stress was decreased by increasing hydraulic gradient stepwise.

- The lateral displacement of a pipe with a gabion decreased compared to that of a pipe without a gabion in the ground where the effective stress decreased.
- By expanding the gabion width, the rotational behavior and bending behavior of the gabion were suppressed by increasing the frictional resistance and bending stiffness of the gabion.

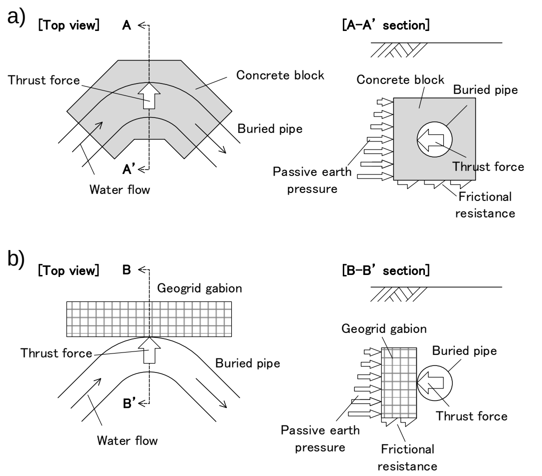

Fig. 1 Schematics of a) conventional method using a concrete block and b) the proposed method using a geogrid gabion.

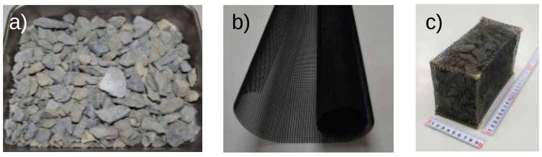

Fig. 2 a) gravel, b) polymer geogrid, and c) geogrid gabion model.

Table 1 Experiment conditions

	Geogrid gabion model	
	W [mm]	Layout
Case N1	None	15 mm, 100 mm, D=50 mm, W
Case A3	25 (0.5D)	
Case B5	50 (1.0D)	
Case C1	75 (1.5D)	

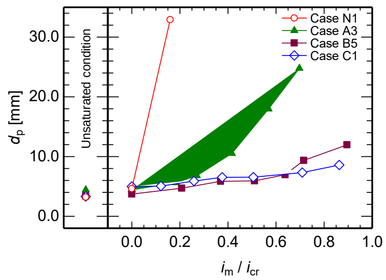

Fig. 3 Relationships between pipe displacement, d_p and excess pore water pressure ratio, i_m/i_{cr}

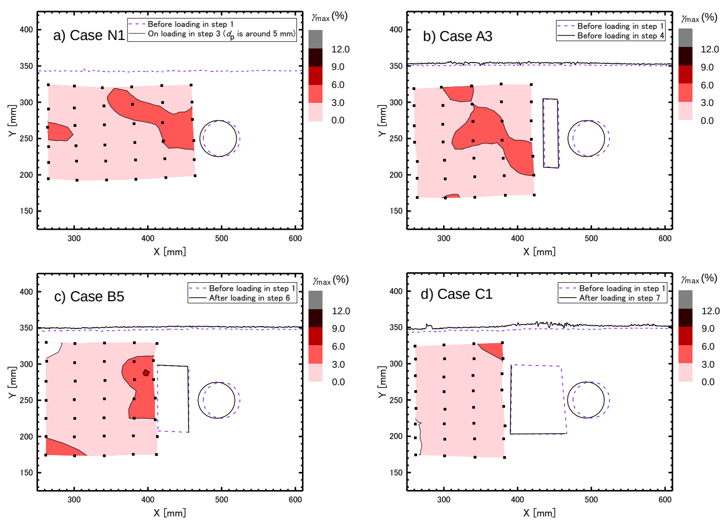

Fig. 4 Distribution of maximum shear strain in the model ground when d_p is 5 mm to 7 mm

Publication: Araki H. & Hirakawa D.:Effects of thrust protecting method for buried pipe using geogrid gabion of different sizes, *International Journal of GEOMATE*,16(58), pp.62-68, 2019.