

Research on calculation of thrust for pipe jacking method

Period

1999.1 ~ 2000.3

39P ~ 42P

(Purpose)

The problem has been indicated for the present thrust calculation formula, since it just suit for limited construction cases, can not deal with present situation using the latest equipment and the trend to be long-distance of the construction for the cost reduction.

On big intermediate caliber jacking method of the mechanized excavation, whether the difference between the calculated thrust by thrust calculation formula and actual thrust is in common with each method of the jacking methods, And, the general investigation analysis under the same condition has been not carried out for the difference of each other, though there are the individual example of results investigation of the jacking method. Therefore, it is difficult to general evaluate, while compare the thrust calculated by thrust calculation formula of the individual method with actual thrust, and it is not possible to accurately judge the necessity of the review.

Accordingly, with the survey of thrust in actual situation and data analysis were carried out on earth pressure shield and slurry shield of 2 methods, the difference between the thrust calculation by the thrust calculation formula and actual thrust was quantitatively grasped, it was judged that the review of the present thrust calculation formula is appropriate. And, the thrust calculation formula was unified by considering the difference between each construction technique 2 methods mentioned above. In this study, the new thrust calculation formula which matches actual condition will be proposed.

Still, on the sludge style jacking method, that the review was carried out in the (Corp.) Japan sewerage sewer propulsion technology association in November, 1999, the second edition of "the jacking method design estimate outline sludge style jacking method edition" was issued, and excluded from the object of present examination.

(Contents)

Considering conditions of application of proposed equation, the construction case of collection and analysis of the data was made as the follows.

Inner diameter: f 800 ~ 3000mm. extension: beyond 200m (the depth of gravel soil is over 150m)
slurry method, earth pressure method.

By putting on thrust reduction coefficient β in a circumferential resistance force per unit length of the jacking pipe (the part of underlined equation), the proposed equation was made to be an equation of the following which reduces thrust.

$$F = F_0 + \beta \{ \underline{(p \cdot Bc \cdot q + W) \mu' + pBcC'} \} L$$

Where,

F : thrust, F_0 : initial resistance force, Bc : pipe outer diameter, q : Uniformly distributed load, W : Weight of the pipe and μ' : friction coefficient between pipe and soil, C' : adhesion force between pipe and soil, L : Propulsion extension, β : Propulsion power reduction coefficient.

Tab.1 Thrust reduction coefficient table

Soil classification	Value
Clay	0.35
Sand	0.45
Gravel	0.6
Consolidated soil	0.35

As a result of examining using the statistical technique, thrust reduction coefficient value β was showed in table -1.

(Result)

In the future, for thrust calculation of the jacking method, the designed value in coordinate to the actual thrust is able to get by adopting this proposed equation. It is considered that the more rational design can become possible by this mean.

Still, this proposed equation was also adopted in "guideline and explanation (2000 editions) of the sewerage jacking method" of the sewerage association.

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Key Words

Propulsion power calculation formula muddy-water-method method, geostatic method