

## Research on practical application of segment using steel pipe insertion style joint between rings

Period

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75P ~ 80P

### ( Purpose )

Until now, there are many cases in which the bolted joint (short bolt + steel plate ) is used as a joint of segment. However, the various joints aiming at cost reduction of shield construction by reduction of segment price and shortening assembly time recently have been developed and used in practice. But, because there are problems of having too many joint parts and being structural complexity due to the joints, in this study, by pushing male metallic material (anector, outer diameter 45mm) of big diameter into the female metallic material (conductor, inner diameter 44mm ) embedded in the segment, the steel pipe insertion style joint which enables the junction between rings of segments was focused on.

This joint used between rings can be fastened only by jack thrust, and it is suitable for labor saving, speedup, automation of construction, in addition, the cost reduction of segment production can be also expected considering the simple structure. Moreover, by using the boltless type joint of segment, it can be also expected for the utilization of inside smoothing and secondary lining omission.

In this study, the segment using such joint is evaluated through the demonstration construction, and the examination for the practical application in design and construction is carried out, moreover it is made to contribute to cost reduction of the sewerage shield construction through examining applicability to the secondary lining omission type segment.

### ( Result )

Main results of the scientific research in the 2000 fiscal year are as follows.

#### (1) Examination on design.

By the experiment on the assumption of the peeling in the junction of the anector powder coating, it was confirmed that assuming necessary push force 300kN or less and strength over requirement pulling power 150kN were obtained in design, when the powder coating exfoliated 50%.

#### (2) Examination of the workability (demonstrative construction )

The demonstrative construction was carried out in straight interval of 100 rings in the 2 construction of second Asakusa trunk line ordered by Tokyo Metropolitan Gov., Bureau of Sewerage. Constructive research results are as follows.

It was possible to improve the production workability and secure the production accuracy.

By the performance verification test used real segment, inserting and pulling force and shear capacity also satisfied necessary value.

Segment assembling time was shortened about 9% than the bolted joint. And, the shortening of about 13% becomes possible by proper arrangement of shield jacks.

Roundness and irregularity quantity after the segment assembly were compared with the case of bolted joint, they became identical and more, and, the aperture quantity also satisfied the tolerance.

The excavation quantity became 7.9m/day, when calculation result and work efficiency of the construction estimates were considered, and about 5% was improved.

#### (3) Examination of application.

The improvement in inside smoothness and assembly accuracy were confirmed by the demonstration construction, moreover, for the aperture occurred in the earthquake it can deal with the corrosion of the joint, that the segment using this joint was suitable for the secondary lining omission can be considered.

#### (4) Reduction of construction cost.

As the result of cost estimation by the case study of demonstration construction site for the secondary lining omission, it becomes the about 13% cost reduction in the case of without assembly bolt, while about 6% cost decrease in the case of with assembly bolt.

The same as the mentioned, the followings were confirmed : that improvement of workability in the segment assembly, shortening of the time, and improvement of production are more possible for the segment using steel pipe insertion style joint between rings than the segment using conventional bolted joint, in addition, it is a segment suitable for the secondary lining omission type.

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| Key Words | Shield tunneling, ring joint, steel pipe insertion style |
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