Talk on New Tunnel Excavation Method Using Abrasive Waterjet

TUNNELLING AND UNDERGROUND SPACE TECHNICAL DIVISION

reported by
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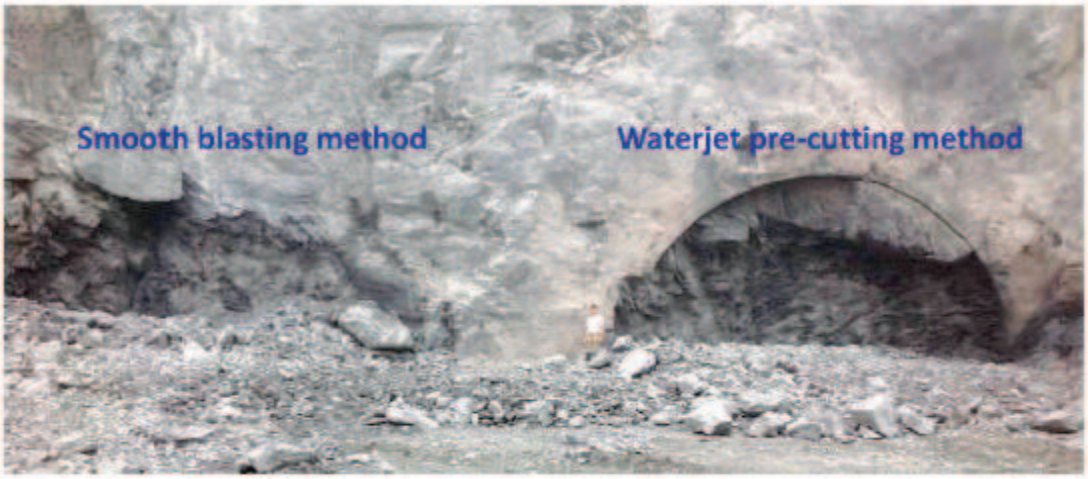


Prof. Cho Gye-Chun of Civil and Environmental Engineering, Korea Advanced Institute of Science and Technology (KAIST) delivered a talk on abrasive waterjet on 17 June, 2015. The talk was organised by IEM's Tunnelling and Underground Space Technical Division (TUSTD) and was attended by 41 IEM members.

CONVENTIONAL ROCK EXCAVATION METHODS

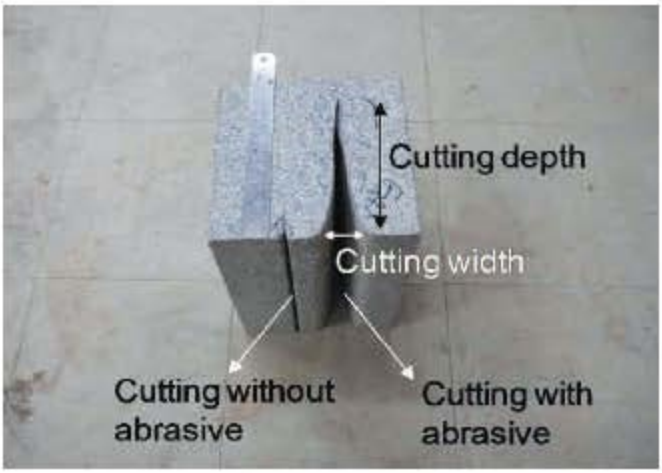
As an introduction, Prof. Cho gave an overall assessment of the conventional rock excavation methods, namely power breaker, tunnel boring machine, hydraulic wedge expansion and drill & blast. In particular, the conventional drill & blast method is the most commonly used in tunnelling. However, this has many weaknesses, such as serious levels of vibration, excavation damaged zone, over-breakage and under-breakage. With this method, there are also a lot of civil complaints and increased construction cost. So a new tunnel excavation method was developed, using abrasive waterjet.

ABRASIVE WATERJET TECHNOLOGY

The new method combines conventional drilling and blasting process or mechanical excavation process with free surfaces on the perimeter or at the face of a tunnel, which are formed by the cutting of the abrasive waterjet.

Since the development of waterjet technology in 1908s, the present researchers focused on the study of rock material using abrasives, improving performance and emergence of high-performance pump.

Prof. Cho gave an insight into KAIST's experience on optimising the water jet parameters through experimental tests.



Interestingly, the water pressure applied is up to 314 MPa and at various traverse speed. A critical pressure of approximately 70 MPa is required to initiate the cutting and there is an optimum feed rate of abrasive (10.33 g/s) because of particle collision.

DATA FROM FIELD APPLICATIONS

Prof. Cho shared the outcomes of using this new method from macro-scale model and in-situ field experiments. The results of field applications show that the developed method has distinct advantages of very low vibration, no over or under-breakages and no excavation damaged zone.

It is expected that the new method can improve safety and stability, reduce public complaints, decrease support system quantity and decrease construction period & cost. Consequently, the new method can be effectively applied to urban rock excavation sites where high levels of silence and stability are expected. ■