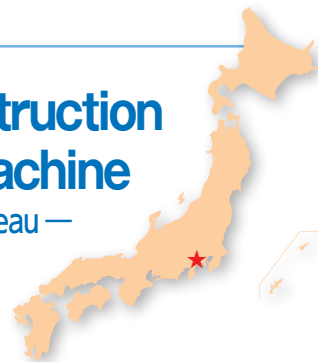


Improved Safety and Productivity in Tunnel Construction Work through Utilization of a Rock Bolt Driving Machine

— Construction Work for the Kiyo No.3 Tunnel of Chugoku Regional Development Bureau —



1. Introduction

In order to secure the safety of rock bolt driving in mountain tunnel construction works, we have jointly developed “BOLTINGER”, an automatic rock bolt driving machine as shown in the Figure 1, with Furukawa Rock Drill Co., Ltd. As the construction work for the Kiyo No.3 Tunnel of Chugoku Regional Development Bureau is designed to drive 6m rock bolts for the entire line, BOLTINGER has been deployed to save labor, improve safety, and speed up the cycles of rock bolt driving.



Fig. 1 “BOLTINGER”, a special driving machine for rock bolts (with 2 booms and 2 baskets)

2. Characteristics of BOLTINGER

This machine has the following three characteristics:

- (1) A mortar feeder integrated to the rock bolt driving machine to save labor for ground work;
- (2) A guidance function for drilling work to improve the productivity in rock bolt driving work; and
- (3) Obtaining of various data during drilling and understanding of information on the ground to realize safe work.

The Kiyo No.3 Tunnel is a fragile large-section tunnel with an excavation cross-sectional area of over 120 m². As shown in the joint bolt specifications in the Figure 2, the aforementioned 6m rock bolts have been driven for the entire line. BOLTINGER has saved the labor for driving these rock bolts that are longer than the regular ones and improved the productivity and the construction speed.

3. Rock Bolt Driving by BOLTINGER

In the rock bolt driving work by BOLTINGER, a driving hole is drilled first by the drilling boom. After drilling, the boom position of the driving device is determined; mortar is automatically filled as shown in the Figure 3; and then, bolt insertion (including for uniting only) is performed. As

the magazine can keep ten 3m bolts, bolts are loaded to the magazine by the lower part of boom each time after five 6m rock bolts are driven.



Fig. 2 6m joint rock bolt

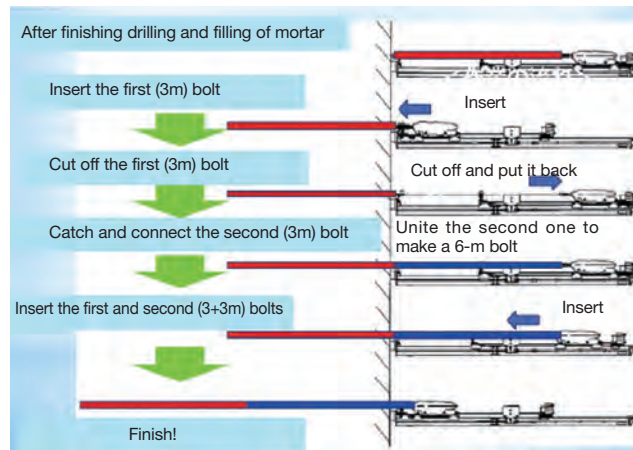


Fig. 3 Rock bolt driving sequence

4. Evaluation on BOLTINGER

Workers have highly rated the usability of BOLTINGER in general. As driving of 6m rock bolts is a tough work, use of machine for this work is beneficial. On the other hand, this machine has three booms; however, one of them is dedicated to rock bolt driving, which means that the actual construction performance just equals to that of 2-boom jumbo. Therefore, it is necessary to improve the operation methods to ensure higher cycle performance and improved construction speed by implementing preboring of face in an idle time or other appropriate measures while ensuring efficient rock bolt driving.