

Haka-router®: A Wireless Strain Measurement System of Steel Supports

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Haka-router® wirelessly measures the strain of steel supports. It wirelessly transmits strain measurement data, monitors it in real time and alerts face workers of danger when stress increases. Following are the features of this system:

- 1) Setting the threshold value for stress allows the system to alert face workers of danger with sound and light when stress exceeds the value. The system is useful for stress measurement of not only steel supports, but also shotcrete stress and rock bolt axial force.
- 2) Since the transmitter is attached to the steel support outside the tunnel, such as in the material yard, there is no hazardous wiring work at the face of the tunnel or delay in the excavation work. The transmitter's base is covered with resin and the body is covered by a steel protector to withstand the vibrations of tunnel works, blast waves and vibrations caused by blasting, and spring water. The transmitter lasts for about 1.5 months, the time needed for the tunnel's displacement convergence, and it can be reused by recharging the battery.
- 3) The receiver, alarm lights, and tablet PC for measurement are installed as a set in the tunnel, and the distance between the transmitter and receiver can be up to 50 meters, thus the measured values can be remotely monitored.

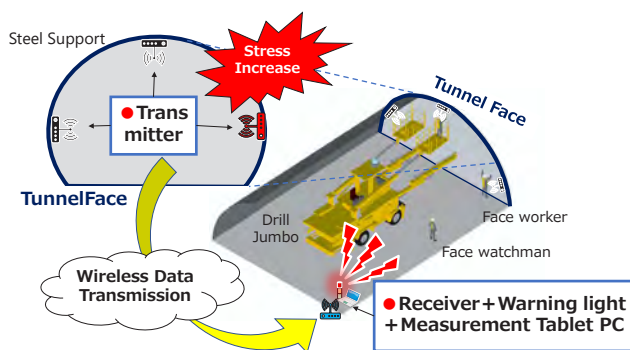


Fig. 1 Haka-router® device configuration

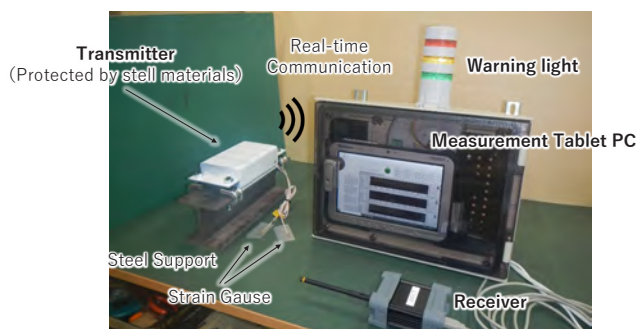


Fig. 2 Haka-router® device set

Remote Operation Using Double-boom Rock Bolt Machine

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The "Remote Rock Bolt Installation System" that mechanizes rock bolting process consists of a double-boom rock bolting machine and an automatic mortar feeding system; a technology that enables seamless operation of a series of work processes from rock bolt drilling to rock bolt insertion in accordance with the high-precision navigation.

The bolting unit (Figure-2) is comprising a drilling equipment (with HD210S drifter), a motor feeder, a rock bolt magazine (stores 9 bolts), and a rock bolt ejector (with HD30 drifter), and the system has a total of 2 bolting units.

The large-size automatic motor feeder is controlled by a level sensor and a timer, and depending on the mortar consumption, it can automatically feed 2 motor pumps for left/right boom with mortar at the maximum speed of 84.8kg/min.

The finished shape of rock bolts and the amount of mortar charge are displayed on the control panel for monitoring and stored automatically in the database. Mechanization of rock bolting enables to shorten excavation cycle time, improve work safety, construction quality, and accuracy of finished shape, and thus, significant improvement of productivity is expected.

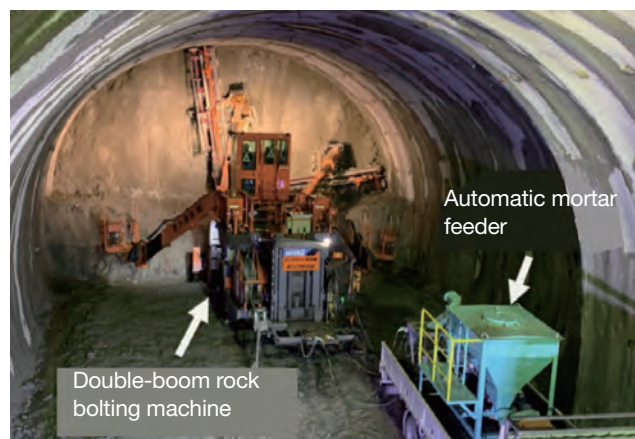


Fig. 1 Remote Rock Bolt Installation System

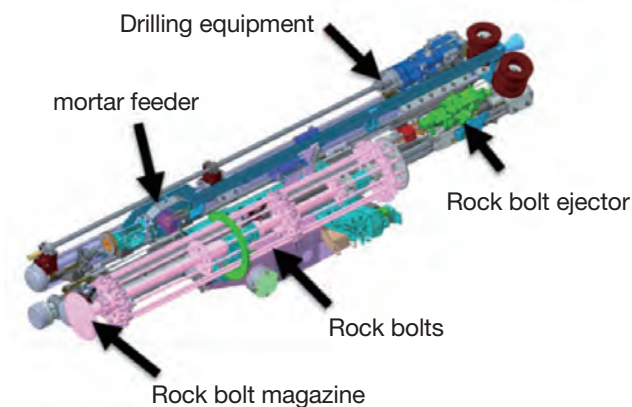


Fig. 2 Bolting Unit