



A⁴CSEL
A:Automated
A:Autonomous
A:Advanced
A:Accelerated
Construction system
For Safety , Efficiency and Liability

A⁴CSEL

"Transforming the construction site into a factory"

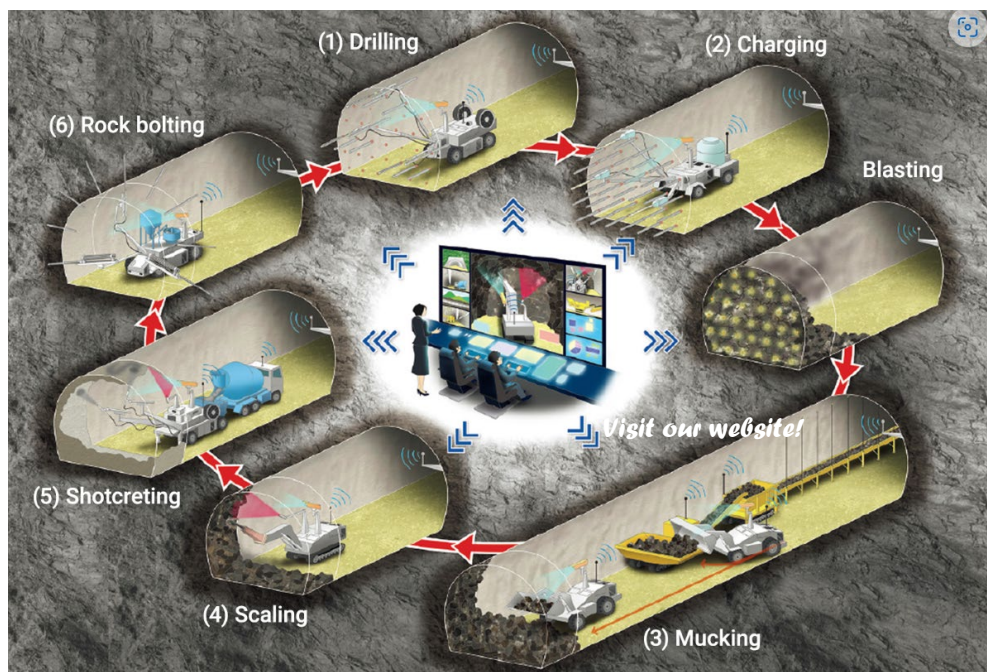
What is A⁴CSEL ?

Developed by Kajima Corporation, A⁴CSEL (pronounced "quad-accel") is a next-generation construction production system with automatic operation of construction machinery at its core. A⁴CSEL is based on the concept of operating multiple automated construction machines—with few workers— in a manner that assures to construction work is performed effectively and safely.

A⁴CSEL for Tunnel

The field of application of A⁴CSEL is being expanded from dam construction to mountain tunneling. Aiming to make all work around the tunnel face (which is accompanied by high risk of accidents such as collapse) during construction of mountain tunnels unmanned, we are promoting the automation of all such work by adopting A⁴CSEL.

In order to improve safety, productivity, and quality in mountain tunneling, "A⁴CSEL for Tunnels" automates the six construction steps involved in excavation work for constructing mountain tunnels. It thereby enables efficient, unmanned work at the tunnel face, with high risk of collapse and other hazards, which until now have relied on skilled workers.



Kajima's concept of "A⁴CSEL for Tunnels"

Brush up automated construction techniques with muck-up tunnels

In November 2018, as a base for developing automated technology for mountain tunnels, a mock-up tunnel was opened at Fuji City, Shizuoka Prefecture. In May 2021, we succeeded in mucking work with an automated wheel loader and shotcreting work with an automated shotcreting machine.



Automated shotcreting machine in the mock-up tunnel



Automated wheel loader in the mock-up tunnel

Implementing on automated construction using rock mountain—the first attempt of its kind in the industry

To demonstrate the blasting planning technology developed to accomplish "blasting excavation without overbreak" and many other automation technologies developed to date in an environment equivalent to that of an actual construction site, we are trying an industry first by actually excavating a test tunnel owned by Kamioka Mining co. Ltd.

Through demonstration tests in the field, we aim to automate the six steps in tunneling, namely, drilling, explosives loading/blasting, mucking, scaling, shotcreting, and rock bolting, to achieve unmanned operation around the tunnel face. In this way, we will establish a construction system that achieves a high degree of both safety and productivity by enabling optimal automatic operation.



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To explain the mysteries of the universe,
We achieved digging tunnels at tremendous speeds.

Two tunnels stretch straight ahead for 3000 meters.

In Kamioka town, Hida City, Gifu Prefecture, home of the “Super-Kamiokande” observatory,
the tunnels had been constructed for the purpose of setting up a large-scale cryogenic gravitational wave telescope.

The KAGRA is a device used to measure “gravitational waves”,
planned by the Institute for Cosmic Ray Research at the University of Tokyo.

Gravitational waves are physical phenomena of ripples in the curvature of space-time.

To respond to the hopes of researchers to begin observations as soon as possible
so they can become the first in the world to detect gravitational waves,

Kajima Corporation dug the tunnels at an unprecedented maximum speed of 359 meters a month.

Kajima Corporation will continue to respond to the needs
of many people through its technology.