The Robot Award

First Prize (Social Infrastructure, Disaster Response, Fire Fighting Category)

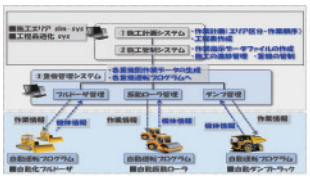
A⁴CSEL® (quad-accel)

The next-generation construction production system with automatic operation of construction machinery at its core

Kajima Corporation

Turning civil engineering sites into state-of-the-art factories

A⁴CSEL development concept



A⁴CSEL configuration

In-use on site (embankment dam, 2018)

■Outline of A⁴CSEL

The A⁴CSEL (Automated/Autonomous/Advanced/Accelerated Construction for Safety, Efficiency, and Liability) was developed to solve important issues in the construction industry such as the shortage of labor and skilled workers, construction productivity, and industrial accidents. It is a construction like none other, that automates general-purpose construction machines, and allows multiple machines to operate automatically at the same time to perform work without the need for a lot of manpower. By sending work data, the automated construction machines can perform routine and repetitive tasks automatically and unattended. By operating a large number of machines simultaneously and with a minimum of personnel, productivity and safety can be greatly improved. The A⁴CSEL consists of the following: **1. Technology to modify general-purpose construction machinery to automatic operation specifications. 2. Technology to ensure stable quality work regardless of site conditions by incorporating AI-analyzed data of skilled workers into the automatic operation control. 3. Construction management technology that coordinates a large number of machines and operates them based on the most productive construction plan.** These technologies make it possible for all machines to operate autonomously and automatically based on a plan that optimizes the placement of construction machines and the order of work. The automation of the three main types of construction equipment used for earthwork, namely vibratory rollers, bulldozers, and dump trucks and the automation of the work performed by these machines has made progress and has been implemented at four sites so far.

■From labor-intensive to information-intensive

In many construction sites, each job is left up to the worker, and as a result, the efficiency has been left up to individual skills that are difficult to quantify. In order to change such qualitative and highly variable production efficiency into stable quantitative values, A⁴CSEL analyzes the onsite work, including the work that requires experience and skill, and reconstructs and standardizes it into a combination of routine and repetitive actions. The company is also building a highly productive construction production system by implementing methods of optimizing the production process that has been cultivated in manufacturing plants. Through these efforts, the company is transforming construction sites, which are considered to be typical of labor-intensive industries, into production bases for knowledge- and information-intensive industry.

A⁴CSEL at work (@CSG Dam 2020)

Developing the system at the life-size construction test site

■Future Prospects

At the life-size construction test site, the first of its kind in the industry, modification to automatic operation specifications, improvement of automatic operation performance, and the study of construction methods suitable for automatic operation are continuously being carried out under the same working environment as a real site. The company plans to continue to increase the number of automated machine models and expand the technology to other types of construction work, using A4CSEL to dramatically improve productivity and safety while also achieving the factorization of civil engineering sites.

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