

Development of ICT Bulldozer and ICT Hydraulic Excavator innovating the construction model of job site

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1. Overview

In recent years, there are growing needs to utilize ICT (Information Communication Technology) in the construction industry to increase productivity, reliability, and eliminate labor shortage. This is realized by connecting “construction workers”, “construction site”, and “construction equipment”. The ICT construction equipment are featured with advanced technology such as machine guidance (MG), machine control (MC) to assist the operator, and the site management system to process productivity and work progress data. In general, it requires years of training and experience to become a highly skilled operator, but with the newly developed machine control technology for ICT construction equipment, by combining the GNSS (Global Navigation Satellite System) positioning technology and electrical control technology of components, it will enable novice operators to become as productive as highly skilled operators. At the same time, productivity and work progress are processed into data and sent via internet to be consolidated in the site management system, visualizing everyday progress without having to leave the office. Komatsu has commercialized these technologies which are immensely contributing to the industry. This is an introduction of the ICT Bulldozer and ICT Hydraulic Excavator innovating the construction model of job site.

2. Technical Description

Figure 1 shows exterior and components of the ICT Bulldozer, Figure 2 shows that of the ICT Hydraulic Excavator. Figure 2 also represents the principle of Bucket edge positioning. Both equipment use stroke sensing hydraulic cylinders to calculate the Bucket edge (2) position relative to the GNSS antenna (1) mounted on the machine with high response. Combining with this GNSS positioning and machine attitude from the IMU, edge position in the world coordinate system can be calculated.

The biggest feature of the ICT Bulldozer is the “load control” which maintains the optimum load in front of the blade. Conventional machine control systems could only control the position of the blade targeting the design surface. Hence should the load exceed the limit, the tracks will start slipping and the machine will lose traction, which limited the usage to light loads. On the other hand, the ICT Bulldozer calculates the load based on the input from the transmission sensors, and controls the blade to match the preset drawbar pull to maximize the machine performance, thus expanding the usage from low to high load applications.

As for the ICT Hydraulic Excavator, there are two major features which allow the operator to operate without having to be cautious not to overcut the design surface. With the conventional MG systems, the operator would operate watching the distance between the bucket edge and the design surface through the monitor, cautiously controlling the implement lever manually to prevent overcut. On the other hand, with the ICT Hydraulic Excavator, the operator can control the implement towards the design surface and the machine will automatically stop the movement to prevent overcut. This is called “Auto Stop” (Figure 4 upper). Next when the stick is pulled back towards the operator, the boom will automatically raise/lower so the bucket edge will trace the design surface. This is called “Auto Grade Assist” (Figure 4 lower).

Simplifying the operations which traditionally required very high skills, by applying machine control, both ICT Bulldozers and ICT Hydraulic Excavators allow skilled operators become more productive and novice operators become as efficient as skilled operators.

3. Summary

The ICT Bulldozer and ICT Hydraulic Excavator have provided a solution to the construction industry’s issues of labor shortage, reduction of skilled operators, and difficulty of skill lore. Furthermore it has brought economic benefits to the customers by maximizing their business efficiency. As a result, both have gained a high reputation in and outside of the country.

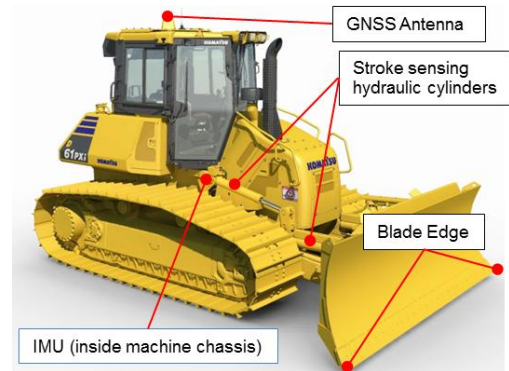


Figure 1 Exterior and Components of ICT Bulldozer

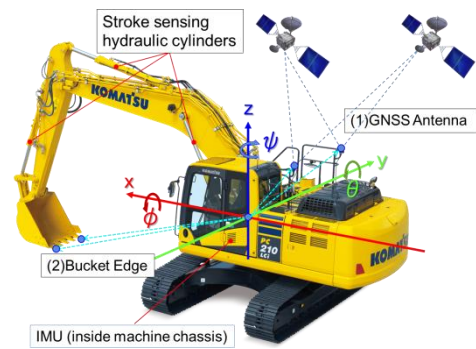


Figure 2 Exterior and Components of ICT Hydraulic Excavator

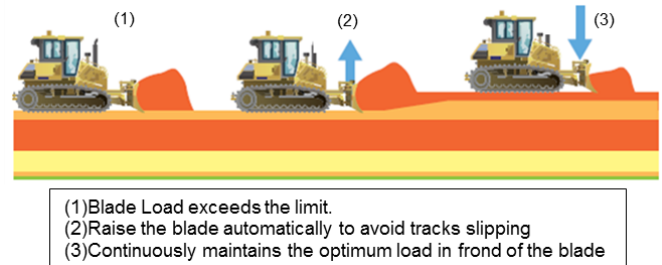


Figure 3 Load Control of ICT Bulldozer

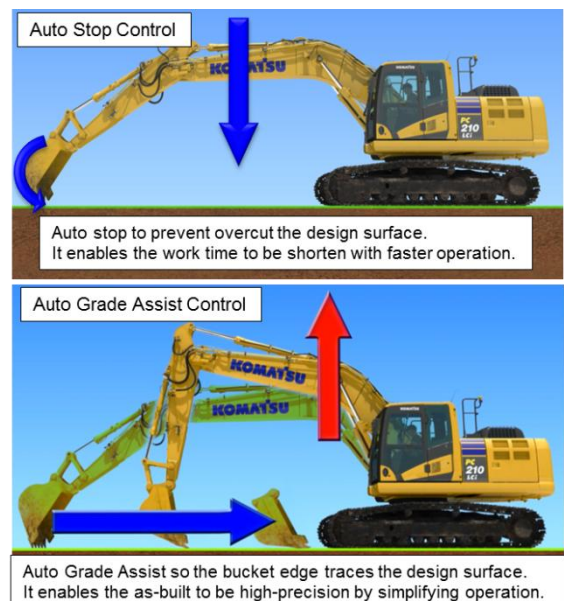


Figure 4 Auto Stop and Auto Grade Assist Control of ICT Hydraulic Excavator