LANDLOG open platform connects land, equipment and materials for innovative construction.
LANDLOG

Joint development and operation of LANDLOG platform to connect all construction processes
LANDLOG is an open IoT platform that collects and processes data from all relevant construction processes, including land surveys, measurements, design, operations and maintenance. The processed data is provided to users in an easy-to-understand format.
Declining availability of skilled construction workers

Japan’s labor shortage is becoming a serious problem, with 40% of skilled workers expected to retire by 2025. Increased productivity is essential to solve this problem.

References:
“Toward renovation and evolution — long-term vision for construction industry,” Japan Federation of Construction Contractors.
More than 90% of all construction companies are small or midsized. Regardless of location (rural or urban) or size, all companies need to improve their productivity.
New Construction Machinery

Advanced construction machinery from KOMATSU is helping construction companies to overcome challenges.

**Intelligent machine control system**

ICT equipment for automatic control of construction machinery was introduced in the Japanese, North American, European and Australian markets in 2013.

ICT equipment is automatically controlled using 3D design drawings.

Performance accuracy is within ±30mm.
Issues Identified After Adoption of Standalone ICT Machinery

Bottlenecks in pre-process stages due to use of conventional machinery

<table>
<thead>
<tr>
<th>Subgrade construction for motorway</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digging</td>
</tr>
<tr>
<td>Conventional Equipment</td>
</tr>
<tr>
<td>ICT Equipment</td>
</tr>
<tr>
<td>Hauling</td>
</tr>
<tr>
<td>Dump Trucks</td>
</tr>
<tr>
<td>ICT Equipment</td>
</tr>
<tr>
<td>Filling</td>
</tr>
<tr>
<td>ICT Equipment</td>
</tr>
<tr>
<td>Compacting</td>
</tr>
<tr>
<td>Vibrating Rollers</td>
</tr>
<tr>
<td>Sloping</td>
</tr>
<tr>
<td>Conventional Equipment</td>
</tr>
</tbody>
</table>

Amount of sediment handled per day

<table>
<thead>
<tr>
<th>Conventional Equipment (amount)</th>
<th>ICT Equipment (amount)</th>
</tr>
</thead>
<tbody>
<tr>
<td>576 m³</td>
<td>412 m³</td>
</tr>
<tr>
<td>576 m³</td>
<td>412 m³</td>
</tr>
<tr>
<td>550 m³</td>
<td>825 m³</td>
</tr>
</tbody>
</table>

Amount of sediment used per day was 412 m³, so the benefits of ICT construction were not fully realized.
Issues Identified After Adoption of Standalone ICT Machinery

Inaccurate estimates of required sediment hampered precision construction planning.

Difference in estimates: 3,500 m³ = 600 10-ton dump trucks

Excavated sediment amount: 14,100 m³

Thousands of terrain points are measured in a week

Excavated sediment amount: 17,600 m³

Millions of terrain points are measured in 15 minutes
Drone surveys provided useful 3D visualization of the terrain before and after construction. Nevertheless, the overall process was still inadequate because total construction, including places constructed with non-ICT equipment and workers, as well as material stocks, etc., needed to be visualized in 3D on a daily basis.
How could construction progress be visualized across an entire site?

In order to visualize the current state of a site that changes day by day, is it possible to make a 3D survey of an entire site on a daily basis?
Newly Identified Key Initiatives

ICT equipment is only part of the entire construction process.
ICT equipment cannot significantly raise overall construction productivity.

Plan
- Business planning
- Site investigation & surveying
- Structural calculations & analysis
- Cost estimates
- Quantity calculations

Design
- As-is surveying
- Detailed design
- Construction planning

Construction
- Construction planning
- Construction management
- Inspection
- Result analysis (as-built quality)
- Documentation
- Reference data (as-built slope & quality)
- Inspection & repairs
- Facility updates

Maintenance

ICT Equipment
- Construction planning (changes & updates)
- Construction management (as-built rate & quality)
- Construction site management
- Safety management

KOMATSU’s new initiatives
KOMATSU Smart Construction

Visualization of site operations by connecting entire construction processes with 3D data

SMARTCONSTRUCTION

Surveying 3D Design 3D Pre-construction 3D Construction Post-construction 3D Maintenance

- Dig
- Haul
- Fill
- Roll
- Slope
- Pave

As-is site surveying

Design drawings

Geological & buried structure information

Materials

All construction-related equipment

All construction-related suppliers

Site supervisors & workers

Completion inspection

IoT data

IoT data

IoT data
Daily Monitoring with Drones

Drones are used to visualize daily changes in terrain of whole site

Explorer 1
Easy-to-use drone

Edge 1
High-performance 3D processor for use at construction sites

Tripod enables easy use even outdoors
3D Site Data

Creation of 3D site data, including drone flight, takes only approximately 30 minutes to complete.
Daily Monitoring with Camera (AI analysis of data)

Construction site data is developed through AI analysis of equipment, vehicle and worker movements captured with on-site camera video.
Overall Concept

Construction site data includes not only data from KOMATSU equipment.

Monitoring of noise and safety beyond the construction site

ICT equipment
Dump trucks
Workers

Drone (Explorer1)

Fixed-point observation camera

On-site office

ICT equipment
Dump trucks
Workers
## Construction Site Management

### Operation Status on Mm/dd/yyyy

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Activity</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hydraulic excavator A</strong></td>
<td>ICT</td>
<td>8:00 - 11:00</td>
</tr>
<tr>
<td><strong>Hydraulic excavator B</strong></td>
<td>ICT</td>
<td>9:00 - 12:00</td>
</tr>
<tr>
<td><strong>Hydraulic excavator C</strong></td>
<td></td>
<td>12:00 - 15:00</td>
</tr>
<tr>
<td><strong>Bulldozer A</strong></td>
<td>ICT</td>
<td>11:00 - 14:00</td>
</tr>
<tr>
<td><strong>Wheel loader A</strong></td>
<td></td>
<td>14:00 - 17:00</td>
</tr>
<tr>
<td><strong>Vibrating roller A</strong></td>
<td>ICT</td>
<td>11:00 - 14:00</td>
</tr>
<tr>
<td><strong>Crawler dump truck A</strong></td>
<td></td>
<td>13:00 - 16:00</td>
</tr>
<tr>
<td><strong>Dump truck A</strong></td>
<td></td>
<td>15:00 - 18:00</td>
</tr>
<tr>
<td><strong>Dump truck B</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dump truck C</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Worker A</strong></td>
<td>Materials transfer</td>
<td></td>
</tr>
<tr>
<td><strong>Worker B</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
LANDLOG Partnership

Autonomous ecosystem managed by innovative partners

- Utilization of collected data
- Use of devices

Open innovation through LANDLOG platform

- Provision of ICT solution infrastructure
- Provision of shared system and platform

Partnering with construction industry for effective solutions

Co-creation of new services and apps

LANDLOG
Working Group: Visualizing operations of site workers

Workstyle reforms based on synergistic combination of assets

Creating new value for construction industry
Global IoT Solution “Globiot”

DOCOMO and Skycatch used LANDLOG to test the data connectivity of EdgeBox for use with the EverydayDrone service available overseas.
Applications Available with LANDLOG

DOCOMO “Construction IoT Solution”
Improving productivity and workstyles in the workplace

Major construction firms

Worksite IoT Solution
Efficient setup, Easy QC, Safe & comfortable worksites, Advanced cost management, Reduction in working hours, Office work Automation

Landlog Cloud IoT Platform
Applications Available with LANDLOG

Atos “Generation-Eye”
Remote operation support solution

- Construction companies develop the apps
- Economical, because all items are available for rent
- Improves productivity and facilitates creativity

Features of Generation-Eye

- Smooth image transmission
- VoIP voice calls
- Guidance with pointer icon
- Sharing documents and websites
- Support for certain wearable devices
- Internet connection (serverless availability)
LANDLOG in the 5G Era

- Massive device connectivity
- Large capacity
- High-speed communication

Everything at construction site connected via 5G