

Innovative Power of PENTA-OCEAN CONSTRUCTION



We focus on the enhancement of on-site and technical capabilities as important business policies. To meet increasing business demands, we address "automation", "streamlining", and "power

saving" while ensuring the safety and high-quality of our projects. The following details our approaches towards our improvement in productivity and innovation of our production system.

Approach towards Automation

We proactively promote the automation of construction techniques aiming to enhance accuracy and power saving. We will address high-level streamlining to ensure construction safety.

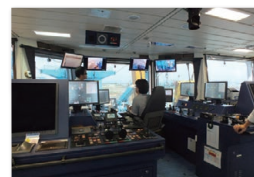
Self-Propelled Cutter Suction Dredger with Auto Dredging Mode

Self-propelled cutter suction dredger, "CASSIOPEIA V", which was built in Singapore in 2014, features the auto dredging mode providing efficient dredging and superior operational accuracy. It has automated rotating cutter head operated by ladder and swing winches, as well as spud carriers.

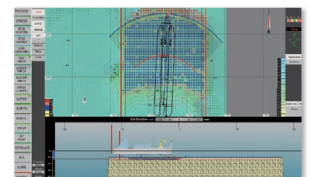
Cutter Suction Dredger—This is a type of working ship used for dredging or reclamation work. It is equipped with rotating cutter to the head of extendable ladder capable of cutting hard soil into fragments. The cut soils are then sucked up with seawater by dredging pump and discharge to designated location through pipeline.



CASSIOPEIA V



Dredging console



Dredging control system

Efficient and Safe Caisson Unmanned Installation System

We use "Unmanned caisson installation system (UCIS)", a technology systemizing caisson installation work in the construction of breakwaters and revetments. Caisson is a large precast concrete block used for the construction of breakwaters and revetments.

Installations can be systemized, which had been previously done by operators working on the caisson. The system will enable all installations to be performed by auto control and remote operation. It can also facilitate efficiency with an automatic water supply control using artificial intelligence (AI), the dynamic monitoring of caisson, and the central administration of winch operation. In addition, it will improve safety by establishing an unmanned work system on the installed caisson or surrounding machinery.

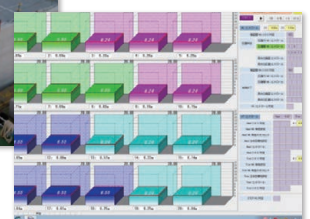
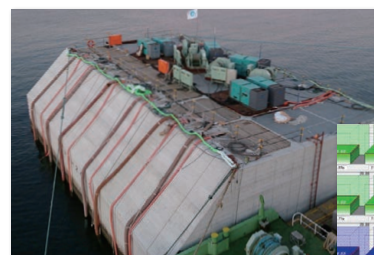


Image of the automatic water supply control by AI

Approach towards Work Efficiency

We have developed Building Information Modeling (BIM) and Construction Information Modeling/Management (CIM) to promote operational efficiency.

Productive Utilization of BIM Enhanced Construction Quality and Productivity

BIM provides consistent management to promote operational efficiency from the planning and design stage to the construction of buildings and structures. We proactively employed BIM on projects in Japan and overseas, aiming at improving construction quality and productivity. In the Changi General Hospital, opened in Singapore at the end of 2014, we utilized BIM for the fitting adjustment of buildings and facilities and so on, and received the BIM Gold Plus Award from the Building and Construction Authority (BCA).

In the Maebashi region joint government building, completed in May 2015, a BIM trial project sponsored by the Japan's Ministry of Land, Infrastructure, Transport and Tourism was utilized for the design, structure, equipment, construction, and so on. A construction BIM model was also developed which can be used for maintenance after construction.

We have also had other achievements with BIM in commercial facilities, office buildings, and so on. We therefore recommend our original BIM utilization to customers.

We will address further construction quality improvements and productivity with BIM as well as BIM expansion used mainly in our design and construction projects.



Changi General Hospital



Construction BIM model



Maebashi region joint government building



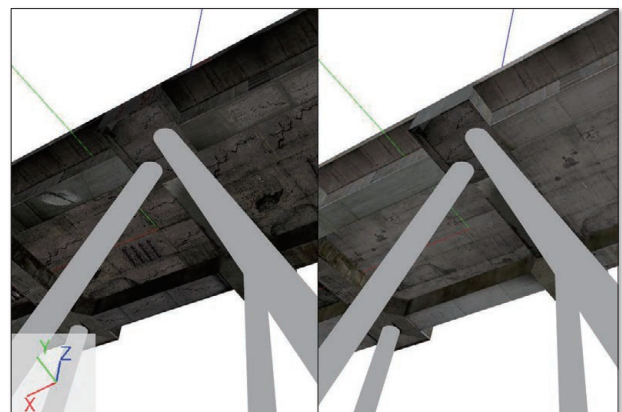
Construction BIM model

Realistic Reconstruction of Deteriorating Conditions of a Pier with CIM

CIM is a concept originally advocated by the Ministry of Land, Infrastructure, Transport and Tourism of Japan as BIM for civil engineering which intends to rationalize the whole construction industry including maintenance. We developed a 3D maintenance system as a CIM approach. This system enables the visualization of the pier condition by registering photos and data of construction or maintenance in a 3D model of the pier. It allows users to see the pier's condition via their internet browser, even from a remote location, as if it were right in front of them.

This system can display photos and diagnostic data of degradation stereoscopically in a 3D model. It enables everyone to visually grasp degradative conditions in the whole structure which could previously only be seen by skilled operators.

The system allows customers and people in charge of inspections and repairs to share necessary information and make proper decisions more quickly.



Deteriorating condition (left) and normal condition (right)

Approach towards Saving Construction Works

To meet increasing business demands, we are making various efforts towards the improvement of productivity, in addition to ensuring construction quality. This includes IT utilization in various conditions and the employment of streamlined construction methods, which aimed at saving construction works. We will strive for the continued improvement of work environments, leading to the enhancement of our innovative power.

"Unique Hybrid S-Beam to RC-Column Structural Framing Method" for Saving Form and Reinforcement Works

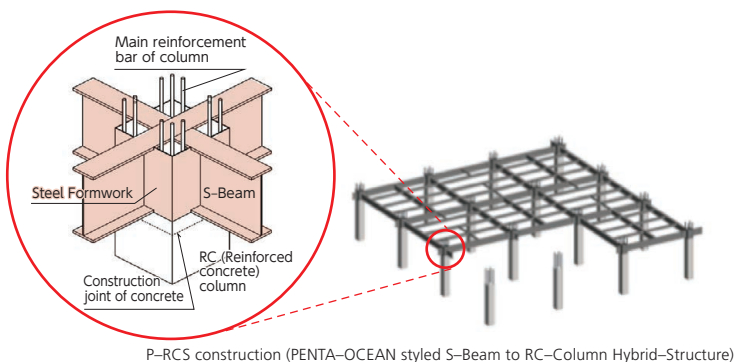
PENTA-OCEAN developed the hybrid S-Beam (steel beam) to RC (reinforced concrete) column structural framing, wherein different concrete strengths can be applied to individual parts. In addition, steel construction is light which can be used for large spans, such as for beams and reinforced concrete construction and also inexpensive and robust to use for columns. In addition, steel construction is light which can be used for large spans, such as for beams and reinforced concrete construction and also inexpensive and robust to use for columns.

This method employs a jointing system without shear reinforcements in which the beam-column joint is covered with steel plates. As form and reinforcement work can be simplified, this method provides an especially perfect solution for the construction of warehouses, which require work in elevated places. It ensures a more streamlined construction than those using traditional steel or reinforced concrete, and contributes to cost reduction. On the SBS Logicom Tokorozawa Center, which is currently under construction, columns are pre-cast for further labor efficiency, enabling streamline construction.

We propose labor efficient construction methods suitable for the characteristics of each site, including the industrialization of foundation skeletons and form work, to meet construction deadlines and maintain quality.



Completion Path of SBS Logicom Tokorozawa center, which is currently under construction

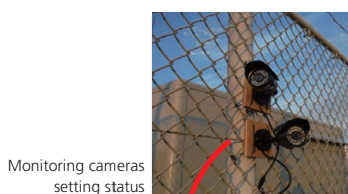


P-RCS construction (PENTA-OCEAN styled S-Beam to RC-Column Hybrid-Structure)

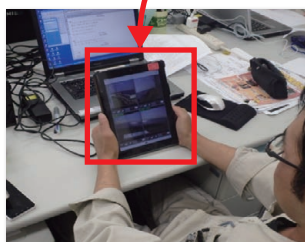
Labor Efficiency of Construction Control Work Realized by Providing the IT Network between People and Sites

Instead of paper renderings or documents, we promote the use of tablets, including iPad, as tools for construction control. This provides compact storage and transport of a large volume of drawings and technical data. We report to field offices promptly to solve issues on site by sending photos and so on regarding construction difficulties, and record and organize photos of construction on the tablets to promote labor efficiency with regards to construction control work.

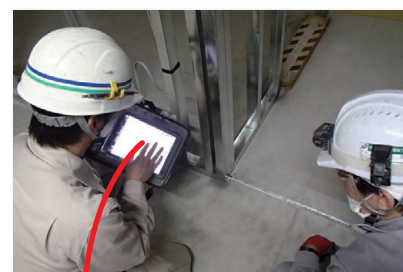
We also utilize IT tools for routine safety management, such as placing monitoring cameras on site so that people can always grasp the conditions on site, even from remote locations, using iPads.



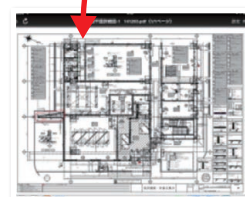
Monitoring cameras setting status



Conditions displayed on the monitor (office)



Site inspection with a tablet (iPad)



Tablet screen (working drawing)