

R&D Technologies

R&D as a Business Strategy

The Penta-Ocean Group's mission is to contribute to the global community by developing, improving and expanding original technology that is cost effective, safe and environmentally responsible. In the consolidated fiscal term under review, the Group focused its resources on three areas of priority - technological development aiming at exploiting new markets, technological support for specific projects, and technological development and improvement for securing conventional markets for short-term, high yield results.

Approximately 80% of investment in research and development during the term was funneled into the development of next-generation recycling protocols, hazardous waste prevention and renewal, and into food, medical, health care and physical distribution systems. Total expenditures in this area in fiscal 2006 amounted to ¥1,442 million (US\$12.3 million).

The following is a list of technological achievements for the Group during the fiscal term.

T-BOSS (T-type basement Branch Off Shield System)

Method

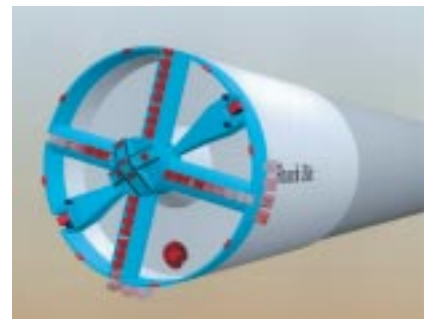
This method makes it possible to mechanically connect a new tunnel laterally to an existing tunnel without building a shaft. A drilling-reinforcing ring housed in a sealed machine grinds and penetrates directly into an existing tunnel and mechanically connects the new tunnel to it. This process conducts lateral side-connecting work underground in a safe, reliable process, even under high ground-water pressure conditions.

In applying this process, a "W" method, in which the drilling-reinforcing ring has a double structure, or an "S" method, in which it contains a single structure, can be employed, depending on the specific jointing requirements of the particular tunnel. This makes the T-Boss method suitable for a wide range of applications.



Shark Bit Method

In this method, tunnel-excavating sealed machine cutter bits are layered much like the teeth of a shark and so can be replaced any number of times automatically. Bits are replaced internally when a ring of new cutter bits is pushed toward the center of an internal periphery through a cutter spoke, one after another, worn cutter bits in the external periphery are pressed into the surrounding earth layers. This method dramatically improves excavation performances, shortening construction time and increasing cost efficiency. The process also increases safety during operation, since the need for dangerous operations such as manual facing is eliminated. This method was first applied to the construction of multipurpose underground conduits in Okayama City in 2005



Portal Grid Method

In January 2006, federal legislation addressing earthquake-resisting ground improvement and reconstruction was revised, raising the earthquake-resisting ratio of Japanese buildings and structures to 90%. Since many public school facilities were constructed in compliance with earlier standards and no effective countermeasures have been taken since that time, the Ministry of Education, Culture, Sports, Science and Technology has called for the reconstruction of many schools to meet the new safety standards. The Portal Grid Method is a new technology developed by Penta-Ocean to cope with this requirement. The Portal Grid aseismic retrofitting method entails the installation of steel framing to the external pillars and beams of existing buildings. Even when the braces that have conventionally been indispensable for reinforcing structures are omitted, this method achieves sufficient earthquake resistance to meet the new standards. Grid bracing does not cover windows or impair the natural lighting of existing buildings, and external facades can be constructed to camouflage the supports at the time the retrofitting work is done.



Hazard Analysis Critical Control Points

Establishing food safety protocols has become extremely important in recent years, and in the wake of these concerns, the Hazard Analysis Critical Control Point (HACCP) protocol has become crucial to achieving success in this area. HACCP is a control system for preventing three potential hazards during food processing, namely, the commingling of foreign matter into food products, microbial contamination, and tampering with chemical substances.

Penta-Ocean has developed a comprehensive service that encompasses protocols for zoning plans, conveyor lines and health control programs, designing and executing these along HACCP guidelines. It constructs distribution centers, as well as port facilities and has accumulated considerable experience in this field. Penta-Ocean has also constructed freezing facilities and frozen food distribution centers and in the food-processing field has constructed confectionery manufacturing facilities, repackaging centers and food-preparation facilities for every stage of food production - from the processing of raw materials to the processing of foods and final distribution to consumers.

