

Technology R&D

Developing Technology with Focus on the Environment and Disaster Prevention

Contributing to the society through development, improvement and adoption of technology is the basic philosophy behind Penta-Ocean's R&D Division. Developed technologies had tremendous impact on civil engineering projects received in the year ended March 2005. Results of proactive marketing that capitalize on developed technology can also be seen in the architectural engineering field. Specifically, engineering contributed to 60% of orders received in the foods/drugs

industry, 30% in the healthcare industry, and 10% in the renovation field, which in aggregate represents approximately 30% of total orders. In the year ending March 2006, we will dedicate 80% of the ¥1.55 billion R&D budget (same as the previous term) to developing technology in these three key fields:

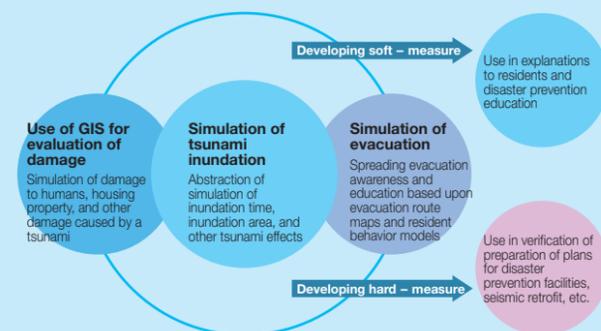
- (1) Environmental/Recycling
- (2) Disaster Prevention/Renovation
- (3) Foods/Medicals/Transportation Engineering.

Recent Major Technological Developments

Tsunami Disaster Prevention and Mitigation

Although Japan is always concerned about the eruption of major earthquakes, there is just as much potential for damage caused by tsunamis/tidal waves, and disaster prevention measures must be taken. Penta Ocean takes a total comprehensive approach in creating disaster prevention plans. The "Tsunami Inundation Simulation" technology takes geographical and other data and creates a tsunami simulation indicating tsunami movement, inundation, and other information. This simulation is used as the basis for forming a disaster prevention plan. The "GIS Damage Assessment" is used to predict how much damage could be caused. This can be used to formulate even more precise disaster prevention plans. The "Evacuation Simulation" software combines data produced from the "Tsunami Inundation Simulation" and "GIS Damage Assessment" to simulate possible evacuation conditions and is used in raising awareness and workshops.

Image of Penta Ocean Tsunami Countermeasure



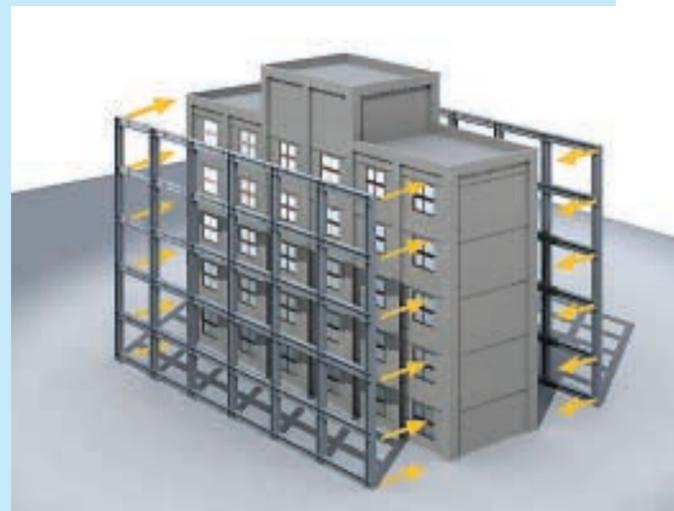
Simulation of evacuation



Seismic Retrofitting "Portal Grid Method"

The "Portal Grid Method", developed in conjunction with Engineering Department at Osaka University from 2001, is a brace-less seismic retrofitting method that allows buildings to withstand up to 7th degree on the seismic scale. This method reduces the retrofitting construction term compared to the steel brace strengthening method. As the procedure is completely external, the building can be used normally during the installation. Architects can design building facades utilizing the retrofitting grids. For this "Portal Grid Method", the Assessment of Technology for Building Construction has been attained from General Building Research Corporation of Japan, in March of 2005. The method can be applied for condominium complexes, office buildings, hospitals and school buildings. So far, we designed and constructed three applications using "Portal Grid Method". Now, we are planning to adapt this method for several school buildings, welfare institutions and department stores.

Retrofitting image of Portal Grid Method



Man-Made Seamount Construction



Man-made seamounts are constructed in deep water areas of about 50 – 100 meters using a mound structure to artificially create upwelling current. The upwelling current, which is generated from the seabed, transports rich nutrient salts from the bottom to the surface, where the salts come into contact with sunlight. This produces phytoplankton, which eventually creates a plentiful fishing ground due to the food-cycle

effect. This technology was introduced in the creation of the man-made seamount in a 90-meter deep section off the coast of Tsushima in Nagasaki Prefecture. Last year two systems were used in this project; one to determine the optimum location for injecting the materials predicting their movements due to complex tidal current in the sea, and one to guide ships to proper locations. This year, technology that estimates the sedimentation pattern for each injection will be introduced, and an injection method that improves sedimentation pattern decreasing the spread of injected materials during their falling has been developed. Currently, a special type of block is under development. It is made from recycled seashells that are considered ocean waste and is becoming increasingly used as injection material.

Classifier System for Dredging Sediment



Example implemented on a ship

This system classifies and collects the recyclable sand from soft dredging soil. This reduces the amount of wasted soil during dredge projects, thereby reducing the capacity volume and increasing the usage life of reclamation processing facilities. This system is based on two new construction methods: the pipe method, which classifies the dredging soil; and the clay filter method, which processes fine particles from dirty water that has been processed by the pipe method. The pipe method separates the sand and fine particles by pressurizing the soil through the pipes, and collects only the sand. The clay filter method uses a special filtering material system with a filtering effect to filter and collect fine particles and to remove and directly discharge processed water.

Construction flow for dredged soil filtering

