

## Marine Civil Engineering

TOA was established at the beginning of 20<sup>th</sup> century and has been engaged in the development of coastal industrial zones, starting from Tokyo Bay Area. TOA has been contributing to the formation of infrastructure, consolidation of industrial foundation and many project completions for our rich, daily life in various local areas.

Among our completed results, it includes the land development for industrial zones, construction of advanced harbor related facilities such as piers, sea berth, container terminals and warehouses, and colossal building facilities that took long-term construction period. We also provided high level of technology for the construction of airports, artificial islands, bridges and facilities including coastal plants, marina and offshore amusement spots. In the background of these completion of large but quality based marine civil engineering projects, there is the requirement for "modernization" in Japan, and we are confident that we have our specific mission and technology to realize these social needs.

In every project, we always think of the importance of harmony between man and nature. Therefore, we initially investigate and study the topography, soil conditions, water and marine sources of the site thoroughly. We then consider the human factors including culture and industries before we engage in our projects. This results in solid reputation not only in the local societies and industries, but from local inhabitants too.

Future projects for marine civil engineering forecast that they require higher level of technology, more remarkable equipments, richer experience and environmental friendly human nature.

### The Central Japan International Airport (centrair)

The CENTRAL JAPAN INTERNATIONAL AIRPORT is a full-fledged offshore airport with a 3,500m runway. Since it began its services from February 17, 2005, the airport has been operating 24 hours a day, and special consideration has been given to its facilities, systems and operations.

A 470-hectare airport site was reclaimed using 56,000,000m<sup>3</sup> of earth and sand, of which 8,630,000m<sup>3</sup> of those soil were provided by effectively utilized recycled materials dredged in the Nagoya Port executed by TOA. Our dredging technologies were applied to the reclamation works that contributed to shorten the construction period. The remaining 4,500,000m<sup>3</sup> soils came from mountains, and were transported to the site from other areas.

The revetment with a circumference of 12km surrounds the area. The minimum distance between the revetment and the opposite shore is at least 1.1km, and the island was curbed to prevent eddy currents. These measures will help to ensure that any potential impact on the tidal stream from this project is minimized.



TOA's dredging method "Plug Magic" (see page 12 for detail) was adopted in order to maximize the recycle of dredged soft soil.



## Kansai International Airport 2<sup>nd</sup> Stage



In this project, a new 545-hectare airport island is completed to build 200m off the existing island to construct a second 4,000m runway, apron and taxiway. The island needs 250,000,000m<sup>3</sup> of earth and sand as it is deep as 19.5m on average at site. The revetment work that began in July 1999 was completed in November 2001, and the reclamation work was completed in 2006. When preparing the ground for an airport, it is important to build a firm foundation free from any ground subsidence. In order to ensure the construction of a firm foundation, TOA utilized various technologies and techniques for this reclamation work. One of the good examples is the use of GPS to ensure the accurate positioning and the height of reclaimed land.

## The Yumeshima Container Terminal in Osaka Bay

The YUMESHIMA CONTAINER TERMINAL was planned to upgrade the container berth consisting three submerged type berths of -15m in order to accommodate post panamax and those increasing container transportation that plays a major role in international logistics. The 350m long wharf consists of steel pipe pile foundations driven into the front area of the caisson revetments and the jetty superstructure.

We conducted extensive studies of concrete cold joints and methods to control cracking after pouring concrete over a large area for the superstructure of wharf and achieved greater results than expected in quality assurance and safety control. Learning from the destruction hit on port facilities in the Great Hanshin Earthquake, we designed the wharf to be available for emergency purposes, giving it a -15m and providing it with functions for an earthquake proof structure. As a sole contractor for this project, we were able to make extensive use of our marine engineering technologies and experiences.

The Yumeshima and Maishima linking bridge for floating portion (878m and 410m long, respectively) has attracted the attention for becoming the world's first floating type bridge. When post panamax is navigating, the floating portion of this bridge revolves with a pivot placed adjacent to Maishima.

Construction works of a submerged tunnel for roads and rails, which connects the Yumeshima Island and downtown Osaka to ensure smooth transportation of goods, have been completed. Other than offshore civil works, we have completed the administration building, maintenance shop building for the repair of various port facilities and support of container handlings, and the gatehouse building used for entry and exit of trailers. These facilities are the core of this Yumeshima Container Terminal C-11, which is one of the largest physical distribution site at the Osaka Port.



## Cebu Coastal Road



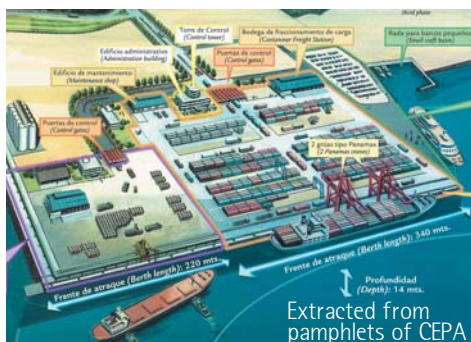
The Company has been engaged in integrated waterfront development in many Asian countries and gained itself an utmost reputation. TOA is currently consolidating various infrastructures in the re-climatized land of Cebu City. The city has faced urgent construction projects of roads, urban infrastructural facilities to supply gas, electricity and water, and treatment facilities of sewage and waste. In 2002, we completed and delivered a coastal road along the shoreline of the south bay in Cebu City. The road extending 4,300m was constructed by embanking the sea that required improvement of the foundation. The project also included the construction of the road extending 800m on the land. The project was completed by TOA's advanced technology of marine civil engineering such as the Paper Drain Method.

## Map Ta Phut Power Plant-Coal Unloading Jetty

The 1,400MW Map Ta Phut Project has become one of the largest IPP investments in Southeast Asia. In September 2005, Toa successfully completed a 346m long coal unloading jetty as well as dolphins and trestles for this facility. The steel pipe pile structured jetty allows 170,000DWT class vessels to berth alongside. The power station itself started the power delivery in late 2006.



## La Union Port Multi-purpose Terminal



Ever since our first project in Argentina in 1989, we have been continuously working in the American regions, including the countries of the Caribbean islands. Based on Japan's official development assistance program, we have mainly been involved in the development of fishery relating facilities and have made great contribution to the local residents.

In the year 2005, TOA was awarded the contract for the construction of a new multi-purpose terminal in La Union, El Salvador. Local labor and organizations have been utilized to great effect on the project and will

enhance the local community by bringing them directly into the project from its inception through to completion. This contract has become the largest project funded in this region by the Japanese Government and has also become a great challenge for us.





## New Container Terminal Project in Viet Nam



container yard with 24ha in space, and construction of 9 buildings.

The project site located 17km south of Ho Chi Minh City is expected to expand as a harbor business area in the southern part of Viet Nam.

In Viet Nam, the Company has a vast amount of experience and technical data in improvement of soft ground. In July 2007, the Company received an order for the construction of a large-sized private-based international container terminal from Saigon Premier Container Terminal Ltd. (SPCT), a joint venture of world top class container terminal operator, “Dubai Ports World” and industrial zone managing company, “Tan Thuan Industrial Promotion Company”.

The project comprises 520,000m<sup>3</sup> dredging works, construction works of jetty and wharf extending 500m, ground improvement work with 24ha in space, paving

## Newly Completed Projects

### Sakhalin II LNG Project-Civil Works

In Sakhalin Island located in the far east region of Russia, foreign investment are being used as a springboard for the development of the Sakhalin Project which is divided into 9 projects. Among the 9 projects, we have been participating in the Sakhalin II LNG Project for the construction of the LNG loading facility including the placing of 25 reinforced concretecaisson units, foundation works of an oil export terminal and provision of concrete for other contractors taking part since June 2003.

The severe weather conditions that are a normal part of the features of this project preclude works on the jetty being carried out during, in particular, the winterperiod. Great care has been taken in the construction for the jetty as the feeding and breeding grounds for many fish and marine creatures are in close proximity to the project site.



Provided by SEIC

### Submerged Tunnel for Shin-Wakato Road

The Company has rich experiences in constructing many marine tunnels with advanced technology and know-how. Wide-ranged IT related technologies, marine engineering technologies related with submerged tunnels, and specific methods related to environment preservation are required to complete projects in severe conditions. Shin-Wakato road, in which the Company has been engaged in its execution, was constructed as the coastal road across the Doukai Bay, alongside with the consolidation of a container terminal located in the Hibikinada district.

In this project, the Company completed the construction of two hybrid caissons among eight in total. The caisson with 27.9m in breadth, 78.8m in length, and 8.4 in height was made out of specific concrete and it was handled with its own developed “Running and Piling Control System” and “Water Amount Measurement Device” that are essential for quality maintenance.

