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KAJIMA'S SPECTACULAR
SUEZ CANAL BRIDGE PROJECT

Elevations

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Kajima is in the final stages of completing the giant Suez Canal cable stayed bridge at Qantara City in northeastern Egypt. The bridge will crown Kajima's distinguished record of civil engineering projects in that country. Towering 70 meters above the canal's high water level, the graceful, Pharaonic obelisk-shaped pylons can be observed on clear days from a considerable distance. As the first major cable

stayed bridge in Egypt and the Middle East, and the highest cable stayed bridge in the world, it could become a major tourist attraction.

Appearances aside, the bridge will help solve one of the main obstacles in developing the Sinai Peninsula. The peninsula is separated from Egypt by the Suez Canal, and despite its considerable potential has a low population. Egyptian national



development plans target a population of three million by the year 2017.

The project began in 1995 during a visit to Tokyo by the president of Egypt, when it was agreed that Japan would provide financing and advanced technical assistance for bridge construction. A joint Egyptian-Japanese team was established to carry out a series of feasibility and technical studies. In late 1996, the

team recommended construction of a cable stayed bridge at the Qantara area about 48 kilometers south of Port-Said. The bridge was to have a four-lane carriageway, a 3.3% vertical gradient and a 730-meter cable stayed portion supported by two 154-meter-high ancient Egyptian obelisk-shaped reinforced concrete pylons. Each pylon was to be supported on 76 reinforced concrete piles

30 meters deep.

Further bilateral meetings in 1996 established the project works allotment plan whereby Japan would finance and build the main bridge and the approach viaduct higher than 49.5 meters. The Japanese finance accounts for 60% of the total bridge cost. The remaining 40% was to be financed and built by Egypt.

A consortium of Kajima, NKK and Nippon Steel, headed by Kajima, was engaged to build the main structure. Work started in late May 1998, and the consortium gradually built up a 1,000-man workforce

and extensive equipment resources to complete construction in a tight 40-month period.

In addition to the tight schedule and Kajima's strict safety and quality control requirements, the consortium was faced with the record height of the bridge deck and pylon. The height necessitated a choice of civil construction systems capable of safely and economically operating under such conditions.

A special slip-form system was designed for the pylons, which have a variable section and are braced by two cross-beams at elevations 74



Elevations



and 123 meters above ground. The system incorporated sophisticated hydraulics and manually adjusted controls, which were used periodically throughout the 24-hour operating period to adjust both the cross-sections and the inclination angles of the forms. Operational control was achieved with special, highly accurate laser beam units, in addition to conventional survey equipment, which were used to adjust the constantly rising forms. The crossbeam construction works were supported on steel girder trusses that were raised into position by heavy lifting techniques using special hydraulic jacks. Following their completion, the pylons were provided with a lightning protection

system, automatic aviation and navigational warning lights, and a special seismic activity measurement and recording system.

For the 1,120-meter-long reinforced concrete approach bridge works—which included the construction of 68 approach and 12 main bridge auxiliary piers—Kajima used two slip-form sets to cast the 60-meter-high structures. The system allowed efficient and safe construction of the structures with ideal timing, but again forced the necessity of adopting 24-hour, seven-day work with its logistical concerns. The central bridge's 28 pre-stressed concrete spans (14 spans on each side of the canal) and

four-lane deck starting at a height of 49.5 meters, necessitated the use of a specially designed advanced shoring system to support the construction of the spans on the piers (each span is about 40 meters long). The system enabled rapid, efficient and safe construction of the bridge deck.

Following completion of the main concrete works, Kajima proceeded with casting of the main bridge sidewalks and medians, and finally the asphalt paving on the steel deck. Asphalt paving was preceded by sandblasting of the steel decking to remove any rust stains, and the application of several protective and binding layers. The paving will be completed prior to the

bridge's official inauguration in early October 2001.

During its various construction phases, the bridge drew intense interest from the Egyptian people, the Japanese community and the numerous seafarers on canal-going shipping. The site became a focus for numerous visits, and offered spectacular vistas of the area from the top of the piers and pylons and later from the bridge deck.

Kajima around the World

From Japan

FROM GARBAGE TO GREEN POWER

A new organic waste treatment and power generation field evaluation facility consisting of Kajima's packed-bed thermophilic methane fermentation system and a 100-kilowatt phosphoric acid fuel cell (PAFC) has been completed in Kobe, Japan in a project of the Ministry of Environment. The ministry plans to commence operation of the facility in August, and evaluate the system performance including correlations among the organic waste input, biogas production, and the electricity output during the following three years.



The facility was constructed as a part of the Field Evaluation Project in the Ministry of Environment's "Global Warming Prevention Measures Program" under its auspices. The newly constructed facility microbiologically converts organic waste to methane-rich biogas that is then reformed to hydrogen and supplied to the PAFC for power generation.

The organic waste used in the project will be collected at commercial premises such as hotels in metropolitan Kobe, and six tons per day will be brought to the facility. The facility microbiologically breaks down organic waste, which is currently being incinerated elsewhere in most of the cases, and chemically generates electricity from the resultant biogas; thus there is no production of toxic substances associated with direct combustion of organic waste and fossil-fuel derived carbon dioxide in power generation.

The project is the start of merging environmentally friendly technologies on local and global scales, as well as of more acceptable organic waste disposal and prevention of global warming.

TEXTILE ART EXHIBITION



(From right) Swedish Ambassador Krister Kumlin and Swedish textile artists Ulla Grytt and Annette Fahlsten

Kajima offered the atrium of its KI Building as the venue for an exhibition of the works of two Swedish textile artists, Ulla Grytt and Annette Fahlsten. The event, titled "Nordic Light—Nordic Night", was staged from June 4 to 15.

Swedish Ambassador Krister Kumlin visited the KI Building venue on opening day to offer his congratulations. He showed great interest in the works, and was guided through the exhibition by the artists themselves, who explained their methods of expression and the intent of the pieces.

Exchanges between Kajima Corporation and Sweden date from a visit 11 years ago to the KI Building by the King of Sweden. During the visit to Japan, the building featured on the King's itinerary as an example of the

latest in office architecture. In 1995, the KI Building was the venue for a very successful exhibition staged by one of Sweden's leading textile artists, Anita Graffman.

The open space and free atmosphere of the KI Building atrium lent itself perfectly to the works of the two Swedish artists, which gave rich expression to the natural attributes of northern Europe.

From U.S.A.

KAJIMA HELPS YAMANOUCHI EXPAND ITS U.S. OPERATIONS

Yamanouchi Pharmaceutical Co., Ltd., one of Japan's leading pharmaceutical companies, is renovating and expanding its plant in Norman, Oklahoma that opened in the fall of 1998. This 9,300-square-meter (100,000-square-foot) plant is owned and operated by subsidiary Yamanouchi Pharma Technologies, Inc. and manufactures and packages solid-dosage pharmaceuticals.



Kajima Associates and Kajima Construction Services of the Kajima U.S.A. Group are working together to provide design/engineering and construction services, respectively, for the Yamanouchi plant. The project consists of expanding approximately 700 square meters (7,450 square feet) and renovating approximately 1,000 square meters (10,300 square feet) of manufacturing space. Kajima has been hired on a design/build basis to perform site work; demolition of the existing building; new construction including structural steel work, building enclosure, interior fitout, and renovation of existing areas; HVAC and plumbing work; all design work associated with process utilities such as steam piping, compressed air piping, and a pure water generation system; fire protection; and all electrical work required for the plant power supply, and access control and fire alarm systems. Kajima will also prepare and execute a validation master plan for the plant.

In addition to this design and construction work, Yamanouchi has contracted with Kajima Construction Services' Process Mechanical Division (PMD) to perform the installation of all process equipment and any process engineering associated with the task.

Following the completion of the work, which is expected in July 2002, the facility will include a total of three production lines for pharmaceutical manufacturing, administrative and training facilities, along with space for quality assurance and control activities.

From Taiwan

CONSTRUCTION PROCEEDS ON TOPPAN CFI (TAIWAN) PLANT, TAIWAN

Chung-Lu (Sino-Kajima) Construction Co., Ltd., Kajima's wholly owned Taiwanese subsidiary, is making progress in the construction of a factory in Taiwan for Japan's leading printing company, Toppan Printing Co., Ltd. Toppan has a Taiwanese joint venture with AMTC, Sumitomo Corporation, and Toppan CFI (Taiwan) Co., Ltd. The new factory is being built in the Tainan Technology Industrial Park.

An initial investment of ¥20 billion is being used to build a 3.8-generation color filter line in the Technology Park. The facility will eventually expand to become Toppan's largest color filter production base.

A Taiwanese ground-breaking ceremony staged on April 19 was attended by a number of dignitaries, including Naoki Adachi, president of Toppan Printing, Wang Jin Pyng, Legislative Yuan, R.O.C President, Yiin Chii-ming, vice-minister of the Taiwan Ministry of Economic Affairs and Yoshihiko Iwamatsu, executive vice president of Kajima.



Kajima has taken responsibility for design and construction of the project, and during the first phase of construction will build a factory with four above-ground floors and a gross floor area of 82,000 square meters. When completed, the factory will become a manufacturing and sales base for Toppan's color filters. The design adopts the catenary arch construction method developed by Kajima and used for the first time in Taiwan. The aim is to reduce both construction time and cost. Construction of the factory began in May, with machinery installation to be started by the end of next March, and mass production will start in June 2002.

From Singapore

SGX CENTER PROJECT COMPLETED

Kajima Overseas Asia Pte. Ltd. completed the SGX Center Project in June 2001, winning praise from industry press in the spring edition of *Concrete Engineering* in the United Kingdom. The 29-story twin tower, situated in the heart of Singapore's financial district, houses the Singapore Monetary Exchange (SIMEX) and the Stock Exchange.

The project commenced in November 1997 with the demolition of a 22-story building. It was followed by the construction of a 45-meter-deep perimeter diaphragm wall and bored piles using Super Jet Grout. Kajima's new soil improvement technique was used successfully during basement construction to stabilize the extremely soft marine clay under the structure.

The site is located near an underground train tunnel, which necessitated special monitoring and careful sequencing of works. Kajima developed the right chemistry with U.S. architect Kohn Pederson of Fox Associates and U.K. structural consultant Oscar Faber. The project went smoothly as a result, and was completed according to schedule.



The new landmark of concrete frames clad in unique and impressive aluminum curtain walls, granite and marble, is situated at Shenton Way. It has been opened to the public in stages since November 2000.



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