

High-Quality Infrastructure for the Next Generation

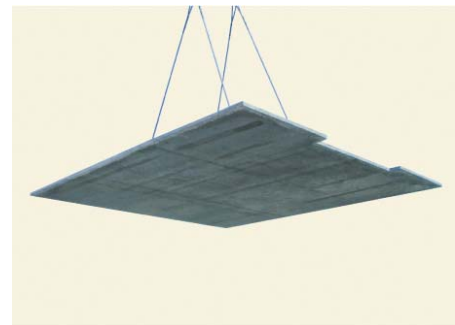
Kajima believes that it is important to provide society with buildings and other infrastructure that can be utilized for many years to come, while at the same time effectively utilize existing infrastructure as much as possible. We feel that it is our responsibility to break away from the scrap-and-build concept and produce long-lasting, high-quality infrastructure to pass on to the next generation.

Ultra Long-Lasting Concrete EIEN (“Earth, Infinity, ENvironment”), a Product of Ancient Wisdom

Kajima has developed EIEN, a type of concrete with an estimated useful life expectancy of 10,000 years. The name is contracted from the first letters of “earth,” “infinity” and “environment” and means “eternal” in Japanese. The development of EIEN was inspired by the discovery of ancient concrete unearthed from an archaeological site on the outskirts of the Chinese city of Xian. Although approximately 5,000 years had passed, the concrete was amazingly virtually intact, owing to carbonation.

Concrete is the product of a chemical reaction from the mixing of sand, gravel, water and cement, which provides a hardness not found in nature. In the majority of cases it is reinforced with steel, and since the internal steel will erode if carbon dioxide seeps through the surface, the key to maintenance in current construction work is preventing carbonation. The ancient concrete that was uncovered, however, had through the process of carbonation become as dense as marble, and decalcification of the surface had been prevented.

EIEN utilizes this principle with a special admixture that reacts with carbon dioxide but not water, allowing for carbonation under more ideal conditions. Since the alkalinity of the final product is low, it is easy on the natural environment and suitable for structures that coexist with plants and animals. The long-lasting concrete EIEN, produced through a fusion of ancient wisdom and modern technology, is expected to be widely used for structures in harsh environments, such as final waste disposal plants or coastal infrastructure.



An EIEN concrete slab for a pier to be part of a buried frame. Durability has been enhanced, although the concrete has been made thinner overall.

Buildings That Will Remain with People for Years to Come

The lifespan of a building varies significantly in response to such social factors as ease of use or changes in lifestyles. The average age of buildings in the Tokyo metropolitan area is 35 years, considerably shorter than their estimated lifespan in terms of physical deterioration. The design concept known as “skeleton/infill” seeks to prevent such socially based deterioration by separating the basically permanent structural aspects (the “skeleton”) from the infill (the internal and external appearance, design, room layout, etc.), allowing the infill portion to be altered freely without having to modify the structure.

The “super RC frame method” endorsed by Kajima is the ultimate example of skeleton/infill design. The consolidation of support pillars and beams allows for a unique type of construction resembling an enormous one-story building. With Japan’s population aging and the number of nuclear families continuing to increase, this method offers a residence that can be freely adapted for new layouts to accommodate changes in family structures. This design concept is now evolving into a hybrid multi-tower construction method, and being applied more widely to also include schools and office buildings. Kajima continues to pursue the development of buildings that will offer an appeal for years to come.



A school classroom constructed with the hybrid multi-tower construction method. The lack of support pillars offers an open space.

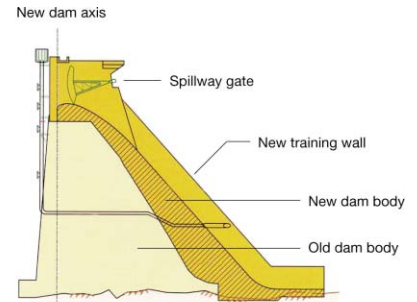
Continuous Use of Public Infrastructure

Japan's public infrastructure increased rapidly since the peak of the high economic growth period in 1970, and by 1998 had grown to an aggregate value of approximately ¥790 trillion. Facilities from that time have already begun to age, and their functionality decline. However, it is not economical feasible to completely rebuild the infrastructure. We therefore need to continue to use current public infrastructure while at the same time maintaining, administering and repairing it from a long-term, systematic perspective. Public infrastructure work has also begun to shift from a "scrap and build" to a "continuous use" model.

Dam Renovation

There are few sites for new dams left in Japan, and amid calls for dams to be more environmentally friendly attention is being focused on renovation of existing dams. Kajima has been involved in 25 dam renovation projects, the most of any construction company in Japan.

The Taishakugawa Dam (built in 1924 in Shobara City, Hiroshima Prefecture) had a small discharge capacity, and there were strict controls on the management of the reservoir. Kajima improved its use efficiency by enhancing the spillways that safely release water downstream when the amount of water flowing in to the lake behind the dam increases, as well as its power generating efficiency by raising the intakes for power generation 35 meters to provide a greater effective head. The areas around the Shimonohara Dam (Sasebo City, Nagasaki Prefecture) had suffered chronic water shortages due to the dry weather in recent years. Kajima raised the body of the dam by 5.9 meters, increasing its reservoir capacity by approximately 1.7 times the previous volume. Both projects required construction work to be conducted while the dams held water, and so necessitated sophisticated construction techniques and skills. The projects were completed without incident through cooperation with the dam operators, with the reborn dams becoming new sources of water for surrounding communities.



The Taishakugawa Dam after preservation measures



The Shimonohara Dam just prior to completion of the raising work

Bridge Renovation

According to the Ministry of Land, Infrastructure and Transport (MLIT), there are approximately 150,000 bridges with a length of 15 meters or more along Japanese national highways and local roads, 45% of which will be more than half a century old within the next two decades. With so many bridges approaching a time when renovations will be necessary, attention is turning to means of managing such vital public assets as bridges.

The Aomori Bridge Management System (BMS), introduced by Aomori Prefecture, draws on the results of bridge inspections and surveys, utilizing bridge and materials engineering to forecast differing degradation phenomena due to structure, materials, environmental conditions, usage, or other factors, to formulate effective and efficient maintenance and management plans that take account of both costs and the needs of the body administering the bridge. The prefecture formed a system development consortium composed of experts in various fields, and over a two-year period from 2004 through 2005 built Japan's first practical BMS system. Kajima was the system developer for this BMS structure.

Budget simulations using BMS show that compared to previous standardized maintenance plans that were exclusively for corrective maintenance, the prefecture can expect to save up to ¥120 billion in maintenance expenses over a 50-year period. Aomori Prefecture authorized a medium- to long-term budget plan based on this result, which has been incorporated into its five-year plan begun in financial year 2006.



Workers use mobile computers to efficiently input the results of bridge inspections.