

Technology



Simulation test of the seismic response of a high-rise building

Kajima has amassed an array of engineering, nuclear, and environmental technologies over the years, underpinned by a robust research and development program.

Engineering for Excellence

Kajima has steadily expanded its presence in the engineering field over the years to complement its core civil engineering, building construction, and real estate development operations. We established the Engineering Division in 1996 to create new value by analyzing customer and market needs, generating innovative ideas, and developing systems to maximize synergies between our technologies and our expertise.

We combine construction technologies with basic technologies in manufacturing, distribution, and data management to formulate proposals for highly functional facilities. We involve ourselves intimately in all design, construction, trial run and adjustment stages and in transitions to full-fledged operations to ensure that facilities are easy to use. We have drawn on our engineering prowess and complete commitment to quality to complete numerous facilities in Japan and overseas.

The Engineering Division is particularly active in the fields of pharmaceuticals, food and beverages, and distribution. Key projects in recent years have included a multipurpose solid dosage pharmaceutical factory for the Fujieda Plant of Chugai Pharma Manufacturing. This facility uses advanced Kajima technologies to fully contain high potency materials. The design also features scalable, fully automated manufacturing and thorough earthquake-proofing technologies.

We have employed advanced information technologies to develop highly efficient distribution systems. Here, flexibility is the key, as systems must be able to accommodate future changes in customer operations. We therefore integrate architectural factors in projects into overall planning for distribution systems. Noteworthy examples of this approach include the Taisho Pharmaceutical Omiya Distribution Center and the Aitoro Distribution Kanto Distribution Center, both of which we completed as full turnkey projects.

Kajima has also been creating innovative agricultural concepts for around a quarter of a century, driven by its bio- and plant-related technologies. One outcome of that

approach is the Iwaki Onahama Greenfarm, a high-tech tomato farm covering around 200,000 square meters. Large, computer-controlled greenhouses all over the facility optimize the cultivation environment throughout the year. Our total engineering package included designing greenhouses, engineering the cultivation environment and cultivation equipment, and assisting with feasibility studies.

We completed the world's first transgenic plant factory, at the national Institute of Advanced Industrial Science and Technology Hokkaido. The design phase required close collaboration between engineers specializing in building construction, equipment and botany experts. We drew extensively on our track record in designing and constructing pharmaceutical factories and our expertise from designing and constructing climate-controlled plants.

It is becoming increasingly important to comprehensively conceptualize and plan integrated systems for facilities, particularly in manufacturing and distribution, going far beyond the traditional approach to designing and constructing buildings and structures. We expect the growing focus on protecting the environment to continue to drive this trend as buildings and structures perform more diverse and complex functions throughout their service lives, affecting all aspects of structural maintenance and care.

Kajima has long stayed ahead of the curve in accommodating customer and social needs. We will continue to create new value for stakeholders by integrating diverse technologies and enhancing our engineering capabilities to formulate innovative solutions

Maintaining Our Edge in R&D

Kajima launched its R&D program in 1949, when it became the world's first construction company to establish its own research center. This was the Kajima Technical Research Institute, whose founding credo was that "Constant research and creativity brings progress and prosperity to society."

Technologies that the Institute developed played key roles in all of Kajima's post-war projects, including for Japan's first skyscraper, as well as for its impressive docks, bridges, tunnels, and spacious structures.

The Institute operates several research centers around greater Tokyo that accommodate diverse needs and verify new ideas and technologies to accelerate commercialization.

The Institute's Main Complex features a laboratory that enables joint multifunctional experimentation, particularly

for environmental research. The Nishichofu Complex engages in a wide range of experimentation. This includes load testing the strength and safety of large structures, testing environmental engineering, testing high-rise building models in wind tunnels, and conducting seismic tests. It also engages in soil and foundation research, one goal of which is to prevent liquefaction.

The Kemigawa Revegetation Laboratory Conducts environmental, slope revegetation, and other studies. The Hayama Marine Science Laboratory researches marine and aquatic environments.

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Noteworthy R&D Successes

Shield tunneling is vital for digging below cities. For the Tokyo Bay Aqua-Line, this method was used to construct tunnels and roads below the ocean floor. Our APORO-cutter shield-tunneling machine can cut through any soil type and can handle an array of sectional excavations needed to construct underground portions of railway networks. Another Kajima contribution to urban excavation technologies is the VASARA method, which makes it possible to enlarge tunnel sections without having to reinforce them.

One key advance is SUQCCEM, an ultrahigh-strength fiber-reinforced concrete that a Kajima-led consortium of four companies developed. The artificial island supporting the D Runway of the Tokyo International Airport in Haneda employs thin and light SUQCCEM slabs. The slabs were used in the runway's pier structure to reduce the number of jackets and piles. The goal was to avoid obstructing outflow from the estuary of the Tama River and thereby minimize environmental impact. Another advantage of SUQCCEM is that it offers outstanding salt resistance.

Kajima has extensively employed its "renewal in residence" method to improve the seismic performance of government buildings, schools, offices, and other structures in earthquake-prone Japan. Our other contributions include the Winchor method for seismic absorption in high-rise condominiums, the world's first active seismic response control system, and passive seismic response control equipment. We are developing systems to respond instantly to earthquake signals, a good example being the Real-Time Disaster Mitigation System. We continue to play a leading role in R&D for earthquake prediction, control, and isolation, a part of which we do in joint research projects including

government, industry, and academia, including universities in the United States.

We developed a technology that uses ultrafine droplets to create a water curtain as a fire prevention system in underground shopping malls and other sites. The curtain helps people to escape during a fire while allowing firefighters to approach the scene. Our safety technologies also include a tsunami simulation system based on analysis of wave speed and height and a road network disaster prediction system for plans used to predict damage from major earthquakes.

Determined to contribute to enhanced building safety, Kajima became the first in the world to explain what caused the collapse of the World Trade Center towers from a structural perspective. This was done by drawing on advanced high-rise and analysis technologies from our experience in skyscraper construction and the data that we have accumulated from shock-resistance experiments for special structures.

We have also developed numerous technologies to reduce the environmental impact of buildings. This is important because heating and cooling account for half of

the energy consumption of these structures. One example is a simulation system that assesses the environmental impact of air-conditioning and heating equipment in a way that reflects regional climatic conditions. One innovative approach is using off-peak, low-cost electricity to store heat and cold in structures, for use during the daytime. We developed computational fluid dynamics technology to predict air current flows in rooms. We have used rooftop greening to improve insulation and counter the heat island phenomenon. Another major innovation was the Kajima urban climate evaluation system, which predicts the heat effects of wind currents and sunlight around buildings and estimates the impact of greening.

Eyes on the Future

Kajima's R&D program pursues social safety and security, exploring the potential of the increasingly sophisticated functions of today's structures to address global warming and other environmental issues, accommodate the needs of customers and contribute to the progress of society at large. The Kajima Technical Research Institute will continue functioning as a knowledge creator, pursuing research in technologies that help Kajima to continue making a difference well into the future.



Mirai High-Tech Indoor Veggie Factory