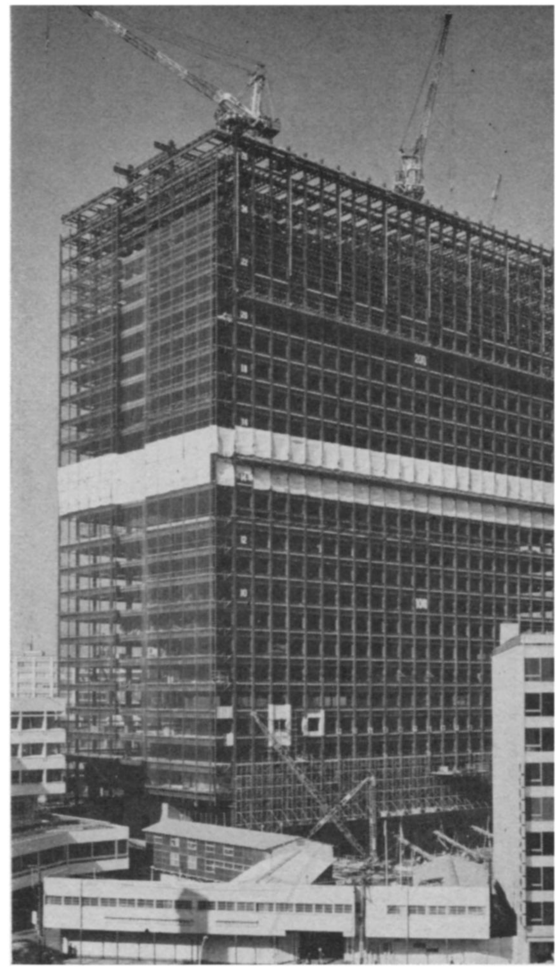
FROM JAPAN

Skyline Changes

Tokyo builds higher as building technology overcomes quakes, tornadoes.



Tokyo's Kasumigaseki Building.

The skyline of the world's largest city was once dominated by the luxurious Hotel Okura, an 11-floor structure with its lobby on the fifth floor, taking full advantage of its high hillside foundation. But not for much longer.

Tokyo's skyline is changing with revision of the 40-year-old Building By-Laws. Now that buildings no longer have to cram 10, 11, even 12 floors into the old 100-foot maximum height, new edifices are being planned, blueprinted and constructed, legally and in safe defiance of Japan's historic deadly trio—earthquakes, typhoons and fires.

Downhill from the Okura the Kasumigaseki Building, Japan's first skyscraper is rising toward its 36-story completion next March. It will stand 441 feet high.

Weighing 150,000 tons—16,000 tons in steel sections alone—Kasumigaseki will be finished, by a 1,000-man work-force, at a cost of about $42 million.

Engineering science has broken the building height barrier, safeguard against Japan's frequent earthquakes, which was first imposed in the wake of the Sept. 1, 1923 Shinsai (great earthquake) that rubbled Tokyo and almost burnt down Yokohama, the port-city 19 miles away.

Overpopulated Japan, forced to build vertically since horizontal spreading was growing impossible, began to look up and take action.

Due to pleas and the inescapable logic of Dr. Kiyoshi Muto, a pioneer in structural mechanics, and an expert on quake-proof buildings, the Government lifted the ban in July 1963. Muto's research had convinced officials of the efficacy of what he calls "dynamic design"—instead of rigid mass—in withstanding earthquake shock waves.

Japan's initial skyscraper is dwarfed by New York's Empire State and other buildings around the world, to be sure. It is, in fact, as senior architect-engineer Sei Nikai observes, "only the exact height of Egypt's first pyramid, built in 2600 B.C."

This, however, by no means diminishes the technological expertise and painstaking research that brought Kasumigaseki into being.

Planning took advantage of Japan's national network of 250 strong motion seismographs, installed specifically to record buildings' reactions to all tremors, great and small. Buildings' responses are now predicted by feeding seismographic data into electronic computers.

Earthquake force has a known relation to the natural vibrations of a building, and through logographs Japanese scientists can first determine response to vibration. They determined the natural period of buildings, having learned that in tall buildings, this period is long and the vibration characteristic is not intense. They call the total temblor force on a building "the base shear coefficient multiplied by the building's weight" and they emphasize that if the structure is taller, the natural period is longer, and that this being so, the base shear coefficient is smaller.

Kasumigaseki has been tested to withstand the "worst conceivable contingency," a repeat performance of the 1923 blow. Kasumigaseki will have a safety margin enabling it to resist a quake 30 percent stronger than 1923s.

Fire, another threat in disaster-prone Japan, is carefully guarded against. Building materials are fireproof. Each floor has a fire shelter and a smoke tower for sucking out fumes. Inner walls are composed of aluminum sheet coated with synthetic resin. Asbestos is widely used. Room divisions are of lightweight concrete.

Typhoons constitute, in experts' opinion, more of a threat to tall buildings than do temblors, since the latter occur on a major scale only every 50 to 100 years. Japan is seasonally lashed, Tokyo especially, by typhoons spawned in mid-Pacific that raise howling winds and bring curtains of rain.

There is need, thus, for balance between rigid and flexible construction. The former is the worst design for quakes, the latter for typhoon-velocity winds, and the taller the edifice the greater the wind blast against it.

Apart from reaction to potential natural disasters, builders took many factors into consideration in planning Kasumigaseki. They devised unique construction devices and unique ways of using them.

For earth shielding during excavation, for example, they resorted to concrete pilings set close together to form a sheath which kept loose earth from tumbling into the excavation.

This was devised by architect-engineer Nikai and his chief assistant, Shoichi Kishimoto, 32. They work closely in what Japanese term a "shite-kankei" relationship, master and disciple.

Another advance is Japan's first heavyweight tower crane. Featuring a two-part climbing system, it rises as the building rises. It consists of a 45-ton rotatable arm and a 45-ton mast, each elevated separately.

The building has another unique feature: there is a lack of interior pillars that permits more floor space on each floor for office rentals.

One skyscraper, of course, does not make a skyline, the Kasumigaseki Building has already set a trend, and new buildings are sure to sprout in skeletonic form long before the pioneer is completed. *Stuart Griffin*