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New Column for Tall Reinforced Concrete Buildings

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A twenty-five story condominium constructed by Kajima Corp. is the highest reinforced concrete building in Japan, meeting the structural requirements for earthquake resistance. However, demand for the construction of taller buildings, particularly in urban reconstruction, is increasing. Therefore it has become necessary to develop new structural systems, especially a column system applicable to high-rise buildings taking into account earthquake resistance, economy and execution of works.

Now, in the twenty-five story condominium, the special lateral reinforcement which combines a circular spiral hoop and conventional lateral hoop is used. Since the concrete is effectively restrained by this special lateral reinforcement, it was proved that the restoring force is slightly reduced by cyclic lateral loading as shown in Fig.2.

So, for 30～40 story buildings, we have devised a new column system using high-strength concrete, small-size H-shaped steel and special lateral reinforcements, as shown in Fig.1.

And many specimens were tested to investigate the structural characteristics of the column system. The central compressive force was applied to test specimens as shown in Fig.3. As a result of this test, the maximum load capacity and its reduction ratio for the KS-type column compared to the central compressive force are the same or more than those for the conventional H-type column which uses H-shaped steel with a large sectional area.

The bending and shearing force was applied to test specimens as shown in Fig.4. As a result of these tests, the special lateral reinforcement is superior to the conventional lateral reinforcement on the capacity of restoring force after the maximum load. And the load capacity and ductility of this column are sufficient performance comparing with the conventional column under high compressive or tensile axial load. In addition, this new column has restoring characteristics regardless of the internal H-shaped steel load direction.

As a result of our research, design range of the column has been setting up like Fig.5. And the construction of economical forty-story buildings has been made possible.

NEW COLUMN FOR TALL REINFORCED CONCRETE BUILDINGS

BACKGROUND

In Japan, demand for the construction of 30~40 story condominium is growing. So it has become necessary to develop new column system taking into account earthquake resistance, economy and execution of works.

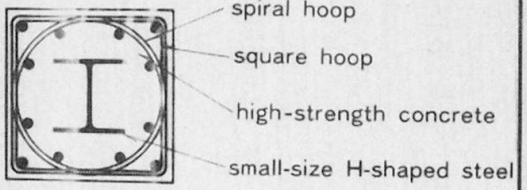


Fig.1 Newly Devised Column

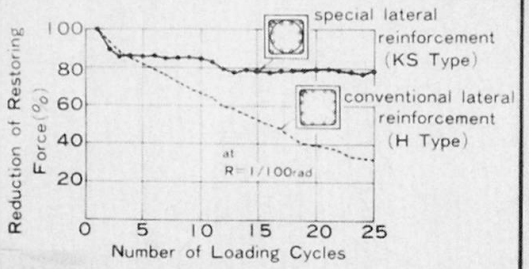


Fig.2
Effects of Special Lateral Reinforcements on Restoring Force for Cyclic Loading

RESEARCH AND DEVELOPMENT

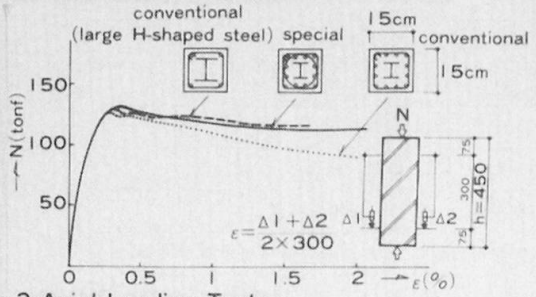
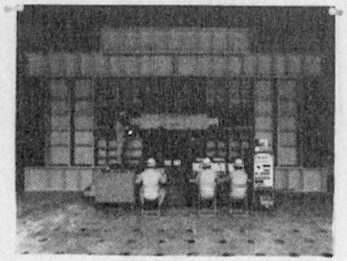
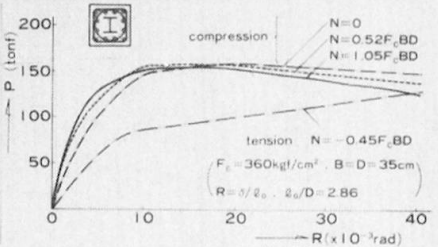
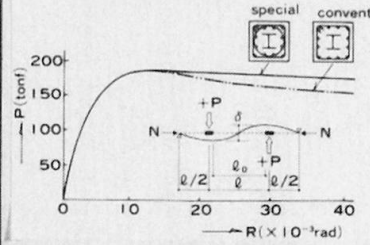


Fig.3 Axial Loading Tests







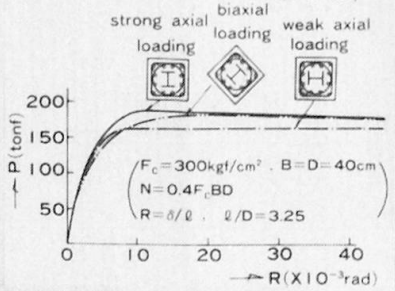


Fig.4 Bending and Shear Tests under Constant Axial Load

DESIGN

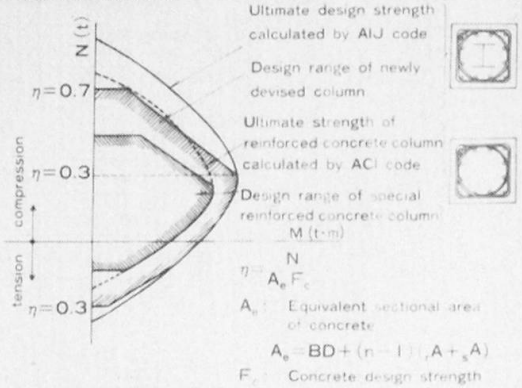
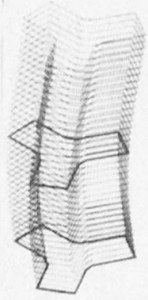


Fig.5 Design Range of Column



an example of analytical deformation magnified one hundred times

Fig.6 Perspective of First Building in which System to be Applied