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Artikel: 30 storey reinforced concrete buildings in Kawasaki City
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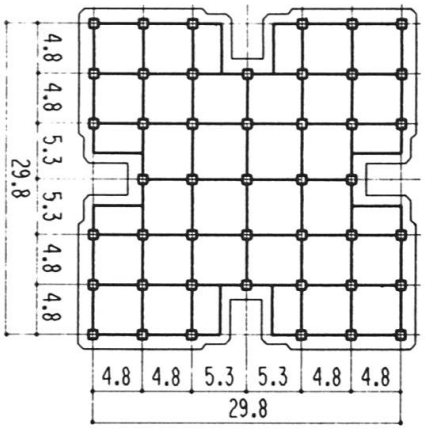
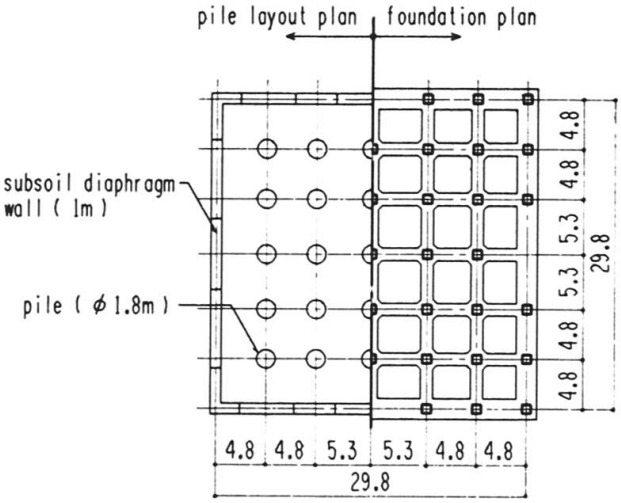
2. 30 Storey Reinforced Concrete Buildings in Kawasaki City

Owner:	*Mitsui Real Estate Development Co.*
Architects & Engineers:	*Kajima Corporation, Architects & Engineers*
Contractor:	*Kajima Corporation*
Size and Scale:	
Number of Storeys:	*30 storeys plus 2 storey penthouse*
Maximum Height:	*97.05 m*
Typical Floor Area:	*813.3 m²*
Total Floor Area:	*24400 m²*
Quantities of Materials:	
Superstructure:	*0.38 m³ concrete and 85 kg steel per unit floor area in m²*
Substructure:	*2124 m³ concrete for whole foundation and 160 kg steel per unit concrete volume in m³*
Construction Period:	*26 months*
Date of Completion:	*March, 1987*



Typical floor plan

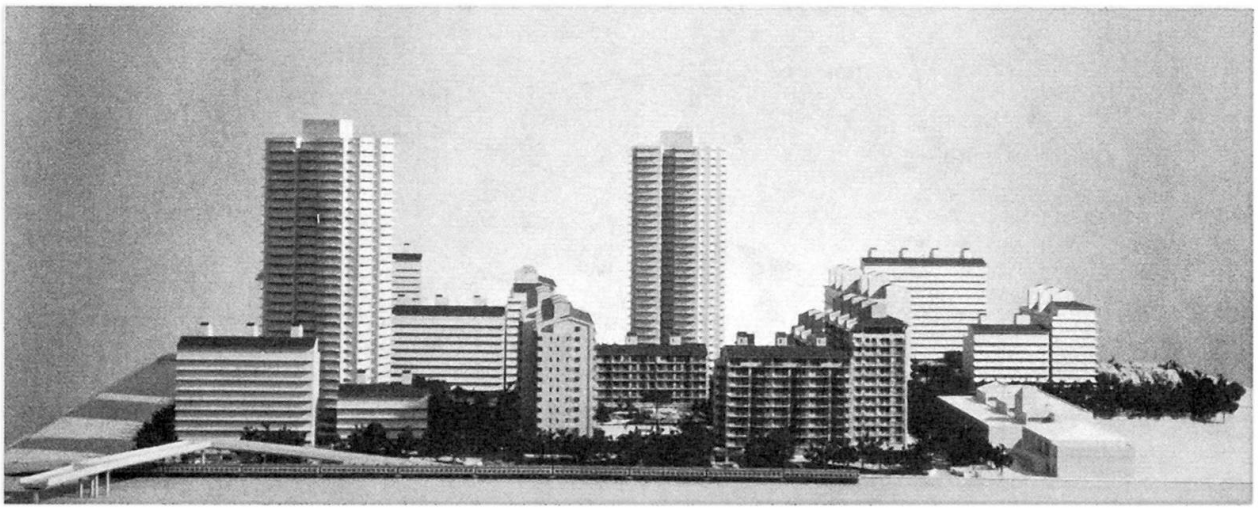


Pile layout plan and foundation plan

Introduction

For the purpose of urban renewal of the city of Kawasaki located 20 km from the centre of Tokyo, a 7.1 ha area by the railroad has been under development since 1983 for a multiple unit housing complex with 22 buildings. Following the completion of medium-rise buildings, 7 to 13 storeys high in two blocks, two 30 storey reinforced concrete buildings are now under construction at two other blocks in the site.

Although the Japanese building code had limited the maximum height of reinforced concrete buildings to 20 meters or 7 storeys due to vulnerability to earthquakes, Kajima Corporation has solved the potential problems in design and construction to successfully develop a new original Design/Construction Method called HiRC.



Schematic view of Park City Shinkawasaki

Design

Subsoil diaphram walls, piles with enlarged base through 30 m of deep silty sand stratum and grid-type foundations are designed to support the gravity load of the superstructure and to resist earthquake-induced load with potential liquefaction.

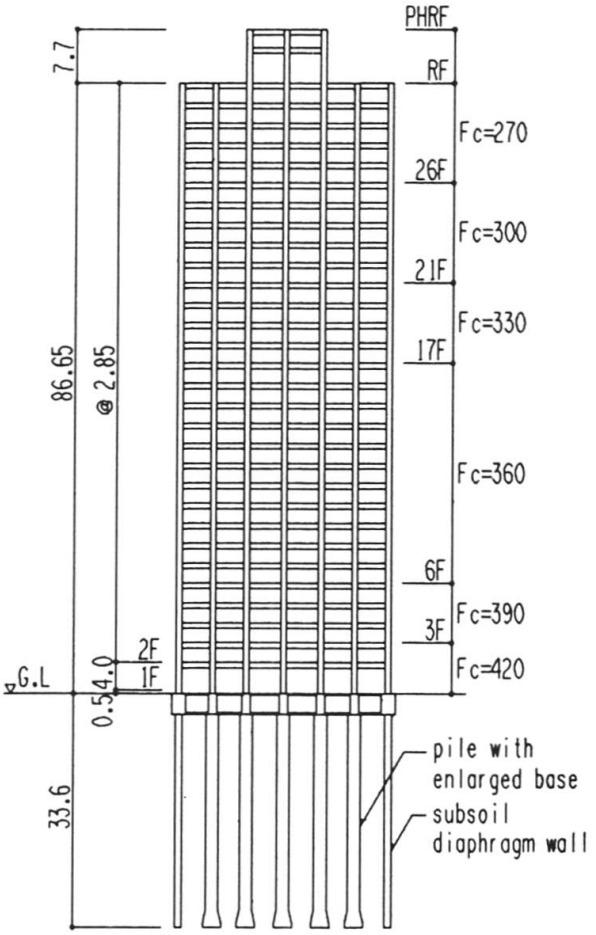
The superstructure is composed of moment resisting frames structurally separated from interior walls, which make possible the flexible housing layouts at every floor. High strength concrete up to 420 kgf/cm² and reinforcing bars up to 4000 kgf/cm² are used with a new system of reinforcing bars arrangement to resist alternate loadings due to earthquakes. In order to minimize high concrete stresses in exterior columns on the lower storeys, additional core-reinforcing bars are provided.

Since these methods and materials were unprecedented in Japan, design equations were verified through extensive structural testing. Nonlinear dynamic response analyses were also conducted for severe earthquakes with maximum accelerations of 0.25 g to 0.5 g.

Construction

Column as well as beam reinforcing bars are preassembled in the stock yard utilizing standardized bar arrangement. The «U» anchoring method for beam reinforcing bars is employed in order to facilitate preassembly. After installing preassembled beam reinforcing bars and slab reinforcing bars, concrete with slump less than 15 cm is poured on the large flying shores.

An unit of preassembled column reinforcing bars up to 41 mm of diameter are hoisted up to the floor level, then, spliced by 3 types of methods (coupling, gas-welding and sleeve squeezing respectively). Concrete for columns is poured separately from horizontal members at each floor level. The average time for these repetitive works is 8 days per floor. *(J. Ohkawa)*



Framing elevation

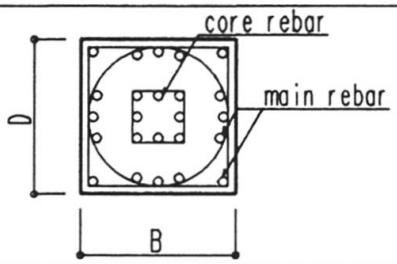
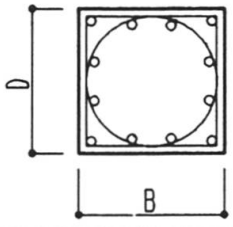
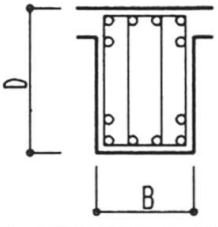
	Exterior Column				Interior Column			Beam		
Cross Section										
floor	B × D	main rebar	core rebar	hoop	B × D	main rebar	hoop	B × D	main rebar	stirrup
30	800×800	12-D32	—	D13 @150 13φ @150	750×750	12-D32	D13 @150 13φ @150	500×750	4-D25 2-D22	4-D13@175
22	800×800	12-D35	—	〃	750×750	12-D35	D13 @125 16φ @125	550×750	6-D35	4-D13@150
12	850×850	12-D41	—	D16 @125 16φ @125	800×800	〃	D16 @100 16φ @100	550×800	4-D41 2-D38	4-D16@125
2	850×850	16-D41	8-D41	D16 @100 16φ @100	800×800	16-D41	〃	600×1000	〃	〃

Table of typical cross section