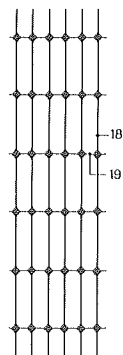
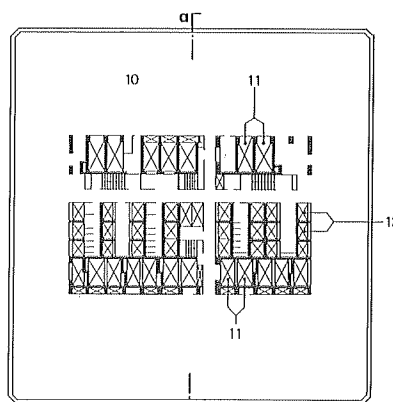


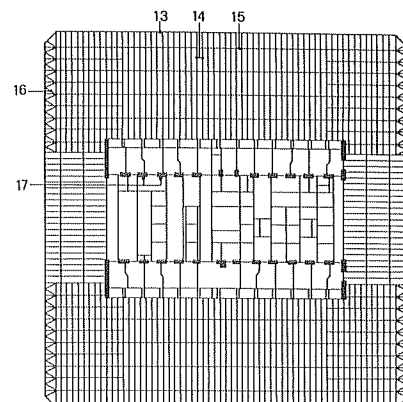
Location plan of the complex



Structural system based on framed tube principle

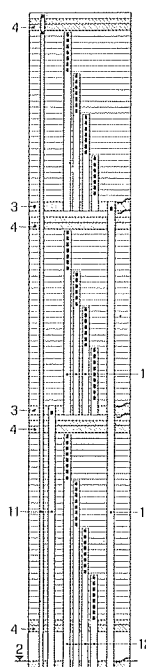


Plan of typical floor, scale 1:1300



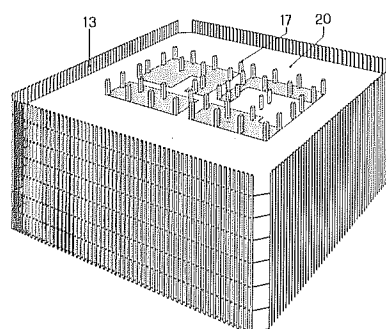
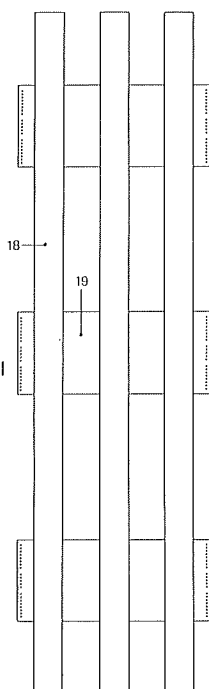
Structural system for typical floor

Diagram of the lift system

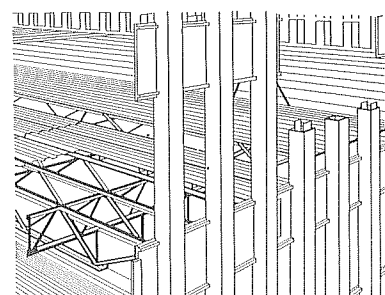


- 6 Office block
- 7 Hotel
- 8 US Customs building
- 9 Ancillary building
- 10 Open-plan office
- 11 Express lifts
- 12 Local lifts

External wall unit

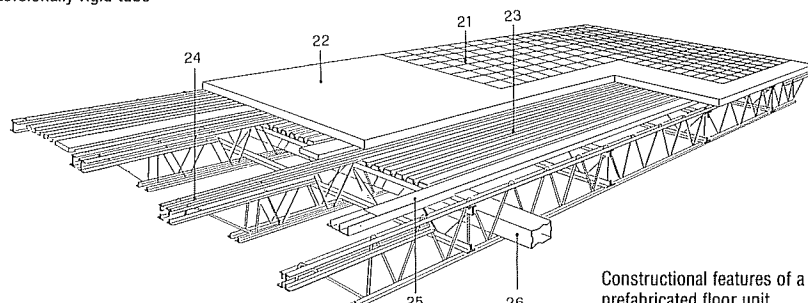


Framed tube construction principle: loadbearing external walls stiffened by the floors to form a torsionally rigid tube



Assembly of the external wall units (alternately staggered in one-storey heights) and floor units

- 13 Loadbearing external wall
- 14 Bar joist 900 mm deep
- 15 Secondary joist
- 16 Horizontal bracing
- 17 Core box column 450 x 450 mm
- 19 Spandrel element with holes for connecting to adjacent member
- 20 Floor slab
- 21 Floor covering
- 22 *In situ* concrete
- 23 Trough decking
- 24 Bar joist
- 25 Electrical services duct
- 26 Air-conditioning duct



Constructional features of a prefabricated floor unit

joists through the steel decking and embedding them in the slab. Dead weight of floor 50 kg/m<sup>2</sup>, imposed load 488 kg/m<sup>2</sup>.

Each upper floor comprises 32 prefabricated units spanning between core and external columns. These units are of two sizes: 18.3 x 6.0 m along the longitudinal faces of the core and 10.7 x 4.0 m along the transverse faces. Additional beams are provided to strengthen the four corner bays.

Oscillations due to wind are absorbed by viscoelastic shock absorbers installed between the floor beams and the external columns. Electricity and telephone cables and air-conditioning ducts are incorporated in the floor units, being installed prior to erection.

Fire protection of the steelwork is provided by 3 mm thick sprayed vermiculite plaster. The core has been designed as a safety zone with emergency stairs for escape and with hydrants for active fire-fighting operations. Water for extinguishing fires is available in tanks, each of 18 500 litres capacity, which are installed on the technical services floors. Additional riser pipes are installed in the core.

● Foundations: Rock with a permissible bearing pressure of 39 kg/cm<sup>2</sup> occurs at a depth of 22.5 m. The excavation for the basement and foundations, area 440 000 m<sup>2</sup>, is enclosed by a 90 cm thick reinforced concrete diaphragm wall anchored back into the surrounding ground. The column foundations comprise two-layer grillages which transmit the loads through a concrete base slab, 2.1 m thick, to the underlying rock.

### Services

The whole complex of buildings is fully air-conditioned. In the tower blocks, air-conditioning units are installed in front of the windows around the perimeter of the floor. The cooling plant at bottom basement level obtains cooling water from the adjacent Hudson River at a rate of 330 000 litres/min. There are seven cooling units each with a capacity of 21 000 Mcal/h. The cooled water (at a temperature of 3.3°C) is distributed through a total of 20 distributing stations.

The top part of each tower (59th to 110th floor) has a high-pressure air-conditioning system comprising two distributing stations

on the 75th floor and two on the 108th. On the floors below and in the ancillary buildings a low-pressure system is provided, with a total of 16 distributing stations located in the basement and on the 7th and 41st floors. Heating is by means of steam generated in the central air-conditioning plant.

Areas and volume (per tower)			
gross area	418 000 m <sup>2</sup>	area on plan	4032 m <sup>2</sup>
effective floor area	319 000 m <sup>2</sup>	volume	1 754 000 m <sup>3</sup>

Quantities of steel (structural steelwork in one tower)			
total	78 000 t	per m <sup>2</sup> gross area	186.6 kg
per m <sup>3</sup>	44.5 kg	per m <sup>2</sup> eff. floor area	244.5 kg

### References

Architectural Forum, 4/1964, p. 119 – *Engineering News-Record*, 9/1964, p. 36; 11/1971 – *Der Stahlbau*, 11/1964, p. 350; 4/1970, p. 123 – *Der Bauingenieur*, 9/1965, p. 373; 11/1967, p. 421 – *Bauwelt*, 32/1966, p. 909 – *Acier-Stahl-Steel*, 12/1966, p. 556; 6/1970, p. 273.