George Daddi

KOENIG	MONTREAL	GLOBE
ROSATI	NEW YORK	S/S
NAGARI	JAPAN	GRANIT
CALDER	CONNETICUT	STEEL

Designed by MINORU YAMASAKI - Detroit
Construction drawings - EMERY ROTH, NEW YORK
Structural " SKILLING, HELLE, CHRISTIANSEN & ROBERTSON
Mechanical " JAMES BAUM & BOLLES
Electrical " Joseph LORING & ASSOCIATES
First tenant move in - December 1970

WTC complex, SITE is a 16 ACRES 65,000 M², six building project which includes the twin towers and four low-rise plaza buildings, all surrounding a 20,000 M² 5 ACRES = SIZE OF 4 FOOTBALL FIELDS landscaped plaza -
The two towers are 450M. 1350' high above sidewalk, 110 stories, ~~and~~
70M 207×207 each side, each floor has an area of 4000 M² 42,000 □' The entire complex has 21,800 (31,000 M²) 43,600 WINDOWS of glass, light reflector 204 ~~208~~ elevators
Below grade at the main lobby level has a concourse with restaurants 100 international shops or stores, 12 banks, below we have additional 6 floors containing parking space for 2000 cars tenant storages and the main mechanical rooms - in addition to a large truck dock serving the entire complex -
In addition to the U.S. Custom building, we have another two 9 stories office building, one mainly occupy by the commodity exchange -
A ~~22~~ floors, 900 rooms Hotel is in schedule to ~~start~~ construction during this year, this building will be located on the south-east corner of the project -
The entire complex its occupied by 50,000 people + 80,000 visitors daily
daily population appox 130,000 people -

Special facilities: 106 floor restaurant called "window on the World"
on the south tower 106 floor observation deck
World Trade institute (at 54 floor) 1WTC
Information center at lobby level
Airlines center at lobby level
~~1,000,000~~ 9,000,000 m^2 of occupied space –

Technical fixtures: foundation on bed rock 70' 23 m below sidewalk
they supports appox 1,250,000 tons of building
Towers divided in 3 zones with express
elevators, each elevator contain 55 people and
traveled ~~44~~ 44 stories in 35 seconds – or
~~[redacted]~~ 4 meter each second –
Office space does not have any interior
columns – giving maximum flexibility of layout
structural system or colums are countained in the
core and of the perifesal wall (between windows)
Elevators, shaft are stack one on top of the other
Floor slab-ceiling space contain al mechanical
electrical-telephone need, a grid of electical.
telephone cells are every 2 meters
Every floor has 3 emergency stairs, & 2 hours
fire retarded construction –

The entire foundation has been built in the river bed, protected by a slurry wall creating a huge. both tubs — 1,2 MILLION CUBIC YARDS OF EXCAVATION

Mechanical

The entire project contain an air condition system of approx 49,000 tons -
Electricity in case of emergency is produced by 5 diesel generators of 1000 KVA each, they get in action automatically and provide essential light and power for the project -

In the office space the lighting fixtures are also use for heating, air condition and ventilation

Floor load for office space 100 lbs/S.F. 500 KG/M²
Each floor has a legal occupancy of 400 people -

The WTC opened for business in December 1970.
The WTC is scheduled for completion in early 1974.
The WTC complext will house 50,000 employees.
The WTC complex will attract another 80,000 business and other visitors on an average weekday, for a total of 130,000 people.
Rentable office space is 9 million square feet.
Cost $700 million.
WTC #1 & #2 dimensions each: height 1,350', 110 stories; base 209 ~~square~~ UN. feet.
Space per floor 40,000 square feet. Elevators 104 local and express elevators.
Windows: 21,800; 310,000 square feet of glass.
Below grade: International shops and restaurants, parking for 2,000 cars.
WTC Terminal: truck docks, and tenant storage areas. Six levels in all.
Taxi loading and unloading lanes are located on the four sides of the WTC site, on Vesey, Church, Liberty & West Sts.
WTC complex is a 16-acre, six-building project which includes the twin towers buildings and four low-rise plaza buildings, all surrounding a five acre landscaped plaza.
7 Centrifugal refrigeration machines for a total of 49,000 tons.
Purge system is not operable during a power failure, it's not connected to the emergency generator system.
294 Level, North and South projections are not supplied with a sprinkler system.
Risers feed systems at elevation B1 294, B2 284, B3 274, B4 264, B5 253, B6 242.
Loop main is 8".
Water main on utility rack on east sice (Church St.) of 294, level in J-4-5 and K-4 area.
City water main 12" runs outside East Slurry Wall and is fed at Vesey & Greenwich and at Libery and Greenwich Sts.
Foundation in bed-rock 70' down and carrying 1,250,000 tons of bldg. ←
Basement 980' long, 510 feet wide, 70' deep houses PATH station, mechanical rooms, storage room for tenants and parking for 2000 vehicles.
Basement perimeter wall is a 3,100 foot concrete rectangle.
Zone 1 - Concourse - 43; Zone 2 - 44 to 77; Zone 3 - 78 to 110.
Express elevators carry 55 people each, no trip takes more than 2 minutes.
Floor slab includes utility and air-conditioning ducts.
Plenium is 32" deep.
43,600 bronze tinted, heat-reflective glass windows Towers only.
Floor loads 100 lbs per sq. ft.
Floor occupancy 100 sq. ft. per person or 400 people per floor.

Towers are 110 stories each - 1350' - a five acre park-like plaza.

A 700 million dollar project - with more than 700 tenants, and Rental Space of

230 Acres or 9 million square feet.....10 million square feet in six buildings.

80 MW at 13.8 KV. Two cables in parallel for each incoming line.

Feeders cabled up the towers to substations (Mer's 7,41,75,108), where voltage is trimmed to 480/277.

District steam is piped throughout the complex for space heating.

Cooling comes from a single 49,000-ton chiller center (B5-253 level) housing seven-7000 ton compressors. Unwanted heat will be carried away by the Hudson River Water.

Both towers have two secondary substations on each of the four machinery floors.

Fire pump circuits bypass the service protectors, being connnected directly to the center section of the 4000-A bus. This reduces the possibility of losing the 250 HP, 750 GPM firepumps power should a fault on another circuit cause the service protector to de-energize a section of the bus.

Separate buses that serve the elevators are included in the tower sub-stations, (MER's 7, 41, 75 & 108). These buses are normally fed by one of the circuits from a main bus section, but a transfer switch can connect them to the emergency generators should the normal power-source fail.

Main lighting risers at 480Y/277V extending from the 7th to the 24th floors. Cable taps are taken off at the 9th, 13th, 17th and 21st floors. Cables then extend upward to lighting panels on three floors above as well as on the floor where the tap is made.

Dry transformers serve the 208Y/120V risers.

Elevators are served from each of the substations on the 41st, 75th and 108th floors of the tower buildings. Each of these floors has two substations, both having a separate bus for elevator circuits. There are four feeders connected to each of the two elevator buses. In the event that power fails throughout the building, as in the case of a utility blackout or severe damage to the incoming power lines, the automatic transfer switch connects the elevator buses to the emergency generator source and disconnects it from the substation bus.

Emergency power supplied to elevators, emergency lights, fire pumps, alarms, exit lights, stairwell lights, etc. are supplied by five diesel-driven generators, each rated at 1000 KVA 480Y/277V. The generators are started up automatically upon loss of a substation when the utility source of power is interrupted. In addition to these generators supporting the electric system, other generators (ultimately five) are provided by the telephone company to support the telephone communications system. In addition, emergency power is available for the fire pumps of the 294 and 41 MER's. However, the transfer is not automatic; it must be selected at the pump in the MER.

The fluorescent flush-mounted fixtures are also air=handling outlets for heating, ventilating and air-conditioning systems.

A 32-inch deep plenum, or floor cavity, is used to house the lighting fixtures, air-conditioning ducts and other services.

Towers are divided into three zones, each with its own lobby. Zone One's lobby is located on the Concourse. The lobbies for the two upper zones are called "Sky Lobbies". Zone Two's sky-lobby is on the 44th floor, that of Zone three on the 78th floor. Express cars from the concourse, each with a capacity of 55 persons. Some express elevators go directly to the 107th floor. At the sky lobbies, passengers transfer to the local elevators. The floors above and below the sky lobbies are reached by escaltors. In an emergency in which normal power is lost, the emergency generator supplies power automatically. In an emergency such as a blackout, the elevators in transit are first brought down to their lobbies so that passengers can be discharged. Elevators can be manually selected to carry people from the lobbies to the Concourse.

NOTE: The PURGE system is not operable during a power failure and is not connected to the emergency generator system.

As noted before, there are two distribution buses feeding elevators on each of the secondary substations. In any bank of six elevators, threee will be supplied from one of the buses and three from the other. If a fault interrupts power from one of the buses, only half of the elevators in a given bank will be affected. The others will continue to operatve normally.

There are 102 elevators in each tower and they have a top speed of 1600 feet per minut

Zone 2 and all PA floors use the four elevator banks 46-54; 55-61; 62-67; 68-74.

The 61st floor is an internal transfer floors where you can switch cars to go from the 55th fllor to the 74th floor.

Each of the four elevator banks has specially desig ned elevators for the convenience of handicapped persons. Unlike the regular cars, these stop at the 43rd floor where the dining facilities are located.

Central chiller-plant is 68 feet below ground level (B4 & 5 ^{EL} @%&).

Size of plant is 49,000 tons of refrigeration on a 2-acre site.

The Hudson River is used as a replacement for cooling towers, to remove heat from the chiller-plant condensors.

Seven 7000 ton-YORK centrifugal machines are used. Chilled water is pumped to 20 MER's throughout the project. Equipment rooms are located below grade and at 7th, 41st, 75th and 108th floors. High pressure zone embraces equipment rooms at 75th and 108th floors; low pressure zone covers remaining equipment rooms. This means that 17,000 tons maximum cooling is sent to the top two equipment rooms in either tower, while 32,000 tons maximum is distributed to the other 16 rooms.

The pumps circulating chilled water must be big; high zone units in particular, must feed points 1400 feet above pump discharge. Five pumps each for high and low pressure zones. The refrigeration machines have a design-chilled-water exit temperature of 38° F at a design flow rate of 1.5GPM/ton. Each evaporative cooler is 26" long, 82" in diameter, weights 64 tons.

Five foot intake and effluent pipes bring in and discharge water from the Hudson River for the cooling system. Intake is at a pump house located on the land-fill about 1000 ft from the WTC. In the pump house water is rough-filt ered through rotating screens and hyperchlorite is added to prevent algae growth in the system. Before reaching refrigeration machine condensers, the water passes through strainers in the chiller-plant. Water flow to and from the Hudson River will be 1.8 gpm/ton (roughly 88,000 gpm); river temperature varies from 35 to 75F.

As stated before, the refrigeration plant generates chilled water that is distributed to two zones in WTC buildings. The high zone reaches the upper floors, low zone supplies lower tower floors and remaining buildings. The seven 7000 ton units use R-22 refrigerant - 22,000 lb. for each unit and driven by 7000-HP synchronous motors coooled by an auxiliary system drawing upon river water. Domestic water is used to fill the chilled-water lines in the towers; the domestic-water system, with pumps at each MER, has the capability of providing water at any tower head pressure. Chilled water risers are 24 inch diameter in both the high and low zones. The maximum riser length will exceed 1400 feet.