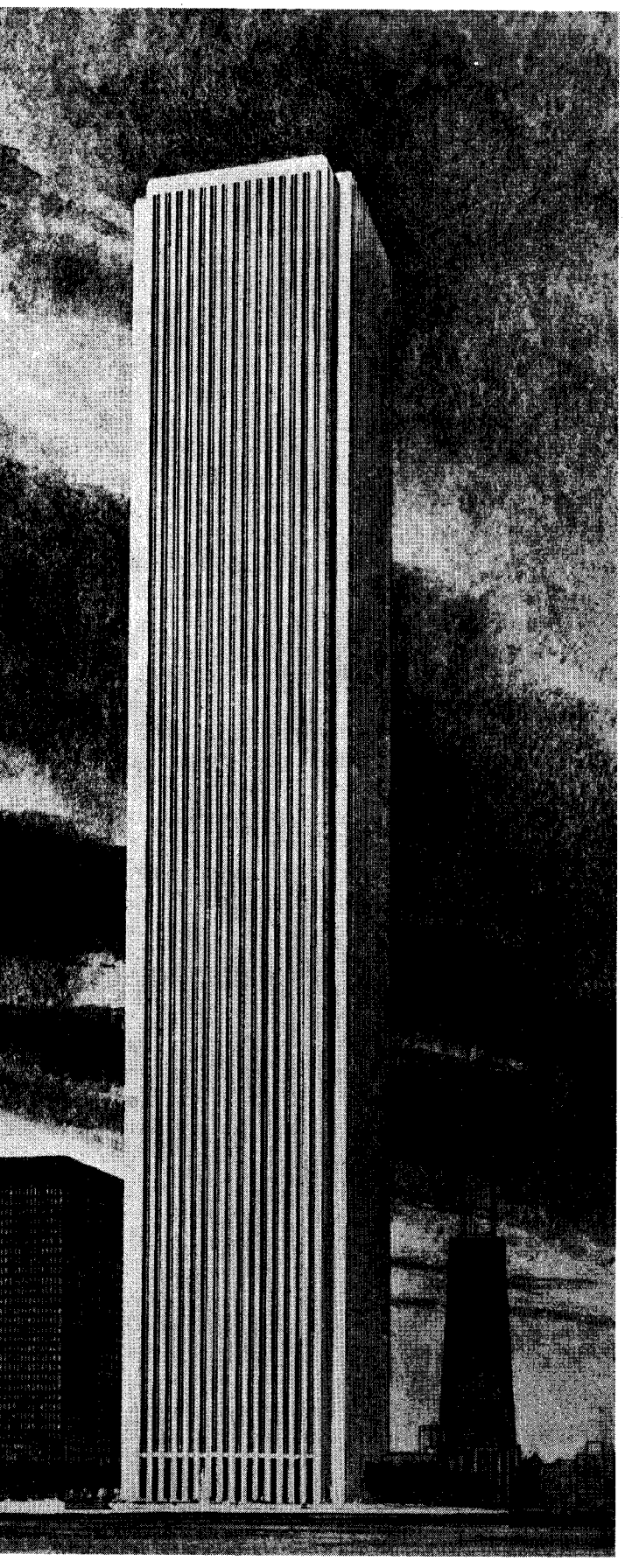


Chicago's 80-story Standard Oil Company (Indiana) Building will have 40 double deck elevators in eight-car banks.

Planning Double Deck Elevator Systems

W. H. WUHRMAN & PALIATH MOHANDAS
Consentini Associates

Every multistory building needs enough elevator capacity for good service above the main floor. Consulting engineers face the challenge of providing the necessary elevator capacity without taking too much space for elevator hoistways. One of the most promising solutions is the double deck elevator.

Today's trends make the double deck approach to elevator efficiency more appealing than ever. As buildings become taller, elevators take longer to reach upper floors. Since the elevators make fewer round trips in a given time period, a taller building must have more cars. All the hoistways may consume so much rentable space, especially on lower floors, as to impair the economic feasibility of a very tall building. With soaring construction costs and land prices, elevator planning to conserve building space assumes even greater urgency. The need becomes most acute in a high-rise building occupied largely by one organization, where people start work and leave for home at about the same time and create exceptionally heavy traffic peaks for elevators to handle.

Double Deck Principle

Elevator carrying capacity is essentially a function of platform area. To travel in comfort, each passenger needs about two square feet, although under rush-hour conditions riders will crowd into an average of 1.3 square feet per person. With conventional elevators, increasing platform area or the number of elevators takes more space for hoistways and leaves less for other purposes.

Instead of increasing available platform area — and, necessarily, hoistway space consumption — engineers have been investigating the alternative possibility of elevators with two platforms, one above the other. In essence, the principle of the double deck elevator is

comparable to building a two-story colonial rather than a ranch home to house a big family on a small lot.

Each double deck elevator has an upper and lower cab in a car frame about twice the usual height. Entrances and interiors look much like those in conventional, single deck elevators. Passengers enter the respective cabs from two lower-terminal levels. The lower terminal may be a split-level lobby, with elevator entrances ½ flight above street level and ½ flight below, or entrances may be at street level and on a mezzanine level. People going to odd-numbered floors use one terminal level; to even-numbered floors, the other. The two levels may be linked by escalators, stairs, inclined moving walks, or stationary ramps.

Each double deck elevator stops as it reaches floors for which passengers have touched the appropriate control buttons. At some stops, passengers will enter or leave both upper and lower decks. But at other stops, passengers will get in or out of only one deck.

Since some stops enable the double deck elevator to answer calls for two floors, it usually has to make fewer stops per trip than a conventional, single deck elevator. Total traffic handled during a period of time is further increased because passengers enter and leave both decks simultaneously, in less time than in a single car with equivalent platform area. Time saved by the double decker in passenger transfer lets it complete each trip sooner, make more trips in a given period, and carry more passengers during that period.

Properly applied in a high-rise building, double decking is estimated to increase elevator handling capacity by 25 to 50 percent, which would permit reducing the number of elevators and hoistways by as much as one third. In a 50-story building, for example, 24 double deck elevators could do the work of 34 of the conventional type. With each elevator taking some 150 square feet of floor space from each floor through which its hoistway passes, going double deck could save 14,000 square feet of area in the 50-story building. At $8.00/sq ft, the floor space saved would be worth $112,000 per year.

Double Deck Installations

Buildings with double deck elevators include the recently completed Time-Life in Chicago and, under construction, the Standard Oil Company (Indiana), also in Chicago; John Hancock Tower, in Boston; and Commerce Court, in Toronto, Canada.

Chicagoans already are using the 12 double deck elevators in the 30-story Time-Life Building. Upper cabs serve even-numbered floors, the lower, odd numbers. Passengers enter from a lobby with upper and lower levels for the corresponding decks of the elevators. They are grouped in two banks of six cars each, one for the upper and the other for the lower floors.

The Windy City's second such system, in the 80-story Standard Oil (Indiana) building, will set records for number and speed of double deck elevators. In all, the building will have 40 such elevators grouped in five banks of eight cars each. The eight elevators to the highest floors will travel at 1600 fpm. Starting from the double lobby levels, the five elevator banks will serve, respectively, the first 20 floors, the 20th to 38th, 38th to 54th, 54th to 68th, and 68th to the top floor.

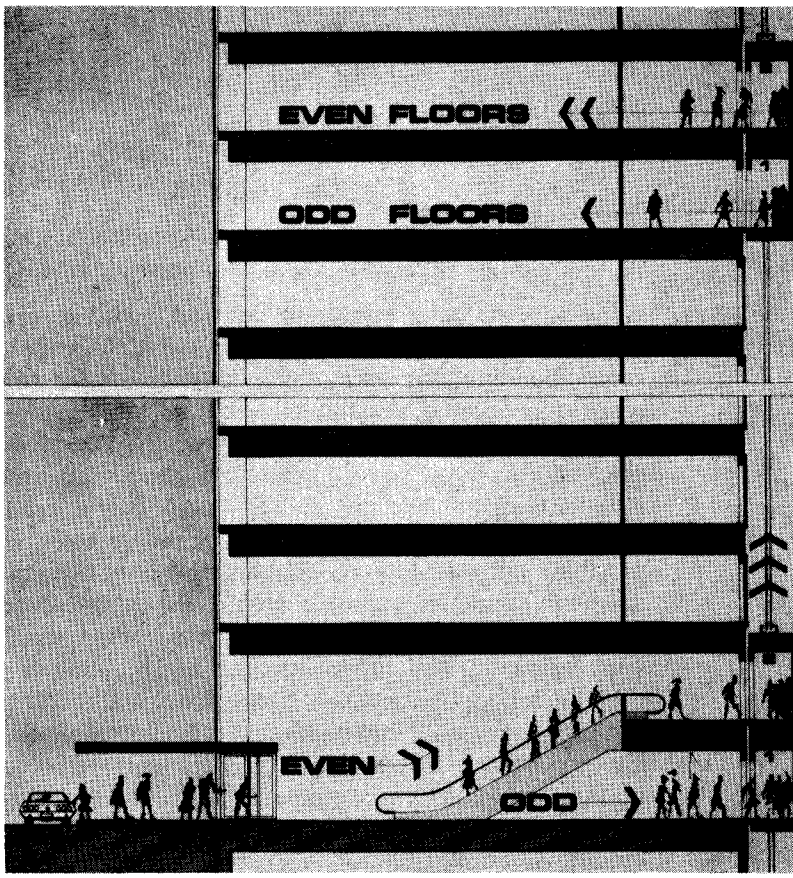
Boston's 60-story John Hancock Tower will have 30 double deck elevators, in five, six-car banks. Speeds range from 700 fpm for the cars serving the lower floors to 1500 fpm for those traveling to the uppermost levels. One bank will serve every floor to the 16th floor; others, the 15th to 26th, 25th to 36th, 35th to 48th, and 47th to 60th floors.

North of the border, the new, 57-story Canadian Imperial Bank of Commerce Tower in Toronto will have five double deck elevators for the lower floors, which are expected to have extremely heavy traffic peaks. Conventional elevators will serve the other floors.

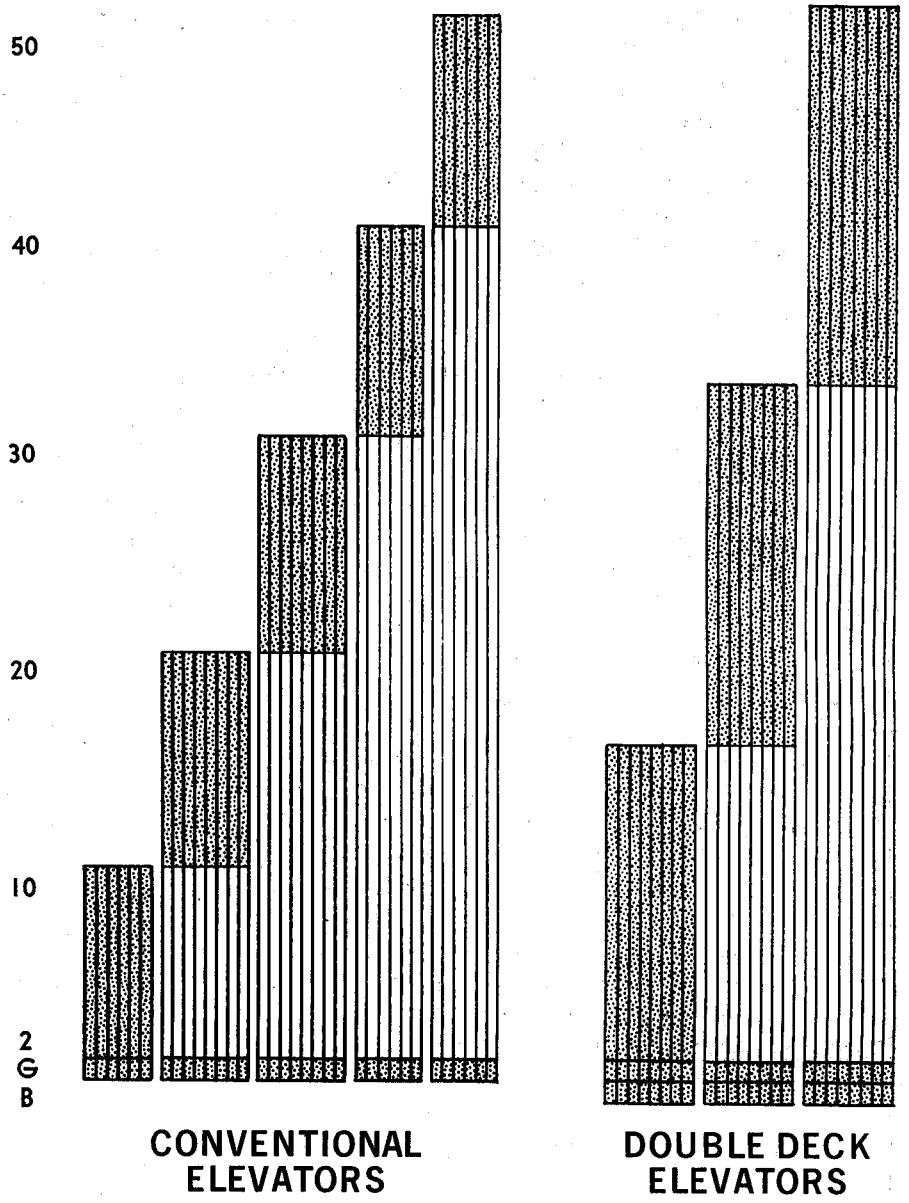
Impact on Building Design

Working with elevator manufacturers to apply the double deck system, we learned lessons of possible

Sectional rendering of double deck elevators for the John Hancock Mutual Life Insurance Company Tower, Boston.



In a 50-story building, 34 conventional elevators could be replaced by 24 double deck elevators. With each elevator taking some 150 square feet of floor space from each floor through which its hoistway passes, going double deck could save 14,000 square feet of area.



value to consulting engineers entrusted with future installations of this type. From the outset, a proposed building must be designed and constructed specifically for the installation of double deck elevators. Planning also should anticipate any subsequent changes that may occur in building occupancy and elevator traffic.

Total number of floors should be fixed as early as possible, since adding or subtracting floors directly affects the number of double deck elevators and their grouping in a system. Closer tolerances than usual must be maintained in constructing the building, especially in heights between floors. Unequal building settling, because of greater compression forces at the lower portion of the building, could affect operation of the double deck elevator system. Elevator hoistways should be planned to permit the "runby" required for the flexible modes of operation that make double deck installations "passenger oriented" rather than "equipment oriented."

Passenger-Oriented Operation

In engineering a double deck system an obvious objective is to maximize carrying capacity while minimizing space consumption. Another important goal centers on the individual passenger. As far as he (or she) is concerned, appearance and operation should not differ appreciably from a conventional, single deck system. To satisfy both goals, control circuits for a double deck elevator enable it to shift automatically from one mode of operation to another, depending on whether it is answering "car" calls registered by passengers who entered at the lobby, or "hall" calls by passengers on various floors.

Prominently illuminated signs and possibly tape recordings direct passengers entering the building to

the lower or upper lobby level, depending on whether they wish to reach even-numbered or odd-numbered floors up in the building. In answering calls registered by passengers who have entered its two cabs from the two lobby levels, a double deck elevator travels in two-floor moves or in multiples of two floors.

After leaving the dual lobby levels, the elevator might stop for the 2nd and 3rd floors, 4th and 5th, and 8th and 9th. In this instance, the upper deck stops only at odd-numbered floors, the lower only at even-numbered floors. This mode of operation limits the maximum number of stops each elevator makes on each trip, increasing its handling capacity.

But this two-floors-at-a-move operation would inconvenience passengers entering the elevator at upper floors, whose destinations might be either even-numbered or odd-numbered floors. In answering the calls of these passengers, the elevator control circuitry therefore selects a different mode of operation, allowing either double deck cab to serve either even-numbered or odd-numbered floors. The elevator automatically stops so that passengers in both the upper and lower cabs can leave at floors for which they have touched the appropriate buttons. Stops are kept to a minimum by special control system circuits that automatically answer combinations of car and hall calls for adjacent floors by a single stop rather than two separate stops.

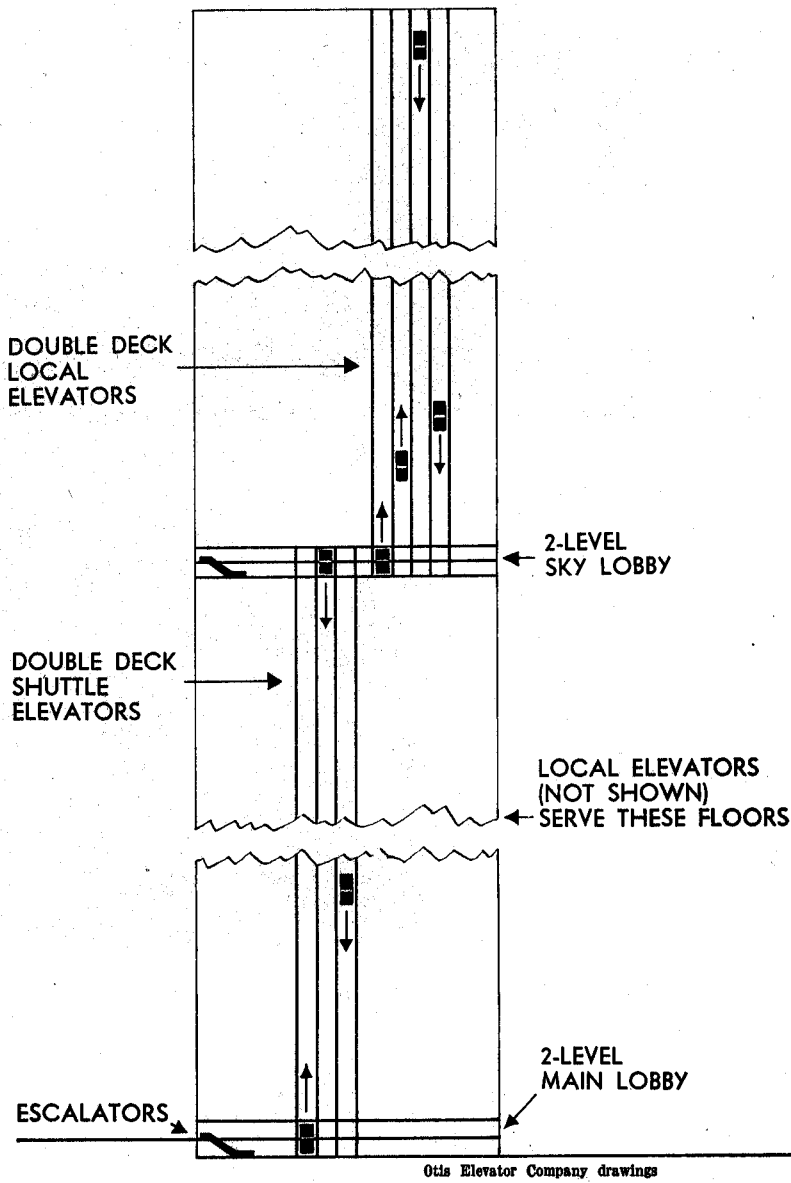
To give passengers complete freedom of travel, the lower deck must be able to stop at all floors up to and including the highest floor the group serves. This requires the "runby" mentioned previously — at least one story of extra travel above the top of the hoistway.

Double Deck Combination

In very tall buildings, another way to gain elevator capacity without a proportional increase in hoistway space consumption is the sky lobby arrangement, used in the 110-story World Trade Center Tower Buildings in New York. Each of these towers is, in effect, two or three "buildings" stacked one over the other, with a sky lobby at the base of each "building" above ground level. Passengers reach floors in the lowest "building" by local or express elevators in the usual way.

To reach upper parts of the tower, passengers take high-speed express elevators nonstop to a sky lobby where they change to local elevators serving their floors. Hoistways for these local elevators are stacked over hoistways of elevators in the lowest part. Round trip time is reduced by nonstop operation from ground level to sky lobby. Large, fast elevators for sky lobby express service achieve high handling capacity per square foot of hoistway.

So far, high-capacity sky lobby elevators have had very large platforms with correspondingly generous



Otis Elevator Company drawings

Sky lobby system with double deck elevators would reduce hoistway space consumption without sacrificing capacity.

hoistway dimensions. Express elevators to the World Trade Center sky lobbies, for example, have platforms 7′3″ by 13′3″, with more than twice the area of those usually installed in large office buildings.

Applying the double deck principle to sky lobby express elevators would further reduce hoistway space consumption without sacrificing passenger capacity. Interfloor traffic presents no problem since elevators travel nonstop to and from the sky lobby. Fewer passengers per cab, as compared with single deck sky lobby elevators, would speed entry and exit. Main terminals and sky lobbies would have two levels, possibly connecting with double deck local elevators to upper floors.

On its own or in combination with sky lobby systems, double deck elevatoring may be the key to effective service with economy in space utilization. ▲▲