ABSTRACT

Transportation Capacity of Elevators for intra-traffic in kilometer Buildings

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In recent years, a great many arguments in Japan have seen about partial or even complete transfer of urban functions to the suburbs of Tokyo. Among these arguments, several plans have been proposed to construct a very high (a few kilometers height) building to form a "compact city". One of the important aims of these plans is to bring residence, office, and urban facilities close together, so that the people in the building should not suffer the hard traffic jam. In this paper, we will discuss whether such plans are realistic from the standpoint of the transportation means in the building.

Why do Tokyo and other large cities attract so many people: there are such urban facilities that cannot be getting along in smaller cities, and highly-developed transportation systems promote using these facilities. Therefore, when we consider the transportation system in the above plans, we must take into account the intercommunicating traffic in the building which may grows quadratically as its population grows. In a high building, it is always experienced that any place on a same floor is very easy to access, but it is almost impossible without taking an elevator to move vertically. Therefore it is important to forecast the traffic volume moving vertically through the building, and provide it with enough elevator passage area to transport the volume smoothly.

We considered this problem in a simple manner when intercommunicating traffic is significant. The model of a building is rectangular with the base area S and the height h which is populated continuously and uniformly. And, the transportation capacity per unit area of elevator passage is constant irrespective of the building height. The traffic passing through a floor **F** consists of visits between one on a lower floor of **F** and the other on the upper floor of **F**, which amounts to the product of population in the upper floors and that in the lower floors multiplied by some constant. This quantity must be equal to the transportation capacity of elevators through **F**. From this condition, we can derive the differential equation to determine the necessary elevator passage area in the building. According to the solution, the remainder of building volume after taking the elevator passage is approximately proportional to the square root of S and scarcely depending on h. This result means that the most of the investment to such buildings may be wasted.