Proposition

The question posed asked to devise and analyze a transportation plan using a combination of escalators, local and express elevators, to efficiently move people throughout the building. Within the question our team determined that one word is left with loose translation: efficiently. In order to better understand the problem “efficiently” has been defined in this model as “the ability to move from two points within the building’s 81 floors using at most 3 of the 40 different possible shafts”. Therefore, the task at hand was to minimize the number of elevators needed to move from any two points within the building.

Assumptions

In order to calculate the number of people with access to certain parts of the skyscraper per day assumptions were made to give some base values. First, based on statistical data showing that an average of 1000 people visit a given floor at US malls per day it was assumed an average of 1000 people per retail floor per day. It has also been assumed that on all office floors 80 people occupy each floor each day. It was assumed that 3 people on average occupy each condo, given normal city lifestyle trends. The assumption that the busiest time of day was during the eight-hour workday was based off of the idea that escalators among the retail floors and elevators among the office floors were in the most use. With this eight-hour concept, we assumed 1 elevator could serve 300 people per eight hours (ie. 38 people/hour). Since escalators are moving constantly in both directions we extrapolated the assumption that they can provide double the service of an elevator (ie. 600 people/day, 76 people/hour). Finally it was assumed that the mechanical floors and observation deck were used infrequently, however the observation deck was used more than the mechanical floors. This assumption is based on the given information that the general public cannot have access to mechanical floors and they are only used for storage and repairs.

Abstract

The mathematical challenge posed, inspires the need to maximize convenience and minimize transportation exchanges. The model presented accounts for an assumed maximum occupant capacity at any given time. Based on the calculated numbers, each section (offices, residences, retail, mechanical, and observation deck) has the most feasible number of transportation systems. The model met the efficiency goal set forth in the proposition. The model uses all three methods of transportation in the most effective way and accounts for peak travel traffic. There are three shafts that travel from entrance to the residential sections. There are eight shafts for residential to residential travel. There is one shaft for mechanical travel only, for means of entrance it also allows mechanics access by swipe card on floor 1. There exist 12 shafts for strictly office sector travel and 5 shafts for office to ground level travel. There are two shafts that stop at the first floor of each sector. There is one shaft for ground floor to observation deck only. Three elevator shafts are reserved for retail travel as well as 5 consecutive escalators among the floors. As stated in the assumption if each elevator were to service 300 people per day then the building has been designed to service a total of 12,000 people each day while the assumed maximum building use is only 11,080, leaving plenty of room for deviation. In summation, based upon the parameters described it is not only possible, but practical to devise a transportation plan such that any given person needs to take at most 3 elevators to get from one location to another within the skyscraper.