Measurements

Average Loading/Unloading Time

Time to Load/Unload Elevator

Run	Time (s)
1	2.5
2	2.4
3	2.6

The mean is the best way to measure the central tendency because the data appears to have a normal distribution and there are no outliers.

$$Average\ Loading\ and\ Unloading\ \ Time\ = \frac{t_1 + t_2 + t_3}{3}$$
$$Average\ Loading\ and\ Unloading\ \ Time\ = \frac{2.4\ s + 2.4\ s + 2.7\ s}{3}$$
$$Average\ Loading\ and\ Unloading\ \ Time\ = \ 2.5\ s$$

Therefore, the average loading/unloading time is 2.5 seconds.

Average Time Between Floors

Time to move between adjacent floors

Run	Time (s)
1	3.2
2	3.3
3	3.1

The mean is the best way to measure the central tendency because the data appears to have a normal distribution and there are no outliers.

$$Average\ time\ to\ move\ between\ adjacent\ floors\ = \frac{t_1 + t_2 + t_3}{3}$$
$$Average\ time\ to\ move\ between\ adjacent\ floors = \frac{3.2\ s + 3.3\ s + 3.1\ s}{3}$$
$$Average\ time\ to\ move\ between\ adjacent\ floors\ = \ 3.2\ s$$

Therefore, the average time to move between adjacent floors is 3.2 seconds.

Maximum Speed

The maximum speed will be calculated using the times it took to move from the ground to the top floor and the total height of the building because the trip from the ground to the top floor has a lower proportion of time spent accelerating and decelerating at the beginning and end of the trip respectively.

Time to move from ground to top floor

Run	Time (s)
1	46.3
2	47.2
3	41.5

The mean is the best way to measure the central tendency because the data appears to have a normal distribution and there are no outliers.

$$Average\ time\ to\ move\ from\ ground\ to\ top\ floor\ = \frac{t_1 + t_2 + t_3}{3}$$
$$Average\ time\ to\ move\ from\ ground\ to\ top\ floor = \frac{46.0\ s + 47.0\ s + 42.0\ s}{3}$$
$$Average\ time\ to\ move\ from\ ground\ to\ top\ floor = \ 45.0\ s$$

$$Distance\ betwen\ one\ floor = 4.0\ m$$

$$Total\ number\ of\ floors\ above\ ground = 19$$

$$Total\ distance\ from\ ground\ to\ top\ floor = distance \times floors$$
$$Total\ distance\ from\ ground\ to\ top\ floor = 4.0\ m\ \times 15$$
$$Total\ distance\ from\ ground\ to\ top\ floor = 76.0\ m$$

$$Maximum\ speed = \frac{distance}{time}$$
$$Maximum\ speed = \frac{76.0\ m}{45.0\ s}$$
$$Maximum\ speed = 1.7\ m/s$$

Therefore, the maximum speed is 1.7 m/s.

Rate of Acceleration

To calculate the rate of acceleration, assume the elevator accelerates to maximum velocity, then decelerates to zero between each floor.
Let $v_1 = 0$ for the initial velocity of the elevator
Let $v_2 = 1.7\ m/s$ for the maximum velocity of the elevator when it is at the halfway point between adjacent floors
Let $t_1 = 0$ for the initial time of the trip

Let $t_2 = \frac{3.2s}{2} = 1.6\ s$ for the time at the hallway point between adjacent floors

$$Acceleration = \frac{v_2 - v_1}{t_2 - t_1}$$
$$Acceleration = \frac{1.7\frac{m}{s} - 0}{1.6\ s - 0}$$
$$Acceleration = 1.1\ m/s^2$$

Therefore, the rate of acceleration is 1.1 m/s.