**Answer on Question #65486-Physics-Other**

A commuter train travels between two downtown stations. Because the stations are only 1.24 km apart, the train never reaches its maximum possible cruising speed. During rush hour the engineer minimizes the travel interval Δt between the two stations by accelerating for a time interval Δt1 at a1 = 0.100 m/s2 and then immediately braking with acceleration a2 = -0.470 m/s2 for a time interval Δt2. Find the time intervals Δt1 and Δt2.

**Solution**

The maximum velocity

$$V = a_1 \Delta t_1$$

The final velocity is zero:

$$0 = V + a_2 \Delta t_2$$

$$\frac{\Delta t_2}{\Delta t_1} = -\frac{a_1}{a_2} = -\frac{0.1}{-0.470}$$

$$\frac{\Delta t_1}{\Delta t_2} = 4.7$$

The distance is

$$1240 = \frac{a_1 \Delta t_1^2}{2} + V \Delta t_2 + \frac{a_2 \Delta t_2^2}{2}$$

Using $0 = V + a_2 \Delta t_2$

$$1240 = \frac{a_1 \Delta t_1^2}{2} - \frac{a_2 \Delta t_2^2}{2} = -\frac{a_2 \Delta t_2}{2}(\Delta t_1 + \Delta t_2) = -\frac{a_2 \Delta t_2}{2}(5.7 \Delta t_2)$$

$$\Delta t_2 = \sqrt{\frac{2(1240)}{5.7(0.47)}} = 14.3\ s.$$

$$\Delta t_1 = 4.7(14.3) = 67.2\ s.$$