Answer on Question #57063, Physics / Other

If there were a speed limit for this train as it traveled through a city, but not a weight limit, what mass must be added to the train to slow it down to 5 m/s while at the same time keeping the momentum the same as in the second part?

Answer in units of kg.

Solution:

Momentum is defined to be the mass of an object multiplied by the velocity of the object.

$$p = mv$$

The conservation of momentum states that, within some problem domain, the amount of momentum remains constant.

Thus,

$$p_1 = p_2$$
$$mv_1 = (m + m_x)v_2$$
$$mv_1 = mv_2 + m_xv_2$$
$$m_xv_2 = m(v_1 - v_2)$$
$$m_x = \frac{m(v_1 - v_2)}{v_2}$$

where $v_2 = 5 \text{ m/s}$,

m = initial mass of train,

 v_1 = velocity of train from the second part of question.

Answer: $m_{\chi} = \frac{m(v_1 - v_2)}{v_2}$.