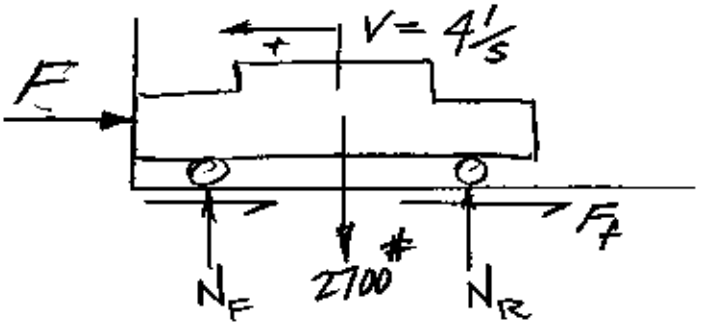
# HIBBELER

15-18

AUTO IMPACTS WALL




IMPACT OCCURS IN 0.06 s

? Avg. IMPULSIVE FORCE

(a.) NO BRAKES $\therefore F_f = 0$

$\Delta$ momentum = IMPUSE $\pm \rightarrow +x$

$$mv_2 - mv_1 = \Sigma \int F\,dt$$

$$0 - \frac{2700^{\#}}{32.2\ ft/s^2}(4\ ft/s) = \int_0^{0.06} -F\,dt = -F(0.06\ s)$$

$$\boxed{F = 5.59 \times 10^3\ lbf}$$

That's some force!

$$V = 4\ ft/s \times \left(\frac{60\ mph}{88\ ft/s}\right) = 2.73\ mph$$

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(b.) WITH BRAKES, $\mu_k = 0.3$

$$F_f = \mu N = 0.3(2700^{\#}) = 810^{\#}$$

$$mv_2 - mv_1 = \Sigma \int F\,dt \qquad \pm \rightarrow +x$$

$$-\frac{2700}{32.2}(4\ ft/s) = \int (-F - 810^{\#})\,dt$$

$$-335.4 = -F(0.06) - 48.6$$

$$\boxed{F = 4.78 \times 10^3\ lbf}$$