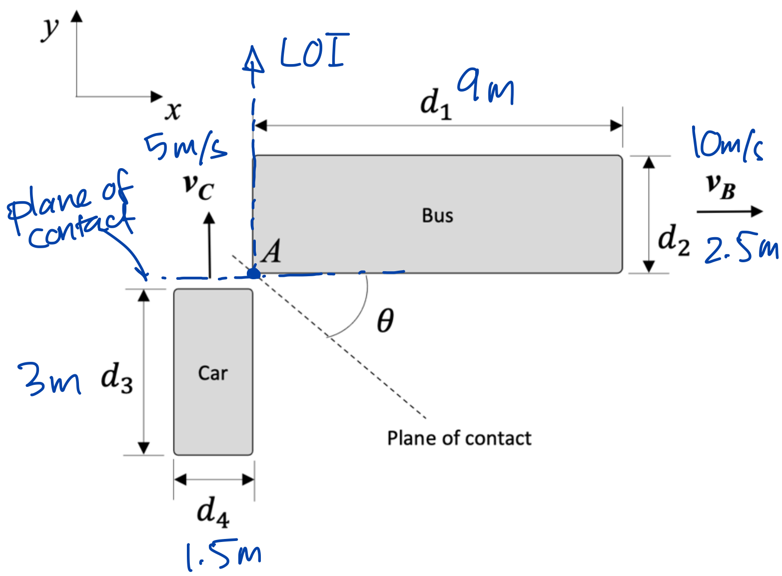
state 1

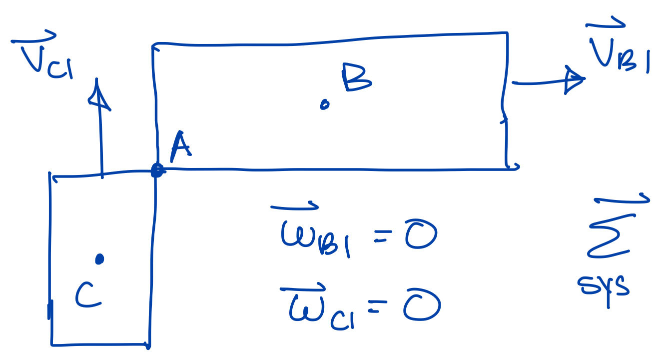
A car (m_c = 2000 kg, d_3 = 3 m, d_4 = 1.5 m) is driving on an icy road (assume frictionless road surface). It is unable to stop at an intersection and impacts a bus (m_B = 8000 kg, d_1 = 9 m, d_2 = 2.5 m). The initial vehicle velocities are $\overrightarrow{v_{c1}}$ = 5 m/s $\hat{j}$ and $\overrightarrow{v_{B1}}$ = 10 m/s $\hat{\imath}$. Assume the impact is such that the vehicles corners contact at *A*, and the plane of contact is θ = 0°. Find the angular velocity of each vehicle just after impact, $\vec{\omega}_{C2}$ and $\vec{\omega}_{B2}$, if the impact is completely plastic at *A*. Assume the car and the bus can be treated as constant density objects.

state 2



Conservation of momentum (both linear and angular) for the SYSTEM (impact impulse is internal)

state 1 just before impact



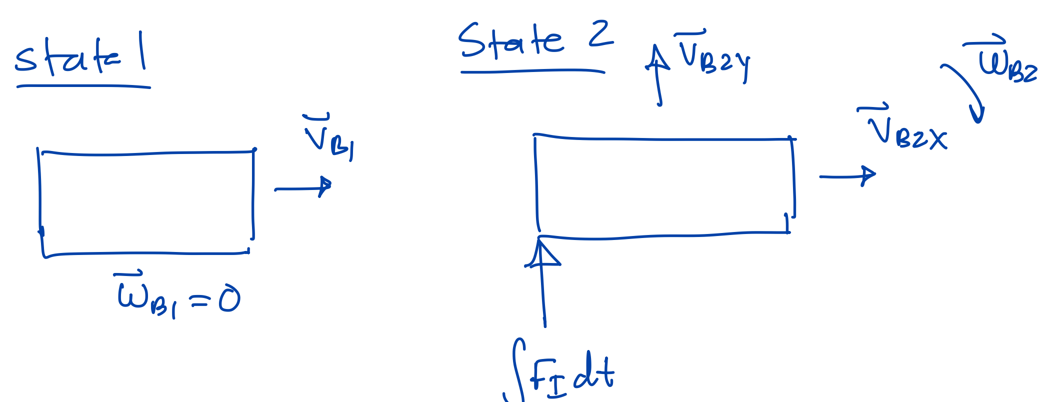
$$\vec{\omega}_{B1} = 0$$

$$\vec{\omega}_{C1} = 0$$

$$\sum_{sys} \vec{J}_1 = \vec{J}_{C1} + \vec{J}_{B1}$$

$$= m_C v_{C1} \hat{j} + m_B v_{B1} \hat{\imath}$$

$$\sum_{sys} \vec{K}_{A1} = \vec{K}_{A,C1} + \vec{K}_{A,B1}$$



$\int \vec{F}_I dt$ in $\hat{j}$ only, lin momentum conserved in $\hat{i}$ for bus