Current density

Current density is related to the concept of flux. This concept is easily understood using familiar terms. Suppose there are people exactly five feet high passing through a doorway ten feet wide and five feet high. If the people take up one square foot each, their density is one person per five cubic feet. If they move through the doorway at a speed of one foot per second, then ten people will move through the ten foot wide doorway per second. The density of the people multiplied by their velocity is $\rho v = 1/5\ ft^{-3} \times 1\ ft\ sec^{-1} = 1/5\ ft^{-2}\ sec^{-1}$. The flux F of people is defined as the number per second per square foot. In this case the number of people is ten per second divided by the area A of the doorway, which is $A = 5 \times 10 = 50\ ft^2$. Therefore we find $F = 10\ sec^{-1} \div 50\ ft^2 = 1/5\ ft^{-2}\ sec^{-1} = \rho v$. In the case of electric current we multiply the number density of the holes or electrons, p_o or n_o (cm^{-3}), respectively, by the charge $\pm q$ to get the current density J ($C\ cm^{-2}\ sec^{-1} = A\ cm^{-2}$).