$$q_x = (1 - \beta - \gamma)p_{1_x} + \beta p_{2_x} + \gamma p_{2_x}$$

$$q_y = (1 - \beta - \gamma)p_{1_y} + \beta p_{2_y} + \gamma p_{2_y}$$

$$q_z = (1 - \beta - \gamma)p_{1_z} + \beta p_{2_z} + \gamma p_{2_z}$$