Following Yassin-Kassab's 1998 paper and with the three node diagram shown in the yEd file.

$$\sum_{i \in I_j} NP_{ij} q_{ij} = q_{j0} \quad \forall j \in J \tag{1}$$

where I_j is the set of source nodes supplying node j and J is the set of all demand nodes in the network, and q_{j0} is the outflow at node j.

$$\sum_{i \in I_j} NP_{ij} q_{0i} p_{ij} = q_{j0} \quad \forall j \in J \tag{2}$$

where q_{01} is the inflow at node i and p_{ij} is the probability that a flow at node i reaches node j.

$$\frac{p_{ij}}{p_{kj}} = \frac{\alpha_i}{\alpha_k} \quad \forall i, k \in I_j; \forall j \in J \tag{3}$$

Substituting this equation back into 2, we arrive at the following equation

$$p_{ij} = \frac{q_{j0}\alpha_i}{\sum_{i \in I_j} NP_{ij} q_{0i} \alpha_i} \quad \forall i, k \in I_j; \forall j \in J \tag{4}$$

where we set $\alpha_1 = 1$.

Now we also have the condition that

$$\sum_{j \in J_i} NP_{ij} p_{ij} = 1 \quad \forall i \in I \tag{5}$$

I indexes the set of source nodes.

Subsituting the path flow probabilities into this equation we get a set of equations which we can solve.

Taken our simple subway example

$$\frac{20}{20 + 10\alpha_3} + \frac{10}{20 + 10\alpha_2} = 1 \tag{6}$$

$$\frac{10\alpha_2}{10\alpha_2 + 10\alpha_3} + \frac{10\alpha_2}{20 + 10\alpha_2} = 1 \tag{7}$$

$$\frac{10\alpha_3}{10\alpha_2 + 10\alpha_3} + \frac{20\alpha_3}{20 + 10\alpha_3} = 1 \tag{8}$$

When we solve for this system, we have $\alpha_2 = 1.3146$ and $\alpha_3 = 0.864$ so that

$$p_{1,9} = \frac{20}{20 + 10 \cdot 0.864} = 0.698 \tag{9}$$

$$p_{1,10} = \frac{10}{20 + 10 \cdot 1.3146} = 0.301 \tag{10}$$

$$p_{2,8} = \frac{10 \cdot 1.3146}{10 \cdot 0.864 + 10 \cdot 1.3146} = 0.604 \tag{11}$$

$$p_{2,10} = \frac{10 \cdot 1.3146}{20 + 10 \cdot 1.3146} = 0.396 \tag{12}$$

$$p_{3,8} = \frac{10 \cdot 0.864}{10 \cdot 0.864 + 10 \cdot 1.3146} = 0.396 \tag{13}$$

$$p_{3,9} = \frac{20 \cdot 0.864}{20 + 10 \cdot 0.864} = 0.604 \tag{14}$$

So that we have the flow paths

$$q_{1,9} = 13.96 \tag{15}$$

$$q_{1,10} = 6.04 \tag{16}$$

$$q_{2,8} = 6.04 \tag{17}$$

$$q_{2,10} = 3.96 \tag{18}$$

$$q_{3,8} = 3.96 \tag{19}$$

$$q_{3,9} = 6.04 \tag{20}$$

So that the track segments have this flow

$$t_{1,4} = 20 \tag{21}$$

$$t_{4,5} = 6.04 \tag{22}$$

$$t_{2,5} = 3.96 \tag{23}$$

$$t_{5,10} = 10 \tag{24}$$

$$t_{3,6} = 10 \tag{25}$$

$$t_{6,7} = 3.96 \tag{26}$$

$$t_{2,7} = 6.04 \tag{27}$$

$$t_{7,8} = 10 \tag{28}$$

$$t_{4,9} = 13.96 \tag{29}$$

$$t_{6,9} = 6.04 \tag{30}$$