

$$\left(3 - U_{(m,i)(n,j,\alpha_2)}^{\text{QC}} - P_{(m,i,\alpha_1),y}^Y - P_{(n,j,\alpha_2),y}^Y + \left| \sum_{x=1}^{O_{(m,i)}} P_{(n,j,\alpha_2),x}^X - \sum_{x=O_{(m,i)}+1}^{x_R} P_{(n,j,\alpha_2-1),x}^X \right| \right) M + T_{(n,j,\alpha_2)}^{\text{Start}} + t_{(n,j,\alpha_2-1)(m,i,\alpha_1)}^{\text{AGV}} \geq T_{(m,i)}^Q + G_{(m,i)}^Q$$

$$, \forall (n, j, \alpha_2) \in W^H, \forall y \in Y^S, \forall (m, i) \in D, \forall \alpha_1 \in \{0\} \text{ or } \forall (m, i) \in L, \forall \alpha_1 \in \{3\}$$

$$T_{(m,i)}^Q + G_{(m,i)}^Q + M(1 - U_{(m,i)(n,j,\alpha)}^{\text{QC}}) \geq T_{(n,j,\alpha)}^{\text{Start}}, \forall (m, i) \in C, \forall (n, j, \alpha) \in W^H$$

$$t_{(m,i,\alpha_1)(n,j,\alpha_2)}^{\text{AGV}} = \left( \left| X_{(m,i,\alpha_1)}^{\text{position}} - X_{(n,j,\alpha_2)}^{\text{position}} \right| + \left| Y_{(m,i,\alpha_1)}^{\text{position}} - Y_{(n,j,\alpha_2)}^{\text{position}} \right| \right) / v^{\text{AGV}}, \forall (m, i), (n, j) \in C, \forall \alpha_1, \alpha_2 \in \{0, 1, 2, 3, 4\}$$