Practice Problem #4: Transportation Problem

Each hour, an average of 900 cars enter a network at node 1 and seek to travel to node 6. The time it takes a car to traverse each arc is shown in Table 2. Table 1 indicates the maximum number of cars that can pass by any point on the arc during a one-hour period. If no number is listed in the table, then you can assume that the road does not exist. Formulate this problem as a mathematical programming model that minimizes the total time required for all cars to travel from node 1 to node 6.

Node	1	2	3	4	5	6
1	–	800	600	–	–	–
2	–	–	–	600	100	–
3	–	–	–	300	400	–
4	–	–	–	–	600	400
5	–	–	–	–	–	600
6	–	–	–	–	–	–

Table 1: Road Capacities

Node	1	2	3	4	5	6
1	–	10	50	–	–	–
2	–	–	–	30	70	–
3	–	–	–	10	60	–
4	–	–	–	–	30	60
5	–	–	–	–	–	30
6	–	–	–	–	–	–

Table 2: Travel Times between Locations

1 Network Representation:

Draw a network representation below. Clearly label each arc as you see appropriate.

2 Concrete Model:

Formulate the problem above as a **concrete** mathematical programming model to minimize the total cost. Clearly define and describe all decision variables, constraints, and the objective.

3 Abstract Model:

Formulate the problem above as a **abstract** mathematical programming model to minimize the total cost. Clearly define and describe all sets, parameters, and decision variables.