# Supplementary Material for "A Game-Theoretic Approach to Analyzing Equilibria in Coupled Power and Transportation Network"

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In the supplementary material, we give the detailed information of the numerical examples in the paper "A Game-Theoretic Approach to Analyzing Equilibria in Coupled Power and Transportation Network".

## I. Sioux Falls Transportation Network

Figure 1 shows the network of Sioux Falls in South Dakota, USA. The area of Sioux Falls is 190.20 km$^2$ (73.47 sq mi) [1].

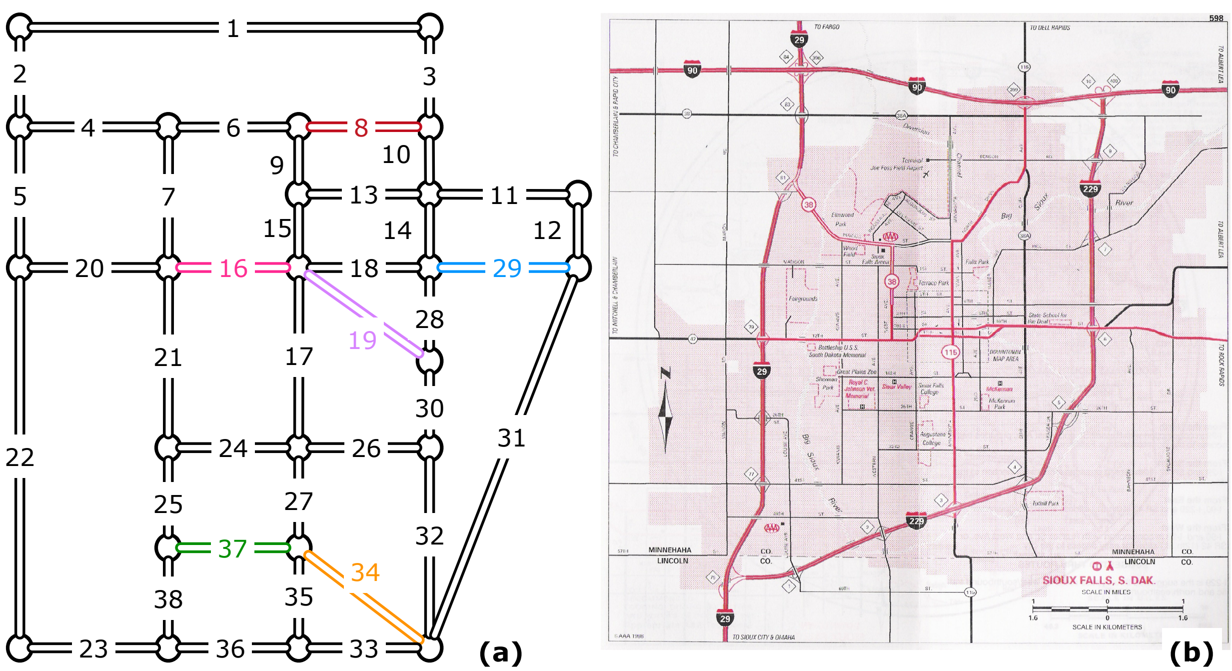


Fig. 1. (a) Sketch of Sioux Falls transportation network. (b) Map of Sioux Falls.

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Figure 2 shows the road length of the Sioux Falls transportation network [1]. Note that the length of the arcs does not necessarily have direct connection with the geographic length of the roads.

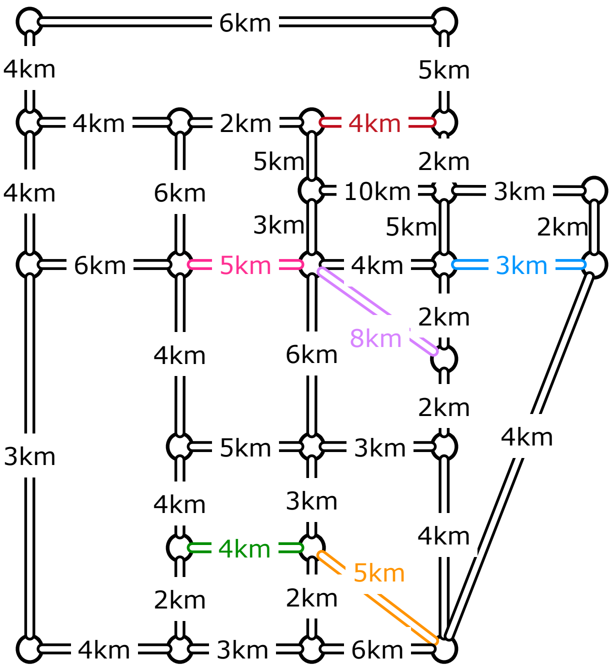


Fig. 2. Road length of Sioux Falls transportation network.

Figure 3 shows the node-arc relationship in the Sioux Falls transportation network [1].

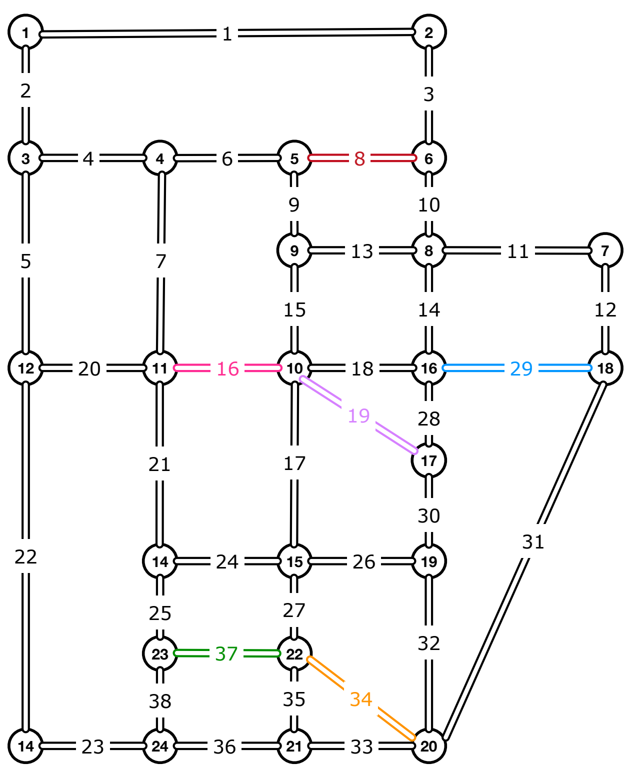


Fig. 3. Node-arc relationship in the Sioux Falls transportation network.

## II. 33-NODE POWER NETWORK

Figure 4 shows a 33-node radial distribution network with voltage of 12.66 kV [2].

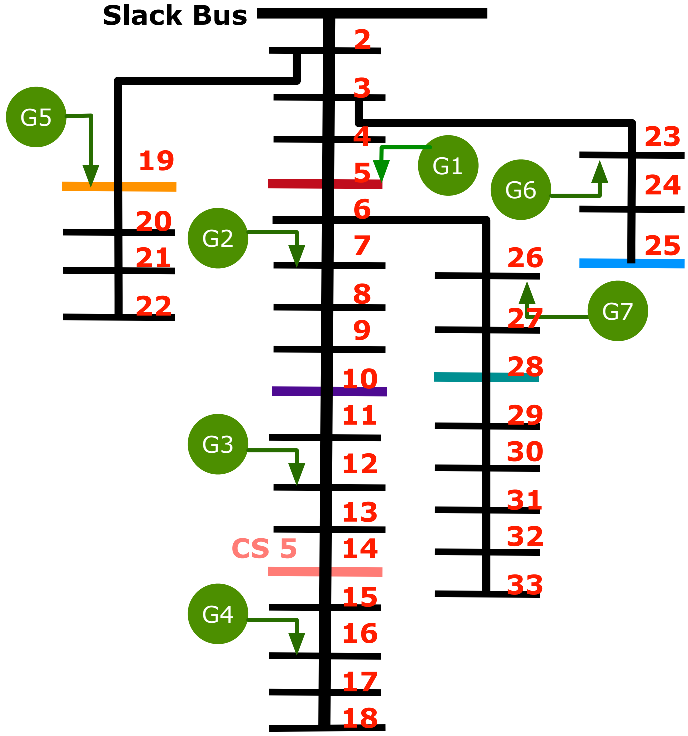


Fig. 4. 33-node power distribution network.

## III. COUPLING NETWORKS

Figure 5 shows the Sioux Falls transportation network coupled with a 33-node power network. The coupled nodes/arcs are labeled with identical colors.

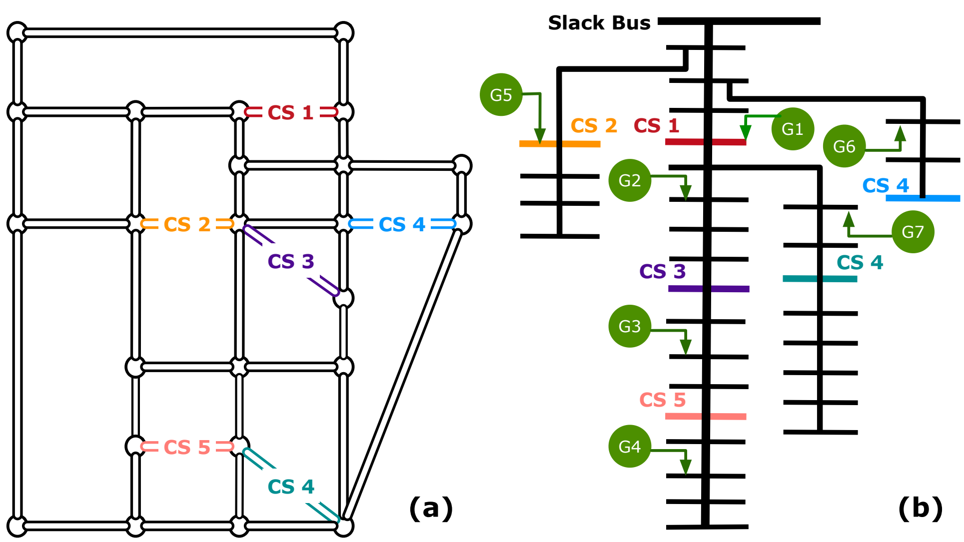


Fig. 5. (a) Sioux Falls transportation network. (b) 33-node power network. The coupled arcs/nodes are labeled in the same colors.

### A. *Coupling Relationship*

The coupling relationship is given in the following table.

TABLE I. Coupling relationship between power and transportation networks (CS: Charging Station).

| No. | Arc in Transportation Network | Node of Power Network |
|---|---|---|
| CS 1 | 8 | 5 |
| CS 2 | 16 | 19 |
| CS 3 | 19 | 10 |
| CS 4 | 29 | 25 |
| CS 5 | 34 | 28 |
| CS 6 | 37 | 14 |

### B. *Travel Demand*

The following table shows the travel demand between origin-destination pairs. The traffic demand is normalized [3] with a unit of traffic flow of $10^3$ veh/h [4], i.e., there are 5000 EVs per hour for each OD pair.

TABLE II. Travel demand between origin-destination pairs for the coupled networks.

| OD demand | Origin | Destination | Charging demand (P.U.) | Non-charging demand (P.U.) |
|---|---|---|---|---|
| OD 1 | 2 | 24 | 5 | 25 |
| OD 2 | 2 | 13 | 5 | 30 |
| OD 3 | 2 | 7 | 5 | 20 |
| OD 4 | 1 | 9 | 5 | 30 |
| OD 5 | 19 | 7 | 5 | 30 |
| OD 6 | 14 | 2 | 5 | 10 |
| OD 7 | 14 | 24 | 5 | 20 |
| OD 8 | 2 | 14 | 5 | 20 |
| OD 9 | 7 | 19 | 5 | 20 |
| OD 10 | 13 | 2 | 5 | 15 |
| OD 11 | 1 | 8 | 5 | 25 |
| OD 12 | 1 | 7 | 5 | 30 |

## REFERENCES


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