

District Division in Arc-Routing

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A typical plan of winter road maintenance of a region consists of hundreds of routes and is regionally divided into many independent parts. Each part services an assigned district of the regional network, and these assigned districts have a local connected character given by the planarity of the whole network. We suggest a new way to construct such a district division which provides alternatives to historically fixed divisions.

We assume there are some wide roads which need to be maintained in both directions while a single passing maintenance in an arbitrary direction is sufficient for the remaining roads. This changes the problem: the basic building block of a route is an orientation of a cycle rather than a symmetrically oriented edge as in our previous paper [1] where the arc-routing problem for symmetrically oriented networks is studied. In this work, the basic building block of a district route is an orientation of a facial cycle of the road network graph.

We thoroughly test our approach. Our tools are T-joins (see e.g. [2]), planar duality and the following graph packing problem which we introduce.

Graphic Bin Packing: the input is (1) a connected graph, (2) a vertex-subset D of depots, (3) a positive integer request for every vertex, (4) a car capacity C , (5) a positive integer length of the edges. The goal is to find a partition of the set of the vertices so that each part is connected and of total request at most C . We further want that the partition is optimal, i.e., the sum of the distances of the parts to D is minimized.

References

- [1] J. Fink, M. Loebel and P. Pelikanova, “Arc-routing for winter road maintenance”, *Discrete Optimisation* 41, 2021.
- [2] B. Boyacı, T. H. Dang and A. N. Letchford, “On matchings, T-joins, and arc routing in road networks”, *Networks* 79(1), 2022.