Green Cities: Network Flow Techniques for Plannig Green Space Provisioning

V. Günther[1], R. H. Möhring[1], and J. Schulz[1]

Abstract: In fast-growing mega-cities, the provisioning of the inhabitants with local recreation opportunities (e.g., green spaces) are of high importance to the social welfare. Up to now, planning and calculation of the green space provisioning (available area per inhabitant) has been done by hand, far apart from any optimization techniques. To this end, inhabitants of building blocks have been assigned to a closest green space (in air-line distance). Hence, the provisioning has been calculated, though some green spaces may become unrealistically overcrowded and others might be disregarded.

We present a model for green space provisioning that reflects the inhabitants desire for short walking distances on the one hand and high degree of provisioning on the other. On top of a pure assignment problem, a 'fair' distribution needs to be identified. We model the problem as a network congestion game in which the cost only on certain edges depends on the load. One crucial part of our study is an appropriate choice of the objective function which models this congestion. Therefore, we compare different functions that are related to congestion games in road networks. Both, the user equilibrium and the system optimum of the resulting problem can be calculated via Frank-Wolfe's algorithm using network flow techniques.

Computational results that compare the green space provisioning before and after optimization, and the influence of the choice of the objective function are presented on real-world data from the capitol of Germany: Berlin, and artificially generated instances.

This is a cooperation with B. Demuth, T. Garske and S. Heiland from the department of landscape planning and development at TU Berlin.

[1] Department of Combinatorial Optimization and Graph Algorithms
Institut für Mathematik, Technische Universität Berlin
Straße des 17. Juni 136, 10623 Berlin, Germany
{*vguenth,moehring,jschulz*}*@math.tu-berlin.de*