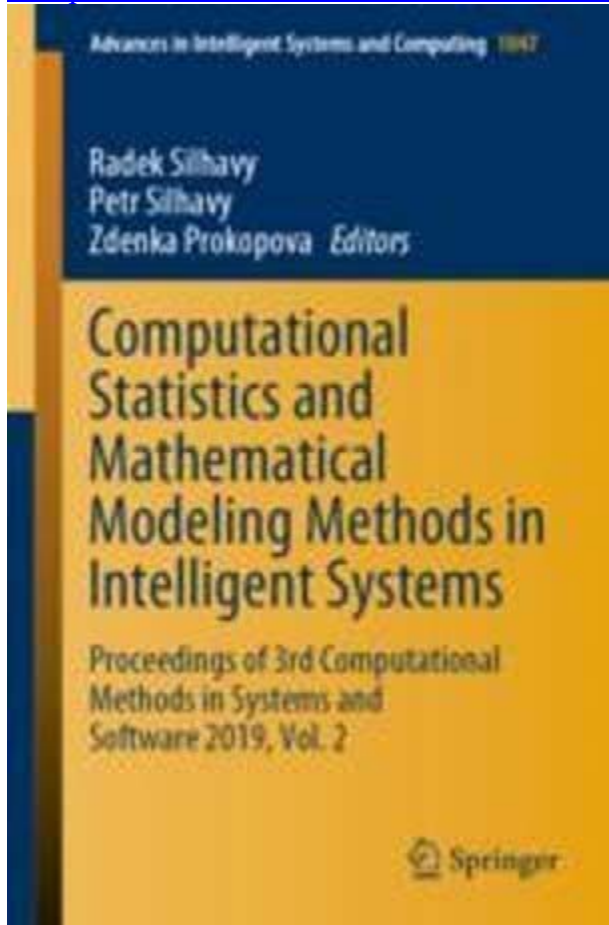Advertisement

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An Improved Location Model for the Collection of Sorted Solid Waste in Densely Populated Urban Centres

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Abstract

This paper presents a facility location model for improving the collection of solid waste materials. The model is especially suitable for densely populated regions with several housing units as well as encourages initial sorting of wastes. Each individual house in the collection area is designated a customer, with randomly selected customers comprising the set of candidate hubs. The fundamental feature of the model is to group the customers into clusters by assigning each customer (house) to the nearest hub. Each cluster is then assigned to exactly one waste collection site drawn from the set of potential collection locations. The objective is to minimize the total number of activated waste collection sites such that all the customers' requests are satisfied without violating the capacity limit of each site. A simple Lagrangian relaxation heuristic is developed for the problem and solved with the CPLEX solver on the AMPL platform to find a feasible solution. Results from the numerical implementation of model show the model is efficient and competitive with existing solid waste collection facility location models.

Keywords

Facility location problem Solid waste collection Lagrangian relaxation Lagrangian heuristic Subgradient optimization

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Notes

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References

1. 1.

   Adeleke, O.J.: Location-allocation-routing approach to solid waste collection and disposal. Ph.D. thesis, Covenant University, Ota (2017)Google Scholar

2. 2.

   Aydemir-Karadag, A.: A profit-oriented mathematical model for hazardous waste locating-routing problem. J. Clean. Prod. **202**, 213–225 (2018)CrossRefGoogle Scholar

3. 3.

   Asefi, H., Lim, S., Maghrebi, M., Shahparvari, S.: Mathematical modelling and heuristic approaches to the location-routing problem of a cost-effective integrated solid waste management. Ann. Oper. Res. **273**(1–2), 75–110 (2019)MathSciNetCrossRefGoogle Scholar

4. 4.

   Beasley, J.E.: Lagrangean heuristics for location problems. Eur. J. Oper. Res. **65**(3), 383–399 (1993)CrossRefGoogle Scholar

5. 5.

   Boonmee, C., Arimura, M., Asada, T.: Location and allocation optimization for integrated decisions on post-disaster waste supply chain management: on-site and off-site separation for recyclable materials. Int. J. Disaster Risk Reduction **31**, 902–917 (2018)CrossRefGoogle Scholar

6. 6.

Chauhan, A., Singh, A.: A hybrid multi-criteria decision making method approach for selecting a sustainable location of healthcare waste disposal facility. J. Clean. Prod. **139**, 1001–1010 (2016)[CrossRef][Google Scholar]

7. 7.

Chen, C.H., Ting, C.J.: Combining Lagrangian heuristic and ant colony system to solve the single source capacitated facility location problem. Transp. Res. Part E-Logistics Transp. Rev. **44**, 1099–1122 (2008)[CrossRef][Google Scholar]

8. 8.

Eiselt, H.A., Marianov, V.: Location modelling for municipal solid waste facilities. Comput. Oper. Res. **62**, 305–315 (2015)[MathSciNet][CrossRef][Google Scholar]

9. 9.

Fisher, M.L.: The lagrangian relaxation method for solving integer programming problems. Manag. Sci. **50**(12), 1861–1871 (2004)[CrossRef][Google Scholar]

10. 10.

Ghiani, G., Laganà, D., Manni, E., Triki, C.: Capacitated location of collection sites in an urban waste management system. Waste Manag. **32**(7), 1291–1296 (2012)[CrossRef][Google Scholar]

11. 11.

Ghiani, G., Manni, A., Manni, E., Toraldo, M.: The impact of an efficient col- lection sites location on the zoning phase in municipal solid waste management. Waste Manag **34**(11), 1949–1956 (2014)[CrossRef][Google Scholar]

12. 12.

Hu, C., Liu, X., Lu, J.: A bi-objective two-stage robust location model for waste-to-energy facilities under uncertainty. Decis. Support Syst. **99**, 37–50 (2017)[CrossRef][Google Scholar]

13. 13.

Olukanni, D., Adeleke, J., Aremu, D.: A review of local factors affecting solid waste collection in Nigeria. Pollution **2**(3), 339–356 (2016)[Google Scholar]

14. 14.

Pissinger, D.: Algorithms for knapsack problems. Ph.D. dissertation, University of Copenhagen, Denmark (1995)Google Scholar

15. 15.

Rabbani, M., Heidari, R., Farrokhi-Asl, H., Rahimi, N.: Using metaheuristic algorithms to solve a multi-objective industrial hazardous waste location-routing problem considering incompatible waste types. J. Clean. Prod. **170**, 227–241 (2018)CrossRefGoogle Scholar

16. 16.

Rabbani, M., Heidari, R., Yazdanparast, R.: A stochastic multi-period industrial hazardous waste location-routing problem: integrating NSGA-II and Monte Carlo simulation. Eur. J. Oper. Res. **272**(3), 945–961 (2019)MathSciNetCrossRefGoogle Scholar

17. 17.

Rathore, P., Sarmah, S.P.: Modeling transfer station locations considering source separation of solid waste in urban centers: a case study of Bilaspur city, India. J. Clean. Prod. **211**, 44–60 (2019)CrossRefGoogle Scholar

18. 18.

Wichapa, N., Khokhajaikiat, P.: Solving multi-objective facility location problem using the fuzzy analytical hierarchy process and goal programming: a case study on infectious waste disposal centers. Oper. Res. Perspect. **4**, 39–48 (2017)MathSciNetCrossRefGoogle Scholar

19. 19.

Yadav, V., Bhurjee, A.K., Karmakar, S., Dikshit, A.K.: A facility location model for municipal solid waste management system under uncertain environment. Sci. Total Environ. **603**, 760–771 (2017)CrossRefGoogle Scholar

20. 20.

Yang, Z., Chen, H., Chu, F.: A Lagrangian relaxation approach for a large scale new variant of capacitated clustering problem. Comput. Ind. Eng. **61**(2), 430–435 (2011)CrossRefGoogle Scholar

21. 21.

Zhao, J., Huang, L., Lee, D.H., Peng, Q.: Improved approaches to the network design problem in regional hazardous waste management systems. Transp. Res. Part E: Logistics Transp. Rev. **88**, 52–75 (2016)CrossRefGoogle Scholar

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