OPTIMAL REGIONAL PLANNING APPROACH IN SOLID WASTE MANAGEMENT

P.I. Katugampola[1] M. Vlach[2] and J.M.S.J. Bandara[3]
[1,3] Department of Civil Engineering, University of Moratuwa, Moratuwa
[2] School of Information Science, Japan Advanced Institute of Science and Technology, Ishikawa, Japan

Solid waste consists of all the solid material that an urban society can no longer use constructively or economically and must be discarded in a way that is harmful to the environment. As a community becomes intensively urbanized, the problem of solid waste management gets more and more aggravated. Cost of providing waste management services is rising both as a result of scarcity of land and due to the tightening environmental regulations. An approach of waste management receiving wide attention recently is to reduce the waste disposal costs by establishing centralized facilities. Centrally operated facilities have the advantage of economics of scale that cannot be owned by smaller municipalities.

This paper investigates problems associated with the new approach of regionalization and waste diversion. It also investigates the application of linear programming (LP) and mixed integer programming (MIP) techniques for the optimal allocation of waste stream and facility scheduling of a regional solid waste management system over a fixed planning period. Waste disposal options include landfilling and waste diversion through recycling and composting. The regional system consists of multiple cities, landfills, material recovery facilities, composting facilities and transfer stations.

Mathematical models used for the optimization are formulated to minimize the net present value of the cost of providing waste management services in a region. The optimization model used consists of a set of constraints defining the waste flow mass balance and capacity limitation of the facilities. It is seen that the LP approach is simple and efficient in computation time but the usage is limited due to its inability to handle discrete size for facilities and mutually exclusive situations. The MIP approach allows for formulating all possible options into a single model run. However, as the size of the problem increases, MIP approach may introduce a large number of binary variables into the model, increasing the time requirement to reach the optimum solution.