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Optimization of Waste Collection and Transportation in Ratmalana Area in Sri Lanka

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Abstract

At present solid waste management has become a national concern where all the local governments, provincial governments, and the central governments seek for sustainable solutions. Much of the Municipal Solid Waste (MSW) management cost in Sri Lanka is allocated for waste collection and transportation rather than for waste disposal and treatment. The objective of this study is to minimize the total cost of solid waste collection and transportation. This enables a direct reduction in the fuel cost, labour cost, emission due to transportation which results in a significant reduction in the total cost of MSW management. The waste collection process was studied in Ratmalana area, which is a suburb in Colombo District in the Western Province of Sri Lanka, where many households and industries are located, and the factories discharge raw untreated waste into open drains leading to natural waterways or low-lying lands. The current practice of waste collection and transportation refers to collecting all the waste from households and factories and other institutions to the disposal station at Karadiyana, Pilyandala using four tractors along the settled routes. The study mainly relies on secondary data in relation to collected and transported quantities of waste by date, by four tractors in the month of September 2020. Linear programming (LP) techniques were applied to route optimization to reduce the daily total traveling distance of waste collection and transportation. Compared to the existing solid waste collection and transportation process from sources to the collection center along six (6) roads in Ratmalana area, the proposed heuristic solution for solid waste collection and transportation problem will significantly be reduced the daily average transporting distance from 86.29 km to 55.06 km with a reduction of 31.23 km (decrease in total distance is 36.2%). As a result, it is required only three (3) tractors (with 3,000 kg capacity) instead of 4 carriers deployed currently and the labour requirement will be reducing from 12 labours to 9 labours. In addition to those advantages of the proposed LP model, the number of vehicles reduced from 4 to 3 on a daily basis. The application of LP techniques will provide many advantages in terms of minimizing number of vehicles deployed, fuel cost, vehicle maintenance cost and labour cost and reduction in emission with the optimization of the resource utilization.

Keywords: Waste, Collection, Transportation, Linear programming

Proceedings of the 26th International Forestry and Environment Symposium 2022 of the Department of Forestry and Environmental Science, University of Sri Jayewardenepura, Sri Lanka

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