Route optimisation of waste collection in an urban environment in Maribor

ICT (routing, guidance), transport optimisation; Transport management, fleet management; Modelling and forecasting

For waste collection rounds in the city of Maribor, Slovenia, a new route optimisation solution has led to savings of 20% in time spent and distance covered by the fleet. The route optimisation makes use of an operational research algorithm that solves the so-called “Chinese postman problem”. This algorithm was used by SNAGA, the main urban waste management company. The optimisation is based on high quality data, GIS use and detailed knowledge of day-to-day operations. The solution resulted in more optimal vehicle routes and savings that are beneficial for the public sector.

Benefits:
• The optimisation of existing waste collection routes generated several benefits including time and cost savings.
• The improvement in efficiency of waste collection is estimated at 20% in time savings, and 10-15% in distance travelled.
• Better efficiency was achieved through a reduced number of operations, reduced mileage and fuel consumption, which in turn leads to benefits in traffic, noise and other externalities.

Success Factors:
Main success factors for the implementation of new routes were:
• High quality of input data
• Detailed knowledge of day-to-day operations
• Comprehension of local conditions
• Familiarity with application of algorithm
• Excellent understanding of the problem

Supported Strategic Targets:
• Increased efficiency - productivity of logistics processes
• Increased company profitability
• Increased competitiveness
• Balanced provision of goods and services
• Reduced emissions

Description:
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Starting Point/Objectives/Motivation:
Many case studies in different countries, regions, and settlement patterns had demonstrated that the application of a route optimisation solution could lead to substantial efficiency gains for urban waste collection trips. New regulations on waste separation for households have caused important changes in waste collection patterns and route planning in the waste management company SNAGA. This business is operating in the medium size city of Maribor, Slovenia. The new waste regulations introduced in recent years required separate curb side pickup of packaging waste and material. This generated additional pickup routes with a different geographic pattern than for other types of waste collection rounds. In order to optimise the waste collection rounds in urban areas, an innovative solution was applied: The use of the algorithm solving the “Chinese postman problem”. A set of more optimal vehicle routes were calculated and prepared at SNAGA. The new routes have enabled the company to increase the efficiency of the pickup process. The improvement in efficiency of waste collection resulted in lower costs for the company (business objective) as well as less pollution and traffic in urban areas (policy objective). The solution is easily transferable to other companies.
Optimised were rounds of waste collection of packaging (PET, PS, PE, ALU, etc.) in several pilot areas of the municipality of Maribor and eight other smaller adjacent municipalities with about 129,000 residents and a fleet of 21 trucks. Optimisation of routes had the effects of lowering the number of required vehicles; smaller work teams; fewer vehicle kilometres and lower fuel consumption; and reduced CO₂ emissions.

The solution was developed by company’s own employee in cooperation with academics, and so the costs for the waste management company were not significant for the implementation of the developed solution.

Potential savings depend on the flexibility of workers’ contracts, since work schedules often need to be changed in order to allow enough flexibility in the duration of planned routes. The results are extremely dependent on the quality of the input data - the better the input, the better the results.

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