



Research Fact Sheet

Research project: **Dynamic (Time Dependent) Green Vehicle Routing Problem**

What's the issue? The classic vehicle routing problem determines optimal routes for a fleet of vehicles to minimize time and costs. But in today's world, delivery trucks and vans include electric vehicles, with related extra costs and charging times, and the mixed fleet of gas and electric vehicles operates in rush hours that can dramatically change travel time, energy consumption and emissions.

What did the research discover?

This project developed more comprehensive time-dependent green vehicle routing problem formulations, which accounted for costs, a mixed fleet, and variations in travel time due to congestion. A case study created a network of 150 demand nodes in an area roughly the size of Washington, D.C., with one depot and five charging stations. Vehicles departed at 8 a.m. and returned at 6 p.m., facing morning and evening rush hours as well as mid-day traffic. The model developed in this study can be used by companies to evaluate the effect of green logistic policies such as low emission zones and emission caps on last-mile delivery operations in terms of the changes in fixed cost of fleet acquisition as well as variable operating costs.

How can I implement this?

This model is an effective way to consider the trade-offs between internal combustion engine vehicles and ECVs under different low emission zones, emission caps and trade policies. The model also can be used to find the optimal fleet size and the minimum cost routing plan.

Learn more:

Details about this research project, Dynamic (Time Dependent) Green Vehicle Routing Problem, and a link to the full report can be found at https://www.morgan.edu/school_of_engineering/research_centers/urban_mobility_and_equity_center/research/completed_research/vehicle_routing_problem.html

The Urban Mobility & Equity Center is a federally funded research consortium led by Morgan State University and includes the University of Maryland and Virginia Tech. www.morgan.edu/umec