MOUNTAIN-PLAINS CONSORTIUM

Assessing and Improving Efficiency of Snowplowing Operations via Data and Analytics

the ISSUE

Snow removal is essential to ensuring public mobility and safety, especially in the areas suffering frequent snowstorms. According to the Federal Highway Administration, more than 70% of the nation's roads are located in snowy regions. As a result, road maintenance operations concerned with snow removal and ice control cost more than $2.3 billion each year. To meet the rising expectations of road users and limit these investments, it is important to maximize the efficiency of snow-removal operations.

the RESEARCH

This project was concerned with improving the efficiency of Utah Department of Transportation's snowplowing operations. Researchers conducted work to optimize snow plowing routes in 12 northern Utah regions by applying vehicle routing heuristics. Researchers met with the supervisor in each region two to five times to validate both sets of routes. Discussions typically involved the following items:

- Road network: In addition to network partition, we had to validate the required number of passes along each road link, which depends on the number of lanes as well as existence of wide shoulders.

- Operational policies: Because different regions have different operational policies, we had to ensure that they are accounted for in the proposed routes.

- Fleet composition: Because snow removal operations may involve trucks of different types and capabilities, we had to validate fleet composition for each region. The UDOT fleet includes regular

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Project Title

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the RESEARCH cont.

(or general purpose) trucks that clean one lane at a time, double-wing trucks that clean one and a half lanes at a time (e.g., right-most lane and a shoulder), and tow-plow trucks that simultaneously clean two lanes.

- Capacity constraints: Salt capacity is a common constraint in snow removal operations. Because salt capacity was more constraining than fuel, the latter was not considered explicitly.

- Performance measures: All the regions were interested in four performance measures: vehicle miles, vehicle minutes, deadhead miles that measure excessive passes, and the turnaround time that denotes duration of the longest route.

the FINDINGS

The objective was achieved by proposing more efficient routes. The team developed an array of computational techniques pertaining to data mining, data visualization, and route optimization to reconstruct UDOT's snowplowing operations, propose more efficient routes, and effectively communicate results. Even though the snowplow routes originally operated by UDOT were fairly efficient, the development and implementation of sophisticated optimization algorithms enabled the team to find more efficient routes.

the IMPACT

On average, routes were improved 4.87% in terms of vehicle miles, 13.95% in terms of deadhead miles, and 15.38% in terms of turnaround time.

For more information on this project, download the Main report at https://www.ugpti.org/resources/reports/details.php?id=1132