

JOINT TRANSPORTATION RESEARCH PROGRAM

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Improve and Gain Efficiency in Winter Operations

Introduction

Effective winter operations have been a top concern for INDOT; therefore, the report outlines and explores technological opportunities surrounding INDOT's winter operation practices. The report focuses on key aspects such as critical locations for route planning, fleet maintenance analysis to improve performance, simulation models to understand weather events, and opportunities to save costs in salt purchases.

First, the report summarizes the winter operations in other states and compares them with INDOT's winter operations to learn about opportunities and challenges. The report also presents an analysis into snowfall trends, resource allocation, traffic trends, and maintenance practices. Second, critical locations such as hospitals, schools, police stations, and fire stations in the state are collated and used as references to improve planning during adverse weather conditions. The report also presents a simulation tool that helps model snow-removal activities during various weather events to draw insights about

resource usage during a winter storm. To do this, the report provides an analysis of route classification, weather events, and route optimization opportunities. Then, the report presents an analysis into road salt purchases and the salt suppliers. Finally, the report explores various equipment and materials for snow removal and recommends reliable products based on surveys conducted by other agencies. The report also presents the benefits and challenges of using Automatic Vehicle Location (AVL) systems and other electronic measurement systems to improve winter management practices and overall service.

Findings

- **Exploratory Data Analysis:** The analysis into Indiana snowfall trends, daily traffic, and maintenance activities present useful insights. Snowfall trends across Indiana indicates high snowfall density in the northern region compared to other regions. The criticality of operations is concentrated in the Indianapolis region. The maintenance cost of



Snowplow trucks.

Tasch. (n.d). Snow removal car standby [Photograph]. Shutterstock.

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different types of trucks has a varying dependence on miles traveled and the age of the truck.

- **Critical Locations:** The next part of the report focuses on the critical locations in the state. The four categories of locations are hospitals, schools, police stations, and fire stations. These locations are identified at the district and county level. There are 101 records of hospitals, 1,918 records of schools, 391 records of police stations, and 391 records of fire stations across Indiana.
- **Simulation Model:** Another major output of this report is the simulation tool for modelling various weather events. The model is designed with customized features that can be used to analyze hypothetical scenarios and draw meaningful insights before real-time implementation. The report focuses on areas where modifying resources would improve operational efficiency. It also explores scenarios of sharing salt from neighboring units for refilling during operations. This presents opportunities to further eliminate deadhead miles on snow routes.
- **Road Salt Analysis:** The report also focuses on annual salt purchases by various agencies across the state through contracts awarded to different suppliers. Salt is the single most expensive commodity in the maintenance budget, and its price has been steadily increasing over the years. Some agencies have been paying a higher price for salt based on supplier and time of order.
- **AVL/GPS Systems:** The report concludes by presenting the benefits and challenges of implementing different levels of AVL/GPS technology in the trucks. There are four tiers of the implementation, and each tier has significant capability to improve service levels over the previous tiers.

Implementation

The project develops recommendations focusing on the planning and execution of various aspects of winter operations.

The analysis into the maintenance of current vehicle fleet led to understanding the asset life and improving performance. The analysis also helps identify the trucks that have lower contribution to maintenance cost based on age and miles driven. The critical locations of hospitals, schools, police stations, and fire stations around the state at a district and county level can be incorporated into route optimization and planning to improve service thresholds.

The simulation model is designed with features that can draw meaningful insights for real-time implementation. It provides tools to analyze and eliminate deadhead miles from snow routes across the state.

There are significant opportunities for cost saving by allowing local agencies to purchase salt at prices negotiated by agencies at the state level. Coordinating deliveries across the various entities involved in purchases can lead to further savings. The analysis into the contracts and the suppliers provides valuable insight for negotiations in future winter contracts and purchases.

The evaluation of different equipment and materials used in snow removal led to recommendation of certain products for INDOT. These recommendations are based on the experiences of other agencies. Finally, the use of technology to collect vehicular information during operations will result in overall improvement in service levels while simultaneously minimizing costs.

Recommended Citation for Report

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