Kansas Department of Transportation

TECHNICAL SUMMARY

Snowplow Route Optimization for the Kansas Roadway System

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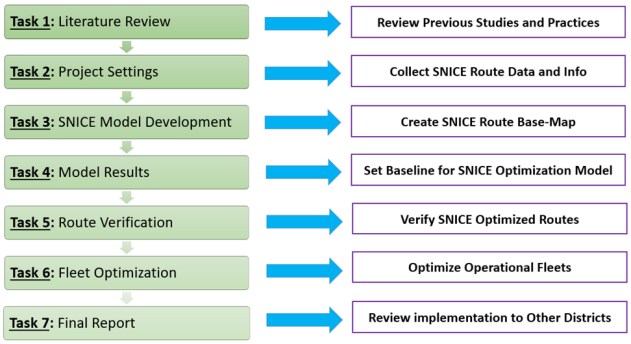

Research Framework

Introduction

State departments of transportation (DOTs) spend substantial resources on snow and ice control activities and operations each year. The Kansas DOT (KDOT) spends from $7 million to $22 million annually. KDOT winter maintenance operations currently deploy a fleet of 591 snowplow trucks, including 1,182 drivers and approximately 200 engineering technicians, to maintain more than 25,000 lane miles. The deployment of so many trucks over a vast maintenance area makes it operationally difficult to determine optimal maintenance routes and fleet size.

The objective of this project was to develop a snowplow truck route optimization plan for one district (District 4) to help KDOT enhance snow removal efficiency by justifying the fleet size and efficiently allocating limited resources while maintaining roadway safety and reliability.

Project Description

The objective of this project was to improve KDOT snow and ice route removal operations in District 4 using a scientific, mathematical methodology built on GIS applications. First, a literature review was conducted to summarize current practices in winter maintenance of snow and ice route removal operations. Second, geospatial data related to geography, route networks, LOS requirements, and recent snow and ice route removal practices were collected. Third, a snowplow fleet optimization model was developed to determine the minimum number of operational trucks needed to treat all snow and ice routes while maintaining the current LOS satisfaction percentage in District 4. A snow

and ice removal optimization model was developed based on Esri's ArcGIS software platform. Finally, the optimized fleet size for the snow and ice routes in District 4 was determined, as well as total travel time savings and potential for cost savings and man-hours for winter maintenance operations.

Project Results

The snow and ice routing network was optimized using LOS time requirements for each route priority, a treating speed of 25 mph for two-lane highways and up to 35 mph for multi-lane divided highways, a refill time of 20 minutes at a truck garage (salt domes) and 40 minutes at remote sites, a salt application rate of 250 lbs/ln mile, and time-related factors such as 15 minutes to re-fuel, clean lights, and refill washer fluids per shift and a total of 20 minutes of operational break per shift during an active snow and ice event. The initial run used ArcGIS Pro version 2.7 with its Network Analyst extension and vehicle routing problem function.

Project Information

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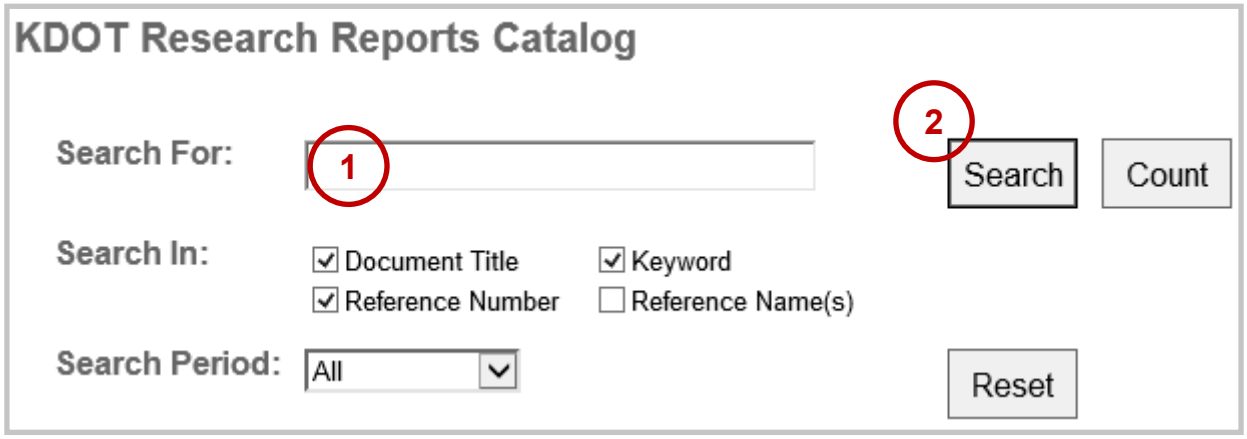

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