

## WINTER WEATHER ROUTE RESPONSE OPTIMIZATION

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## THE CHALLENGE

Industrial Engineers (team SnowDawgz) at the have prepared a system for making route recommendations for the City of Bellevue street maintenance crews to use during their deicing and snow plowing operations. This system takes into consideration predetermined priority routes, as well as other impactful considerations, to optimize the routes of deicing and snow plowing operations for best use of the city's resources. Overall, the project looks at the city's deicing routes, citywide snow plowing routes, and neighborhood plowing routes to recommend approaches to the City of Bellevue Street Maintenance Division.





*SnowDawgz team testing out route traveling times on Main Street in Bellevue.* ARYTON TEDIARJO

## OUR METHODS

The route optimization uses python programming and several APIs (Application Programming Interfaces) to implement the backend. For data gathering, the Google Maps Directions API is used to request distance and time data that is required for one truck to travel from one deicing route to another, based on their midpoints. Afterwards, route recommendations are made based on the Vehicle Routing Algorithm that will minimize the overall distance of the operation, which is also coded in Python by implementing an open-sourced module provided by the Google OR-Tools library. Predetermined clusters are made to separate upper and lower Bellevue based on the crew's mode of operation. To best utilize the City's resources, the team assigned each truck to specific clusters, taking into account their ability to cover multiple lanes.

The SnowDawgz team used the route sequence generated from the routing plan algorithm to transfer the data into Google Sheets for simpler interpretation. Next, the team implemented the methods that have been used with the deicing operations to the snow plowing operation, so that the operators will possess route recommendations that optimize the road-clearing process as a whole.

For the assessment of each of these areas, students are using data from a variety of sources, including technical and academic literature, government reports, previous HIAs, field visits, and key informant interviews with city stakeholders. Student editors will synthesize the findings of the various chapters to develop the final HIA report.

*Citywide snow routes, with arterial and neighborhood routes.* CITY OF BELLEVUE



## OUR RECOMMENDATIONS

SnowDawgz has created a process of operations for the City of Bellevue to implement that will be intuitive and efficient. This process of operations will include the ability to actively record deicing and snow plowing operations via Google Sheets using a similar format to their paper records. The active recording tool can be used to access past deicing and snow plowing history, thereby significantly decreasing the City's current time, operational costs, and resources spent. Furthermore, the transition from a paper mapping to digital device with mapping could improve the City's operations by providing a consistent ordering system for routes.

To implement the solution, SnowDawgz trained a team from the Bellevue Transportation Department on how to use the Google OR-Tools library to generate a routing plan, and demonstrated how to make future changes to the model. SnowDawgz also trained snow plowing operators on how to use the digital system.

*Process flow chart for the SnowDawgz team's provided recommendations.* PARDIPTA NURAHMAT

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