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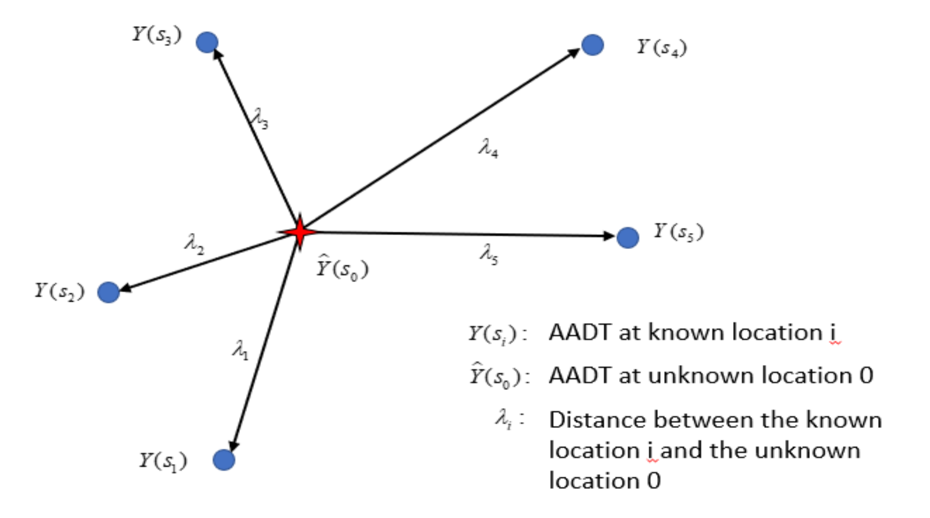
This final report is available online at:
http://www.scdot.scltap.org/projects/completed/

Estimating AADT on Non-Coverage Roads

This project developed several models for the SCDOT to obtain accurate estimates of Annual Average Daily Traffic (AADT) at non-coverage locations. Based on the findings from the literature review and state DOTs survey, the kriging, regression, and point-based models were developed. Comparison of these models against the use of default values showed that all of the developed models outperformed the default value method currently being used by SCDOT. To facilitate the implementation of the developed models, an Excel-based tool was created. The tool uses primarily estimates from the kriging model but will resort to using the mean AADT based on county and functional class of the non-coverage location if a nearby coverage location is found to have a high absolute error. The tool also allows the SCDOT to use the predicted AADTs from the regular regression model, quantile regression model, or point-based model, when roadway characteristics data are available via asset management data collection efforts.



Kriging uses AADTs from nearby short-term count stations to give the best linear unbiased predicted AADT at a non-coverage location

Problem

The SCDOT currently uses default values to estimate AADT at non-coverage locations based on their functional class. That is, if the roadway is a local, rural road, then a default value of 100 vehicles/day (vpd) is used. Similarly, if the roadway is an urban, local road, then a default value of 200 vpd is used. The SCDOT recognizes that these default values may not reflect the actual AADTs, and therefore, sought to improve upon current practice with this research project. The aim of this project is to provide quantitative and justifiable methods for obtaining AADT at non-coverage locations.

Research

The kriging, regression, and point-based models were developed using a dataset consisting of 3,687 coverage counts. The standard kriging approach was modified in this project to use a default value when its predicted value is over a user-specified threshold (referred to as "hybrid kriging model"). Specifically, when a sampled coverage location is found to have a high absolute error using the kriging method, it is assumed that the surrounding non-coverage locations will also have AADT errors if kriging is used. In such cases, the mean AADT, based on county and functional class, is used as the AADT estimate. Two types of regression models were developed: regular and quantile. The validated models and their specifications are shown in Table 1. Additionally, the point-based model, based on the work of Portland State University and sponsored by Oregon DOT, was adapted using South Carolina roadway data. This model is essentially a lookup table. That is, given a number of "points" (i.e., roadway features), it provides a corresponding AADT estimate. These estimates are simply the median AADTs of roadways with the same number of points. A roadway's number of points is dependent on how many of the following conditions are met:

- In urban area
- Presence of centerline marking (i.e., double yellow line)
- Presence of median
- Presence of right-turn lane
- Presence of left-turn lane
- Presence of parking lot adjacent to the study road segment
- Presence of sidewalk

The point-based model estimates are shown in Table 2.

Table 1: Regression Models

Model	Equation
Regular Regression	Predicted AADT = 40 + 110 × Urban + 113 × Single Line + 249 × Other Type Median + 158× Right-turn Lane + 539 × Left-turn Lane + 66 × Sidewalk
Quantile Regression	Predicted AADT = 29 + 50 × Urban + 64 × Single Line + 42 × Other Type Median + 286× Right-turn Lane + 450 × Left-turn Lane + 36 × Sidewalk + 50 × Parking Lot

Table 2: Point-based Model

Number of Points	Predicted AADT for Local Roads
0	125
1	175
2	350
3	650
4	900
5	1,600
6 or 7	1,800

Results

The performance of the developed models was evaluated using data collected at 1,024 non-coverage locations and the Root Mean Square Error (RMSE) metric. It can be seen in Figure 1 that the current default value method resulted in an RMSE of 276. Using the hybrid kriging model reduced the RMSE to 217, a 21.37% improvement in terms of RMSE. The point-based model yielded an improvement of 22.28% compared to the current default value method, whereas the regular regression model yielded a 17.03% improvement, and the quantile regression model yielded a 23.19% improvement.

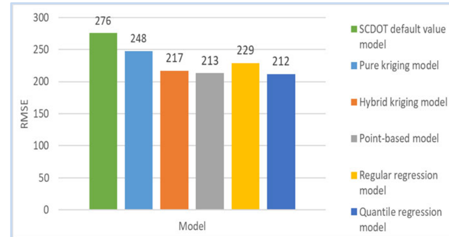


Figure 1. Comparison of models' performance

Conclusions

This project identified suitable methods to estimate AADT at non-coverage locations in terms of ease of implementation and accuracy. These methods include kriging, point-based model, regular regression model, and quantile regression model. The kriging model was selected as the primary model because it leverages existing coverage counts and does not require the SCDOT to collect additional data. Other models were also developed to complement the kriging model.

Based on this project's findings, it is recommended that the SCDOT consider adopting the developed Excel-based tool. It can be used to improve AADT estimates at non-coverage locations without any change in process or additional data collection effort. Moreover, when roadway characteristics data are readily available, the SCDOT will be able to leverage these data and the developed point-based and regression models for additional gains in accuracy.

Value & Benefits

By using the developed Excel-based tool to obtain accurate AADT estimates for non-coverage locations, the SCDOT will be able to reduce the number of non-coverage counts performed annually, from 5000 to 3000. At $51 per count, this translates to an annual savings of $100,000.

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