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Developing a Method for Estimating AADT on all Louisiana Roads

INTRODUCTION

Annual Average Daily Traffic (AADT), the average daily volume of vehicle traffic on a highway or road, is an important measure in transportation engineering. AADT is used in highway geometric design, pavement design, traffic forecasting, and highway safety (Highway Safety Manual). AADT is collected either automatically through permanent or portable count stations or manually at a fixed point of a roadway. Louisiana DOTD collects traffic counts regularly on state-maintained highways. Major cities associated with their respective MPOs, generally collect traffic count data for the locally maintained roads within a particular MPO study area. Most parishes and small urban areas do not collect traffic counts frequently, and the DOTD does periodically conduct traffic counts on some selected non-state roads.

However, limited resources are a major reason for not collecting AADT regularly on all non-state roads. Non-state roads account for the majority (75%) of the statewide highway network in Louisiana. HSM applications particularly need AADT information.

OBJECTIVE

The goal of this project is to develop a methodology for estimating AADT on all Louisiana roadways with an emphasis on non-state rural roadways. Exploring different AADT estimating procedures established previously and new data collection technologies will do this. Specifically, the objectives of the proposed project are to:

- Review existing (permanent and mobile) traffic counts and identify roadways currently without traffic counts on the entire Louisiana roadway network.
- Identify variables influential to AADT estimation such as population, demographic characteristics, distance to permanent counts, and number of jobs.
- Select the representative parishes to develop models.
- Develop the AADT estimation models for non-state roadways in rural areas.
- Explore AADT estimation methods for non-state roadways in small urban areas.

SCOPE

The research is to develop a method for estimating AADT on non-state roadways in Louisiana. The study has developed the AADT estimation models by support vector machines (SVM) method for eight parishes at the census block level.

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PRINCIPAL INVESTIGATOR:
Xiaoduan Sun, Ph.D., P.E.

LTRC CONTACT:
Kirk M. Zeringue, P.E.
225.767.9169

FUNDING:
SPR: TT-Fed/TT-Reg

Louisiana Transportation Research Center

4101 Gourrier Ave
Baton Rouge, LA 70808-4443

www.ltrc.lsu.edu

METHODOLOGY

The study consists of four basic steps:

Review existing AADT estimation techniques and research: By reviewing the state of the practice and state of the art in modeling techniques, the research team identified the pros and cons associated with AADT estimation methods in traditional statistics models and machine learning algorithms, as well as their past application limitations.

Data collection and processing for eight selected parishes: Based on the parish population, existence of small urban area, geographic location of the parish in Louisiana (north and south Louisiana), accessibility to Interstate and U.S. Highways and the number of available traffic count stations, eight parishes were selected for the study. Traffic count data and census data (population density, employment, number of households, etc.) at the block level were collected. Using GIS mapping techniques, the shortest roadway distance from a traffic count to a major state highway or Interstate were derived. Finally, all data with relevant information were compiled in one single database.

Model development: After spending considerable effort in exploring various kinds of models, the research team finally settled on the SVM method in estimating AADT. SVM is a branch of machine learning that focuses on the recognition of patterns and regularities in data. It works better in recognizing "irregular" relationships/patterns and in capturing unknown factors' influence. It is good for prediction but not so much for relationship discovery. The open source called the "e1071 library in R" was used to develop the AADT estimation models with the support vector regression techniques.

Result analysis: As shown in the table, the 82% predicted AADT in Acadia Parish is close to the observed AADT (within the observed ±100). This percentage increases to 89 when the bandwidth increases to the observed ±200. Such a close match is unprecedented at this disaggregate level based on the information review.

CONCLUSIONS

- Among all potential modeling techniques, the SVR, a so-called machine learning or pattern recognition method, works the best in predicting the complicated AADT generation in rural and small urban areas.
- The estimated AADT are sufficiently accurate for transportation planning and roadway safety evaluation purposes.
- The developed method tends to underestimate AADT for roadways observed with traffic count higher than 1,500 per day.
- There is significant differences in the estimated AADT among the parishes, thus parish-specific models should be developed.
- AADT estimation by nature is complicated and highly stochastic. Lack of probability estimation of the results is the main drawback of SVR or all machine learning methods.

RECOMMENDATIONS

This project recommends DOTD develop parish-specific models for all 64 parishes in the state to estimate AADT on non-state roadways in rural and small urban areas, and repeat the estimation procedure every 10 years in general and at small time intervals for specific roadways of interest.

An interactive web application should be developed to facilitate the AADT estimation for all DOTD offices.

			Predicted AADT vs. Traffic Counts within ±100 boundary		Predicted AADT vs. Traffic Counts within ±200 boundary	
Parish		Sample size	Counts	Percent	Counts	Percent
With Interstate Access	Acadia	464	380	82%	413	89%
	Avoyelles	481	391	81%	425	88%
	Natchitoches	453	373	82%	406	90%
	Webster	380	310	82%	333	88%
Without Interstate Access	Claiborne	335	283	84%	310	93%
	Franklin	431	304	71%	357	83%
	Vermilion	447	298	67%	368	82%
	Washington	740	477	64%	581	79%

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