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Think Jersey DOT

Tech Brief

ESTIMATION OF TRUCK VOLUMES AND FLOWS

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HERE'S THE PROBLEM

Trucks dominate the freight movement within the State of New Jersey, accounting for 75% of the transported goods (in tons) and impact the roadway network in several ways. As truck volumes have grown dramatically in the past few years, so has the need for better methods to estimate truck volumes, percentages and flows on major truck facilities such as interstates and principal arterials, as well as on minor arterials with lower truck volumes. According to the Quick Response Freight Manual (QRFM) current freight modeling approaches are either simplistic or make many assumptions and inherit the inconsistencies among the steps of sequential processes. In this project a statistical approach for estimating truck volumes is used that avoids many of the inconsistencies of sequential models while requiring less data.

AND, HERE IS THE SOLUTION...

- Use a statistical approach for estimating truck volumes based primarily on classification counts and information on roadway functionality, employment,

sales volume and number of establishments within the state, that requires less effort and data compared to current methods.

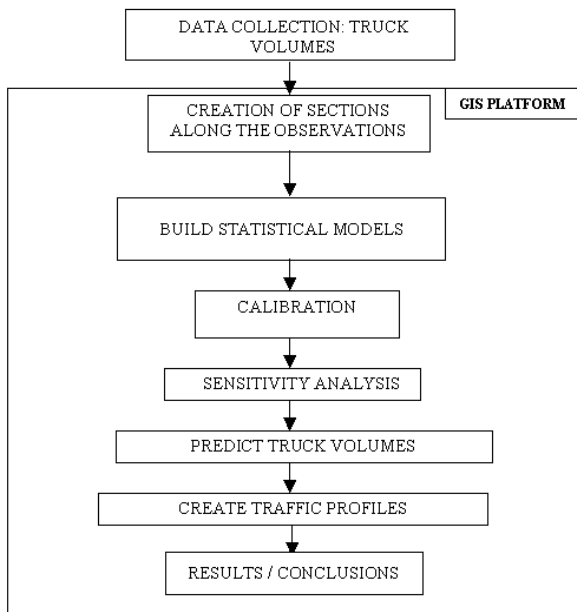
- Create models that may predict truck volumes and percentages at any given location in the state truck route network.
- Develop profiles of truck traffic on roadways, indicating the AADT, truck and passenger car volumes and percentages.
- Automate the above procedures within a GIS environment.

THIS IS WHAT IT CAN DO

- Estimate Truck Volumes on a selected highway section
- Create truck volume and percentage profiles
- Visualize these results within a GIS environment

BUT HOW CAN IT DO ALL THIS???

- Collect data and identify variables that would help in predicting truck traffic
- Using the above described data; built relationships between truck volumes and adjacent activities
- Perform sensitivity analysis to determine the change in the models' behavior with a change in the size of the activity area considered
- Choose the best model for each roadway class based on the sensitivity analysis results
- Make predictions for locations where no truck volume information is available through traffic counts



- Produce profiles of traffic on roadways, indicating the AADT, truck and passenger car volumes and percentages

AND, HERE'S WHAT WE DID...

Using truck classification counts from various locations throughout the state of New Jersey, relationships between truck volumes on roadways and their adjacent land uses and economic activity were developed. Measures like employment, estimated sales volumes and number of establishments were considered.

Classification counts from 270 locations throughout the State were used. The analysis areas were defined by taking a buffer zone around each location. The buffers were analyzed as bands along the roadway section. Sensitivity analysis was performed for band widths of 0.25, 0.5, 0.75, 1.0, 1.25, 1.5, 2.0, 3.0 and 5.0 miles.

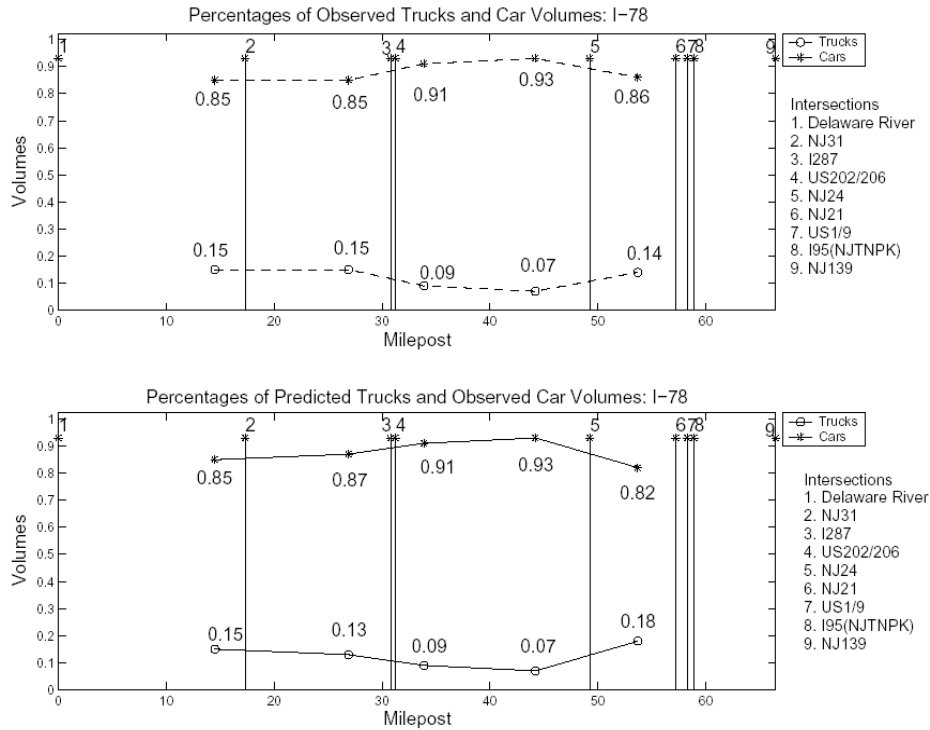
Linear Regression and a Constrained Optimization approach were used for creating the predictive models. Both approaches formulated the relationship in a general sense as given below:

$$Truck\ Volume_i = \sum_j (a_{ij} * \text{number of employees in } SIC_j + b_{ij} * \text{estimated sales volume in thousands of dollar for the } SIC_j + c_{ij} * \text{Number of businesses for } SIC_j)$$

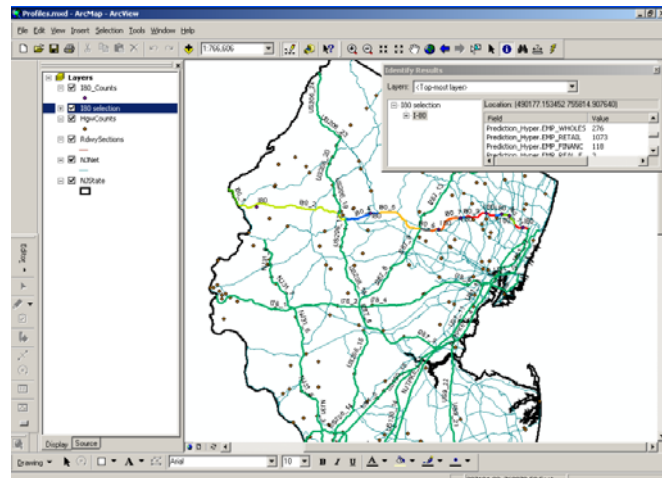
Where: *Truck Volume_i* = is the number of two-way daily truck trips of truck class *i* produced in a zone, *a*, *b*, *c*.. = coefficients, and *SIC_j* *Standard Industrial Classification for industry j*

After the models were created and predictions were made for the locations where no prior information was available on truck volumes, the traffic profiles were

produced. These profiles help in better visualizing and understanding the flow of truck traffic throughout New Jersey and validate the models for the sections with observed data.



The econometric data and classification count databases along with the truck volume estimation models were implemented within a GIS platform to facilitate calibration and data visualization. The resulting tool allows the user to select a roadway segment and, depending on its functional grouping, use the appropriate model to estimate truck volumes and truck percentages. Graphical images showing the traffic profile on the selected segment and the adjacent ones are generated.



HERE'S WHAT WE CAME UP WITH...

- Building models considering roadway classes is significant, as different roadways attract different types of truck traffic and truck volumes.
- Number of Employees, Estimated Sales Volume and the Number of Establishments based on the Standard Industrial Classification for the region are considered to be good predictors of truck volumes.
- Creating vehicle profiles for different roadway sections helps in understanding the truck traffic flow patterns within the state.
- Models become sensitive to the area considered along the section. A larger bandwidth resulted in better truck volume estimates for Interstates and Expressways. Models for minor roads gave better estimates when smaller buffer areas were considered.
- Although preliminary results obtained through this study are promising in terms of the proposed methodology and results, it is recognized that a much larger set of counts should be considered in order to obtain more sound statistical models and more accurate results.
- Additional data collection and surveys (example: cordon counts or license plate surveys) should be carried-out in order to provide accurate estimates of the 'through traffic' on the various major highways. Through traffic does not depend on local activity and obtaining a good estimate of it would further improve the models.
- The proposed method is not intended to "replace" or "compete" with existing methods and should not be used as a freight-forecasting tool. It can effectively be used for facility planning, corridor planning, and strategic planning for transportation systems including pavement and bridge design and management, reconditioning and reconstruction of highway pavement, planning for freight movements, environmental impact analysis, and investment policy applications.
- This statistical tool can help planners in obtaining truck volume, flow and percentage estimates on state roadways without having to use complex, time

consuming and data demanding freight forecasting tools. This kind of analysis is typically outsourced to consultants by state DOTs. Having the proposed tool available and directly linked to the state DOT's database, facilitates the quick, in-house estimate of truck volumes. Any additional information on future scenarios and what-if kind of analysis will have to use the traditional channels.

THE BOTTOM LINE...

The preliminary results obtained through this study are promising in terms of the proposed methodology. It is recognized that a much larger dataset should be considered, in order to obtain more sound statistical models and more accurate results. The proposed technique, however, and its implementation within a statewide GIS tool, may provide state transportation professionals with a valuable tool to predict truck volumes and percentages on the state truck route network, generate volume and percentage profiles, and better understand truck movements in the state of New Jersey.

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A final report is available online at <http://www.state.nj.us/transportation/refdata/research/>

If you would like a copy of the full report, please FAX the NJDOT, Bureau of Research, Technology Transfer Group at (609) 530-3722 or send an e-mail to Research.Bureau@dot.state.nj.us and ask for:

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