



Overview of TxDOT's Traffic Data Collection and Load Forecasting Process

The Texas Department of Transportation (TxDOT) is concerned about its process of predicting traffic loads for pavement design, particularly the consistency, accuracy, and timeliness of estimates. Several deficiencies have been evident in the methods for collecting and reporting traffic loads. These include the number and locations of data collection sites, vehicle trends that may accelerate pavement damage, route-specific factors that were being ignored, proposed new procedures for collecting and using data, and the need for improvement in the software used to predict equivalent single-axle loads (ESALs). This research evaluated TxDOT's state-of-the-practice in traffic data collection and load forecasting for pavement design, identified shortcomings, and recommended improvements.

What We Did . . .

The research team synthesized information from the literature,

TxDOT, other states, equipment vendors, and researcher knowledge to determine the adequacy of current TxDOT practice. Research staff conducted a comprehensive needs assessment for the Transportation Planning and Programming (TPP) Division by surveying TxDOT's 25 districts, TxDOT's Motor Carrier and Design Divisions, and the Texas Department of Public Safety. The survey requested information from TPP customers to assess user perspectives on the data provided by TPP. It solicited information from the following offices in each district: area engineer, district design engineer, and district transportation planning and development engineer.

The research also synthesized information on the current traffic load forecasting process used in Texas by conducting personal interviews with TPP staff, reviewing their procedures, and conducting a step-by-step review

of the program used by TxDOT to predict traffic (RDTEST68). The research team also conducted a traffic load forecasting state-of-the-practice review by contacting more than 30 states via the Internet, then conducting follow-up telephone interviews to gather more detailed information from selected agencies.

What We Found . . .

Data Collection

The Peek ADR-6000 and the U.S. TrafficCorp IVS-2000 are promising inductive loop-based systems that could improve data collection. The Peek unit is the only known device that can accurately classify vehicles in stop-and-go traffic. The IVS-2000 reads inductive loop signatures from either one or two loops per lane. Both of these detection systems need further testing to fully determine appropriate applications. The only non-intrusive detector that can classify vehicles by



detecting axles from off the roadway is the Autosense IIA by Schwartz Electro-Optics (SEO).

TPP collects weigh-in-motion (WIM) data at permanent sites on a quarterly basis for periods of 48 hours, so it misses some of the day-to-day and week-to-week variations. A majority of WIM sites are on the Interstate system, ignoring other roadway types. Significant variations occur in truck axle weight distributions: 1) from one site to another, 2) at the same site during different seasons, and 3) from one direction to the other at the same site. On U.S. 380 in Decatur, Texas, for example, differences in projected ESALs were seven times greater in one direction than in the other. Accuracy of traffic load forecasts on a facility could be improved by more than 85 percent through weeklong WIM sessions at a specific site being considered for improvement.

User Needs Survey

Results of a user needs survey indicated that although TxDOT districts and sections commonly request and receive information/data from TPP, very few, if any, fully appreciate the extent of TPP work required to complete a request. Therefore, requestors often underestimate the amount of time required by TPP. All districts and sections interviewed expressed a desire for better communication with TPP to improve efficiency. These improvements will be even more

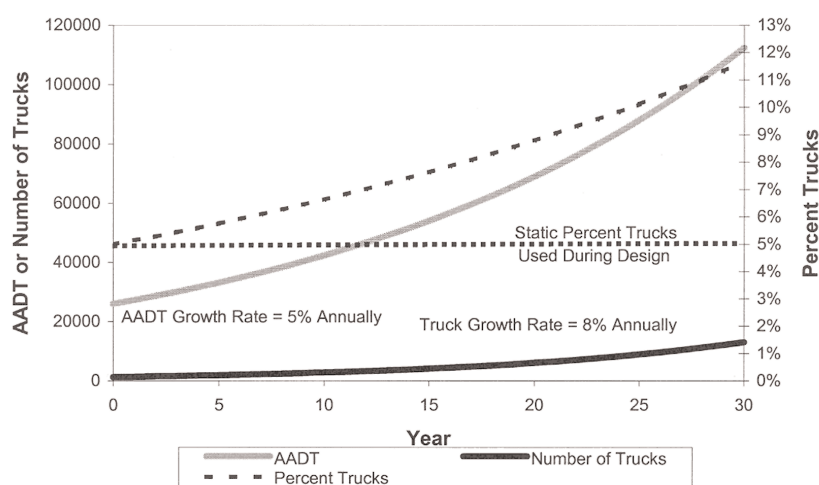


Figure 1. Impacts of differences in annual average daily traffic (AADT) and truck growth rates

imperative with upcoming revisions to the American Association of State Highway and Transportation Officials (AASHTO) pavement design guidelines and the Federal Highway Administration (FHWA) *Traffic Monitoring Guide* (TMG 2000). Both documents require more traffic data than before. To improve efficiency in the data request process, this research developed a document called *Traffic Data Request Guide for Highway Pavement and Geometric Design*.

Data Analysis and Forecasting

The data analysis performed on both the truck weight and vehicle classification data can best be characterized as data validation rather than a true analysis of the data. Truck weight data receive a cursory analysis review (applying trend analysis and professional judgment) and are forwarded to the reporting and forecasting steps. TPP scrutinizes vehicle classification data more thoroughly than truck

weight data through the application of 20 criteria elements plus professional judgment. In some vehicle classification criteria, analysts use three previous years of data for comparison.

Providing design-level data is the function of the weight data forecasting process through the RDTEST68 program and its prediction of design life ESALs. Inherent weaknesses of this program include assumptions of constant truck percentages, axle factors, load equivalency factors, percent single axles throughout the design period, and one growth rate for all truck classes. Figure 1 shows the difference between a constant percent trucks as assumed in the model and a truck growth rate of 8 percent (AADT growth rate of 5 percent). The results of this forecasting process serve as input to design pavement structures to meet the estimated damage from truck traffic over the design life of the pavement. Significant over- or



under-prediction of pavement loading can result in unnecessary expenditures or premature failure, respectively.

Fifteen states participating in a recent FHWA survey use procedures that, if adopted by TxDOT, would improve the outcome of the traffic load forecasting process. Five states backcast traffic to check predictions, and 11 states collect project-level data. Six states routinely update traffic between preliminary and final design, while 13 states use two or more truck classes to project future traffic loadings. Nine states project truck growth separately from other vehicle growth. Four states use either regional or seasonal factors. Eleven of the 15 states reevaluate their truck factors periodically.

Researchers Recommend . . .

Data Collection:

- Establish a plan to implement its new *Traffic Data Request Guide for Highway Pavement and Geometric Design* to improve the data request process.
- Increase the number of truck weight sites to comply with the draft of the new *Traffic Monitoring Guide*.
- Develop monitoring tools to evaluate the calibration of WIM equipment through analysis of gross vehicle weight distributions

of 3-S2 trucks. Include additional preliminary WIM data screening tools to include: 1) an average of 4.3 ft on drive tandem separation, 2) Class 11 overall length, and 3) the average gross weights by speed bin from the general traffic stream instead of individual trucks.

- Prepare for full TxDOT implementation of GIS by locating all current data collection sites on a layer of the department's selected GIS platform.
- Districts should request a directional WIM analysis in some circumstances because it could reveal significant differences in pavement loadings directly affecting the subsequent pavement design.

Data Analysis:

- Integrate continuous vehicle classification and a limited continuous truck weight data program to develop temporal adjustment factors as suggested in the draft *5th Ed. Traffic Monitoring Guide*.
- Develop more formalized procedures for data analysis to minimize the amount of professional judgment in special cases.

Weight Data Forecasting:

- Develop regional weight distribution tables for a variety of

road types and road uses as suggested in the draft *5th Ed. Traffic Monitoring Guide*.

- Develop class-specific growth rates for Classes 5 through 13 and incorporate the rates into forecasting processes.
- Monitor the propagation of spread tandems due to their higher damage to pavement per pass compared to other Class 9 vehicles. One way is to separate the spread 3-S2 truck configuration from other Class 9 vehicles by adopting a special Class 14 vehicle.

Data Archival:

- Utilize TxDOT's core technology architecture by adopting Oracle and developing database applications for both the truck weight and vehicle classification programs.

Data Reporting:

- Develop reporting procedures to generate temporal (time-of-day, day-of-week, and seasonal) adjustment factors, as required by the *5th Ed. Traffic Monitoring Guide*.
- Develop reporting procedures to generate axle load distributions by axle sets as required for the 2002 *AASHTO Pavement Design Manual*.



For More Details . . .

The research is documented in the following report:

Report 1801-1, *Evaluation of TxDOT's Traffic Data Collection and Load Forecasting Process*

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To obtain copies of the report, contact Dolores Hott, Texas Transportation Institute, Information & Technology Exchange Center, (979) 845-4853, or e-mail d-hott@tamu.edu. See our on-line catalog at <http://tti.tamu.edu>.

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Two products were required for this project:

1. Recommendations for enhancing current traffic forecasting process including performance measures and methodology for pilot testing the recommendation.
2. Guide for requesting traffic data and WIM prototype database.

The recommendations (4 pages) were submitted as 1801-P1, and the guide is 1801-P2. The Transportation Planning Division (TPP) is in the process of developing a strategic plan for operating improvements for data collection/reporting activities. These products could be helpful in educating districts and other divisions regarding the data collection process and offer substantial opportunities for an improved and coordinated data collection process in the future.

The results of this project are being coordinated with the Statewide Traffic Analysis and Reporting System (STARS) project.

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YOUR INVOLVEMENT IS WELCOME!

Disclaimer

This project was conducted in cooperation with the Texas Department of Transportation (TxDOT) and U.S. Department of Transportation, Federal Highway Administration (FHWA). The contents of this report reflect the views of the authors, who are solely responsible for the facts and accuracy of the data, the opinions, and the conclusions presented herein. The contents do not necessarily reflect the official view or policies of TxDOT, FHWA, the Texas A&M University System, or the Texas Transportation Institute (TTI). This report does not constitute a standard or regulation, and its contents are not intended for construction, bidding, or permit purposes. The use of names or specific products or manufacturers listed herein does not imply endorsement or those products or manufacturers. The engineers in charge of the project were Dan R. Middleton, P.E. # 60764, and Jason A. Crawford, P.E. # 83241.