The research is documented in the following report:

Report 1801-P1, 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.

TxDOT Implementation Status

January 2002

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.

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.

For more information, please contact Bill Knowles, P.E., RTI Research Engineer, (512) 465-7648 or e-mail wknowle@dot.state.tx.us.

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Disclaimer

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For More Details . . .

The research team synthesized information from the literature, TxDOT, other states, equipment vendors, and researchers 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 accelerated pavement damage, route-specific factors that were vehicle trends that may not be ignored, proposed new methods for collecting and reporting traffic loads. These include the number and location of data collection sites, vehicle types that may include the number and location of data collection sites, vehicle types that may accelerate pavement damage, route-specific factors that were not being ignored, proposed new data collection methods that could improve data prediction. The recommendations included:

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improvements will be even more
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
categorized 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
RDTTEST68 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.
Elevens 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.
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.

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.

Data Reporting:
• 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.

• 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.

• 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.

Figure 1. Impacts of differences in annual average daily traffic (AADT) and truck growth rates
The research is documented in the following report:

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The research also synthesized recommendations for improving traffic data collection in Texas by conducting personal interviews with TPP staff, reviewing their procedures, and conducting a step-by-step evaluation of the program used by TxDOT to predict traffic (RDTTEST68). 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. TraffiCorp IVS-2000 are promising inductive loop-based systems that could improve data collection. The Peek unit is the only non-intrusive detector that can classify vehicles by axle loads (ESALs). This system is promising inductive loop-based systems that could improve data collection. The Peek unit is the only non-intrusive detector that can classify vehicles by axle loads (ESALs).

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, and 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.

What We Did . . .

The research team synthesized recommendations for enhancing current traffic forecasting process including performance measures and methodology for pilot testing the recommendations. The guidelines (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.

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