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LRRB
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$92,749

The proportion of five-axle semitrailers on county state aid highways has increased 340 percent.

MINNESOTA DEPARTMENT OF TRANSPORTATION
RESEARCH SERVICES
OFFICE OF POLICY ANALYSIS, RESEARCH & INNOVATION

Update of Vehicle Classification for County Road Pavement Design

What Was the Need?

Traffic analysis is an essential component of proper pavement design and construction. Equivalent single axle load forecasts are one factor used to determine the type and durability of roadways. Accurate ESAL forecasts require accurate average annual daily traffic counts and vehicle classifications. It is vital to know, for instance, how many multi-axle semitrailers are expected to use a roadway as compared with the number of passenger cars. Since one five-axle semitrailer can be equivalent to thousands of passenger cars in terms of pavement damage, a dramatic impact on pavement design will result if heavy truck traffic increases by even a small percentage.

Researchers conducted vehicle classification counts in 15 counties across the state. They discovered that the proportion of heavy trucks on the County State Aid Highway system is at least twice as high as the counts found in the latest Pavement Design Manual.

Mn/DOT has installed many permanent traffic classification sites on interstate and state highways throughout the state, resulting in continuously updated information. However, there are often long gaps of time between classification counts on the county road system. The default vehicle classification tables for county road systems from the most recent Pavement Design Manual were originally created in 1977 and last updated in 1997. Proper design and construction of roadways require accurate classification data based on up-to-date traffic analysis.

What Was Our Goal?

The primary goal of this project was to update the vehicle classification and distribution tables that counties use when designing pavement structures. Secondary goals included characterizing this data by region, season and Average Daily Traffic, or ADT, category, and developing a method for local agencies to determine appropriate vehicle classifications for use in the design of a particular roadway.

What Did We Do?

Fifteen county engineers from different counties with varied geography, demographics and commercial activities worked with the research team to select five roadways within each of their respective counties to conduct traffic classification counts. Roadways were selected that were representative of traffic within the county, including one roadway in each ADT category when possible, and were limited to those in the County State Aid Highway system and county system.

Each county then obtained traffic classifying equipment from local Mn/DOT State Aid offices or via purchase, including TimeMark Delta IIIL tube counters. These counters were installed on each of the selected roadways, with two tubes set exactly 16 feet apart; the counters determined the class of vehicle by calculating axle spacing using the speed of vehicles crossing the tubes. Each counter remained on the roadway for an average of 12 days, which is longer then the standard 48 hours generally used for vehicle classification counts.

From November 2006 through July 2009, 47 sets of classification counts were collected with approximately five roadways each, for a total of 239 individual roadway counts. This data included counts in spring, summer and fall for each participating county.

Researchers then analyzed the data to determine vehicle classification trends by vehicle

continued

"We need to be designing roads based on up-to-date vehicle classification data. A large increase in the use of five-axle semitrailers has a significant impact on pavement damage and the types of roads we should build."

—Tim Stahl,
Jackson County Engineer

"We were able to address the need for accurate and updated vehicle classification data and go further by analyzing the data by region, season and ADT category."

—W. James Wilde,
Professor, Minnesota State University Center for Transportation Research and Implementation

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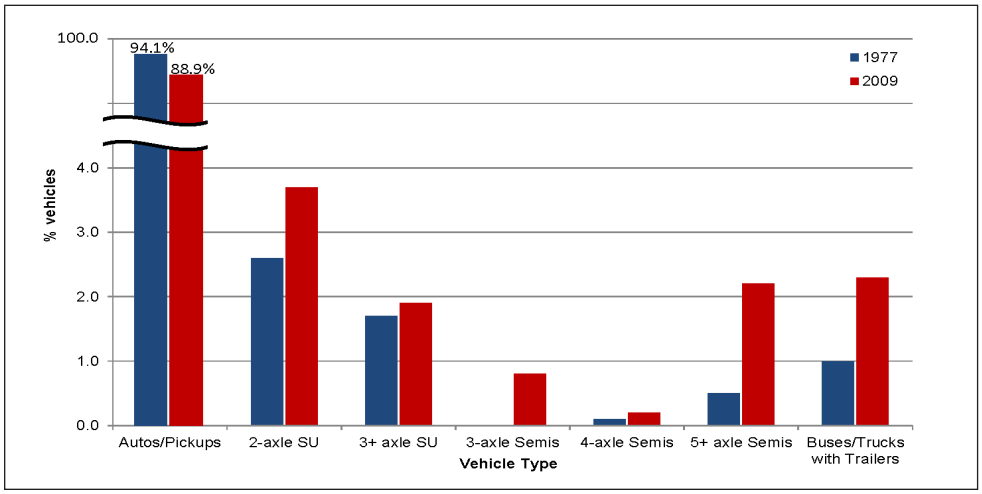

Researchers analyzed data to capture traffic trends, including by vehicle category. This chart illustrates the difference between 1977 (blue) and 2009 (red) percentages of traffic for each category, showing the significant increase in larger vehicles that have a greater impact on pavements.

type distributions statewide, district/region, season, ADT category, weekend versus weekday, and combinations of these categories.

Finally, researchers produced a guide for local agencies to develop vehicle classification distributions using three different methods: the updated statewide classification tables, tables categorized by region/season/ADT, and hardware counts to conduct individual counts on specific roadways.

What Did We Learn?

The results of this study indicate the vehicle classification distributions on the County State Aid Highway system have changed since the classification tables were last updated. The changes are most prominent in the increase of large trucks on county roadways. A summary of statewide vehicle classification changes in the traffic mix by vehicle category follows:

- Autos and pickups decreased 5.5 percent.
- Single-unit trucks (two-axle, six-tire) increased 42 percent.
- Single-unit trucks (three-plus axle) increased 12 percent.
- Tractor semitrailers (four-axle) increased 100 percent.
- Tractor semitrailers (five-plus axle) increased 340 percent.
- Buses and trucks with trailers increased 130 percent.

Spring and fall seasons displayed the highest percentage of commercial vehicle traffic because of the increased numbers of farming and harvesting vehicles. Regional classification data showed the percentage of heavy truck traffic varies between districts. For instance, District 4 reported the highest proportion of heavy commercial vehicles at 18.4 percent, while District 5 reported only 6.8 percent. Researchers anticipated that roadways with lower ADT and in rural areas would experience a higher proportion of heavy truck traffic, but the data indicated only a small increase.

What's Next?

Researchers recommend providing additional guidance to counties in collecting, analyzing and interpreting traffic classification data. The results of this project should be formally presented to a full meeting of county engineers from across the state, and researchers are working with the Mn/DOT Office of State Aid to determine if the research will be used to update the Pavement Design Manual.

This Technical Summary pertains to the LRRB-produced Report 2010-17, "Update of Vehicle Classification for County Road Pavement Design," published April 2010. The full report can be accessed at http://www.lrrb.org/PDF/201017.pdf.