



## Summary Report on Truck Accommodation Design Guidance

The number of trucks on many highways in Texas and across the nation has increased to the point that special or unique roadway design treatments may be warranted. As particular corridors have become increasingly dominated by truck traffic, or in locations where truck traffic might reasonably be segregated, questions have arisen regarding accommodations and treatments to address issues caused by truck traffic that may be appropriate for those corridors.

### *What We Did . . .*

We developed a profile of the current Texas truck fleet and evaluated major truck corridors as reflected in commodity flows and truck classification counts produced by the Texas Department of Transportation (TxDOT). The project evaluated not only existing traffic, but also anticipated changes in truck

traffic based on projections enunciated in recent freight system studies and corridor project reports. Researchers then identified the key truck corridors that had the highest likelihood of carrying heavy flows of large trucks.

Using the literature search and previous experience with other truck roadway studies as a basis, we gathered and assimilated additional information on methods used elsewhere for truck design to determine their applicability to Texas Interstate, U.S., and state roadways. Two

truck roadways — a 32-mile segment of the New Jersey Turnpike and a 2.4-mile segment of I-5 in California — provided information pertaining to operational and safety aspects of truck roadways in a side-by-side comparison of mixed flows and car-only flows. (Truck roadways did not prohibit smaller vehicles, so the truck roadways had a mixture of trucks and cars while remaining lanes had cars only.) Finally, using the information gathered, we developed geometric



Figure 1. Inadequate Intersection Design for Trucks.



guidelines for implementation by TxDOT designers, and we determined truck volume thresholds for their use.

### *What We Found . . .*

Three prominent scenarios of truck treatment or accommodation that seem to depend largely on the volume of trucks on the roadway are:

- allow trucks to operate in mixed flow with little or no special design treatment,
- allow trucks to operate in mixed traffic with some restrictions on trucks and/or cars to improve safety and/or operations, and
- provide separate truck roadways.

For at least the second and third scenarios, special design considerations are needed to accommodate trucks and make the roadway as safe as possible.

Our findings related to heavy flows of commercial vehicles indicate that the two highest categories of truck flows occur on a relatively few miles of roadways. For example, highways with high truck volumes (about 6000 to 12,000 trucks per day [tpd]) account for 6 percent of the route miles and 31 percent of the annual truck-miles traveled (TMT). Highways with very high truck volumes (over 12,000 tpd) account for 2 percent of the route miles and 18 percent of the annual TMT. By

highway type, Interstate highways account for 11 percent of the route miles and 49 percent of the annual TMT, while U.S. highways account for 40 percent of the route miles and 32 percent of the annual TMT.

In comparing results from the various truck studies, it is important to understand how trucks are defined. Some studies define a truck as Class 3+ in the Federal Highway Administration (FHWA) Scheme “F,” whereas others define trucks as larger vehicles such as Class 5+. In Scheme F, Class 3 vehicles include four-tire vans, some pick-up trucks, and small trucks pulling one- or two-axle trailers. In the context of this project, the larger trucks (primarily Class 5+) are more critical because of their size and operating characteristics.

A review of past research evaluating the effects of truck lane restrictions on operations and safety indicates mixed findings. A 1989 study concluded that safety could be enhanced, while a study in 1990 found that capacity and safety were not improved. Public opinion was so favorable in a third study (pertaining to the Washington D.C. Capital Beltway) that lane restrictions were maintained even in the absence of positive findings related to safety and operations. General guidance suggests that lane restrictions should be established only on roadways with three or more lanes by direction, trucks should be

restricted to the right two lanes or from the left lane(s), and lane restrictions should not make the use of entry/exit ramps difficult.

Data from the two truck roadways noted above provide some useful information for other states that might consider building similar facilities. Comparing crash rates between each of the two parallel roadways over the most recent three years indicates no significant difference in either injury or total crash rates. However, it should also be noted that crashes of cars with other cars should usually be less severe than crashes of trucks with cars. Average annual daily truck traffic (AADTT) values on these two roadways range from 20,000 to 28,000 (Class 5+) trucks per day.

### *The Researchers Recommend . . .*

Previous studies that established the need for truck roadways based on truck volumes used AADTT thresholds of 20,000 Class 5+ vehicles or 25,000 Class 3+ vehicles per day. Other important criteria that should be considered besides truck volume include volume of non-trucks, number of mixed-flow lanes available, level-of-service, the truck-involved fatal crash rate, and proximity to significant truck traffic generators. For example, other requirements that supplemented the 20,000 large trucks per day were an average annual daily traffic (AADT) of



120,000 vehicles per day, four travel lanes in each direction, and consistent traffic demand over a length of 10 miles or more. These AADTT values are general guidelines, not final criteria.

Separate truck roadways should not have less than two continuous lanes in each direction. Capacities of roadways with 100 percent trucks are 1600 trucks per lane per hour in flat terrain and 800 trucks per lane per hour in rolling terrain. (The researchers recommend further review of these values in future research.) Based upon these level-of-service “E” values, observed peaking characteristics of truck flows, and growth rates in the 3 percent to 5 percent per year range, we predict the maximum peak-hour truck flows in 20 years will be 2000 trucks per hour at 3 percent growth rate and 2500 trucks per hour at 5 percent growth rate.

This result indicates that a truck roadway with two lanes (by direction) in flat terrain will have a capacity of 3200 trucks per hour and can accommodate a growth rate of 5 percent (or higher) over a 20-year design period. Considered another way, this finding suggests that a separated truck roadway with two lanes in flat terrain would not reach its capacity even during peak hours (assuming trucks only) at the end of 20 years and even at a 5 percent annual growth rate. The perception of underutilization may become an issue, at least at first. In rolling terrain, the higher growth rate would require more than two lanes, given the values cited above.

Research findings encourage TxDOT to adopt truck-friendly design to the extent feasible even at forecast design year volumes of 1000 or more trucks per day. Beyond this design level, a reasonable criterion to

begin considering special truck treatments is 5000 trucks per day (with about 6 percent of this daily value expected to occur in the peak period). The truck volume that would justify building future separate truck roadways would be about 25,000 (Class 5+) trucks per day.

Table 1 summarizes the design parameters and design year thresholds in AADTT that researchers recommend be changed to better reflect the unique characteristics of large trucks. Much of TxDOT’s current design practice already reflects the characteristics of trucks, so we recommend no change to several design parameters. Figure 1 shows an example of intersection design that did not adequately consider off-tracking of the largest trucks.

**Table 1. Design Element Thresholds.**

Design Element	Design Year AADTT		
	1,000 to 5,000	5,001 to 25,000	Over 25,000
Stopping Sight Distance	NC <sup>a</sup>	NC <sup>a</sup>	NC <sup>a</sup>
Intersection and Channelization	NC	*	*
Lane Width	NC	NC	*
Shoulder Width and Composition	NC	*	*
Traffic Barrier	NC	* <sup>b</sup>	* <sup>b</sup>
Passive Signs	NC	* <sup>c</sup>	* <sup>c</sup>
Acceleration Lanes	NC	*	*

\* Change required from current TxDOT practice to design specifically for trucks.

NC No change from current design practice.

<sup>a</sup> Recommend a change in wording in the *TxDOT Roadway Design Manual*.

<sup>b</sup> Apply findings of NCHRP 22-12 as appropriate to Texas roadways.

<sup>c</sup> Fo□ areas.



## *For More Details . . .*

The research for this project is documented in Report 0-4364-1, *Truck Accommodation Design Guidance: Final Report*.

**Research Supervisor:** Dan Middleton, Ph.D., P.E., Texas Transportation Institute, d-middleton@tamu.edu, (979) 845-7196

**TxDOT Project Director:** Gus Lopez, Pharr District, (956) 702-6159

**To obtain copies of reports, contact Dolores Hott, Texas Transportation Institute, TTI Communications, (979) 845-4853, or e-mail d-hott@tamu.edu. See our online catalog at <http://tti.tamu.edu>.**

## *TxDOT Implementation Status February 2004*

This research resulted in recommended truck accommodation design guidance for TxDOT. These recommendations separate truck accommodation design guidance into three categories based on truck design year AADTT. For less than 5000 trucks per day, there are no significant changes recommended to current design practice. There are changes recommended to accommodate trucks at 5000+ trucks per day, with separate truck roadways recommended at 25,000+ trucks per day. This guidance will enhance TxDOT planning and design practices when large volumes of trucks are predicted and will prove useful in development of the Trans-Texas Corridor.

For more information, contact Mr. Bill Knowles, P.E., RTI Research Engineer, at (512) 465-7403 or e-mail wknowle@dot.state.tx.us.

***YOUR INVOLVEMENT IS WELCOME!***

## *Disclaimer*

The contents of this report reflect the views of the author, who is responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the Texas Department of Transportation (TxDOT), the Federal Highway Administration (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 of those products or manufacturers.