Toll vs. Nontoll: Toll Facilities Are Safer

By Jeff Campbell

In the spring of 2006, national newspaper headlines screamed that toll plazas were "the most dangerous place on the highway." The articles were based on a National Transportation Safety Board (NTSB) study of a 2003 multivehicle accident in a toll plaza that underscored the apparent dangers of such facilities.

In response to the headlines, naturally, many in the government and media contacted IBTTA as well as individual transportation agencies for a response. Unfortunately, at the time, we had no concrete statistics of our own to refute the NTSB's claims. Since then, however, we've surveyed our members extensively about their operations, the results of which are maintained in the IBTTA Data Warehouse. The data show resoundingly that toll facilities in this country are as safe as or safer than their nontoll counterparts.

The Goal of the Research

The primary goal of our research (see Methodology) was to determine how fatality and accident rates on U.S. toll facilities compare with the same statistics for all U.S. roads, bridges, and tunnels. In addition, in studying the survey results we examined the effect of fatalities and accidents on various transportation-related costs and analyzed several factors that might significantly affect fatality and accident rates.

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The variables we analyzed that could affect fatality or accident rates include:

Types of toll configurations, including:
- Mainline barriers (main exits and entrances),
- Barriers at interchanges, and
- Open road tolling (ORT) segments.

Types of managed lanes used:
- Electronic toll collection (ETC) only lanes,
- ORT lanes,
- High occupancy toll (HOT) lanes,
- High occupancy vehicle (HOV) lanes,
- Reversible or zipper lanes, and
- Slip ramps.

Traffic management information services used:
- Message signs,
- Highway advisory radio,
- Dedicated broadcasts, and
- Traffic operations centers.

Annual budgets for the following:
- Operations,
- Capital improvements,
- Maintenance, and
- Marketing.

We also considered the number of years since a facility had undergone a major renovation (or since the facility had opened if no major renovations had been done). Additionally, we hypothesized that high fatality and accident rates would have an impact on the following costs:

- Emergency roadside assistance (mechanical),
- Emergency roadside assistance (medical),
- Fire,
- Police,
- Maintenance, and
- Debris removal.

Study Sample

The study sample represents various toll entities throughout the United States. Table 1 presents the types of toll entities included in the study by three main categories: roads, bridges, and tunnels. The sample includes 39 toll-road facilities, 30 toll bridges, and 6 tunnels.

Table 2 shows the number of toll entities examined by state. The sample includes toll entities from each of the 20 states that currently have toll facilities and is representative of U.S. toll facilities in general.

Table 1

Type of Toll Entities Surveyed

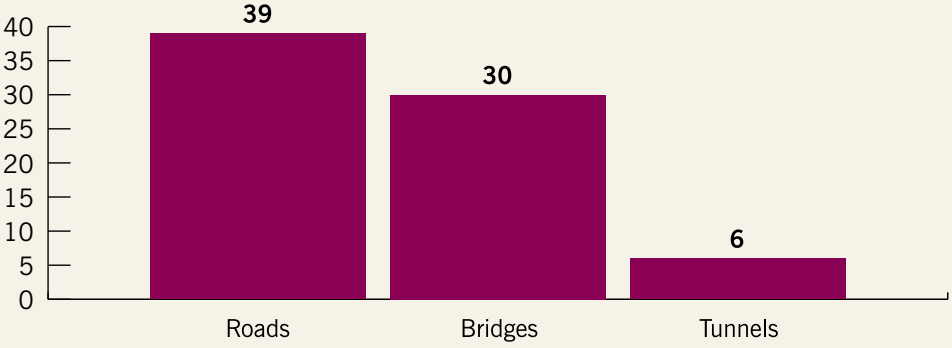


Table 2

Number of Toll Facilities Surveyed by State

CA 2	IN 1	NH 1	PA 7
CO 2	KS 1	NJ 3	SC 2
DE 3	MA 1	NY 16	TX 4
FL 10	MD 2	OH 1	VA 5
IL 2	MI 1	OK 10	WV 1

Toll facilities in the United States have a much lower fatality rate than do U.S. roads overall and lower fatality rates than both urban and rural interstate highways.

Measures Used

The industry standard measure for fatality rates is fatalities per 100 million vehicle miles traveled, which is used by the U.S. Department of Transportation. Vehicle miles traveled is calculated by totaling the number of miles each vehicle travels. This measure allows us to compare a wide variety of toll entities regardless of their length or the number of vehicles they serve.

In analyzing the data, we used a similar measure for accidents, calculating the number of accidents per 100 million vehicle miles traveled. As we went to press with this edition of *Tollways*, we were unable to locate a comparable number for all U.S. roads. One reason for this is that the industry definition of "accident" is not as clear as it is for fatalities, which are those traffic incidents in which one or more people are killed. Further investigation will be required to ensure that similar measures are used by all toll facilities. Nonetheless, we present below some interesting findings regarding accidents on U.S. roads.

Study Results

Overall safety. The primary question we were interested in examining in this study was how the accident and fatality rates of toll facilities compare with the overall national statistics (see Table 3).

As Table 3 shows, toll facilities in the United States have a much lower fatality rate than do U.S. roads overall. A more appropriate comparison however, is with the fatality rates of interstate highways which have much lower fatality rates. Toll facilities in the United States have lower fatality rates than both urban and rural interstate highways. The Fatality Analysis Reporting System of the National Highway Traffic Safety Administration's National Center for Statistics and Analysis reports that in 2005 the overall road fatality rate for the United States was 1.47 fatalities per 100 million vehicle miles traveled. The fatality rates for urban and rural interstate highways in 2004 (the last year for which data was available) were .55 and 1.21 respectively. The fatality rate for toll facilities was slightly lower than the rate for urban interstate highways and significantly lower than the rate for rural interstates. Of the toll facilities, toll roads had the highest fatality rate, at 0.52 fatalities per 100 million vehicle miles traveled. The fatality rates for toll bridges and tunnels were significantly lower, at 0.27 and 0.14 fatalities, respectively.

We are uncertain why bridges and tunnels have lower fatality rates than toll roads, but one could surmise that a bridge or tunnel is a known obstacle that motorists are aware they are approaching before they reach it, whereas open-road accidents are likely to be spontaneous events and take place at higher speeds, leading to more fatalities.

We also looked at the accident rates for toll facilities, although, as noted above, similar figures weren't available for U.S. roads as a whole (see Table 4).

While toll roads have much higher fatality rates than bridges or tunnels, the opposite is true for accident rates: toll bridges and tunnels have significantly higher accident rates than toll roads. This may be the result of measurement differences. For example, it may be that accidents are more likely to be recorded for bridges and tunnels, where accidents are more likely to impede traffic.

Predictors of accident and fatality rates. As part of our analysis, we examined several budget items to determine whether there was a correlation between budget amounts and the accident and fatality rates for facilities. We compared budget figures by dividing

Table 3

A Comparison of Fatality Rates Toll Entities vs. All Roads Fatalities per 100 Million Vehicle Miles Traveled, 2005

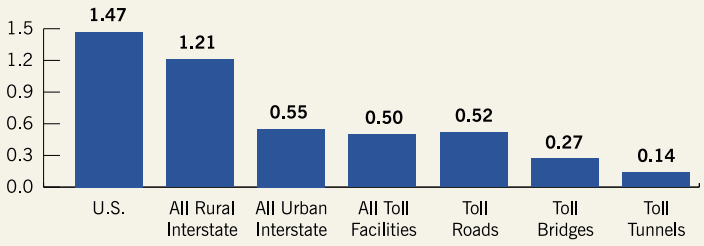
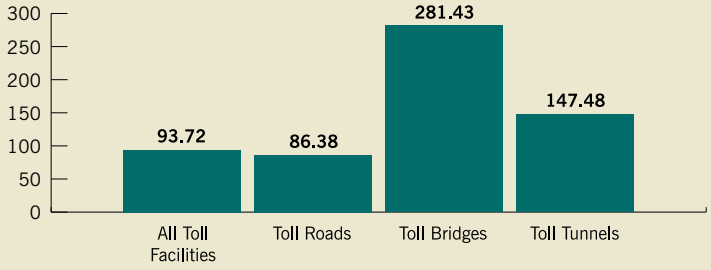


Table 4

Accidents per 100 Million Vehicle Miles Traveled by Type of Toll Facility



the figures by the total vehicle miles traveled for each facility. For this part of the analysis, we analyzed roads, bridges, and tunnels separately and calculated Pearson's product-moment correlation coefficients for both fatality and accident rates. Pearson's correlation reflects the degree of linear relationship between two variables. It ranges from +1 to -1. A correlation of +1 means that there is a perfect positive linear relationship between variables. A correlation of -1 means that there is a perfect negative linear relationship between variables. A correlation of 0 means there is no linear relationship between the two variables.

We also analyzed a number of variables using a Student's t-test. The t-test assesses whether the means of two groups differ statistically from each other. For example, does the average fatality rate of facilities with ETC differ from those without ETC? (See Table 6 for more on this question.) The following relationships had a significance level of .05 or lower, which means that there is less than a .05 probability that the relationship occurred by chance.

Fatality rates on toll roads. Both the amount budgeted for capital improvement and the amount budgeted for debris removal positively correlated with fatality rates. That is, the higher the amount spent for capital improvement and debris removal, the higher the fatality rate. The amount of capital improvement had a correlation of 0.766, while the correlation for debris removal was 0.708. These findings may reflect the disruption caused by ongoing construction and a problem with higher levels of debris on these roads. It may also indicate recognition on the part of their operators that the safety and performance of these facilities need improvement.

Other factors related to fatality rates included whether the road utilized barriers at interchanges and whether the road had ETC-only lanes. Tables 5 and 6 illustrate the findings for these two groups.

Three of the toll roads we analyzed lacked barriers at interchanges. These 3 had significantly higher fatality rates, five times the fatality rates of the 34 toll roads that had barriers at interchanges. This would make sense, as one could reasonably assume that the speed of travel on such "open" roads is higher than in traffic that is forced to slow down when encountering barriers at interchanges.

Only 3 toll roads reported that they had no ETC-only lanes. These facilities had an average fatality rate that was much higher than that of the 35 facilities that reported having ETC-only lanes. It is difficult to explain this result without further investigating the specific facilities involved and their particular setups, but possible causes for the higher fatality rate could be an absence of

Table 5

Barriers at Interchanges and Fatality Rates

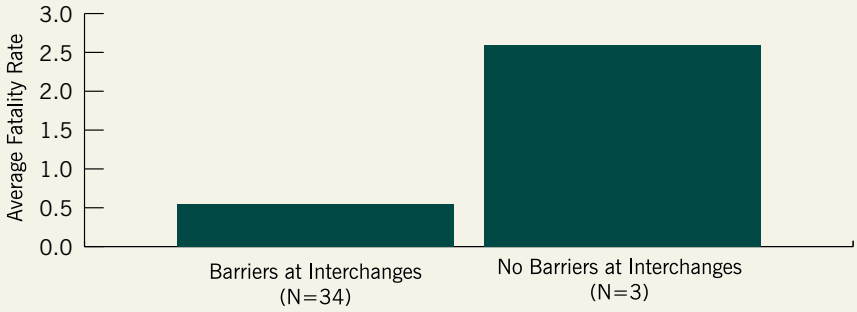


Table 6

Fatality Rates and ETC-Only Lanes

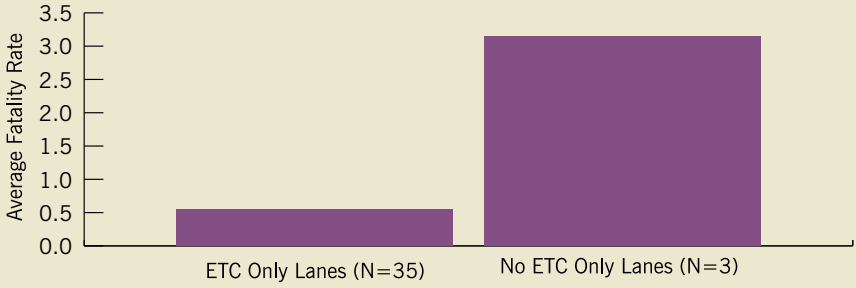
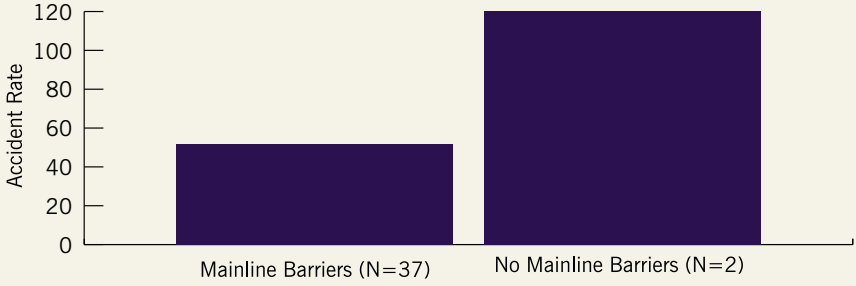


Table 7

Accident Rates and The Use of Mainline Barriers



IBTTA's research shows that toll roads actually have a lower fatality rate than nontolled roads.This is true for even the safest type of roads, our interstate highways.

dedicated lanes, severe space constraints, and short approaches to the toll plaza that give motorists little forewarning of a potential traffic backup ahead.

Accident rates on toll roads. Accident rates correlated positively with the number of years since the facility last had a major renovation. If no major renovations had been done, the year the facility was opened was used instead. This relationship showed a moderate correlation, at 0.52.

Two facilities reported that they lacked a toll configuration that included mainline barriers. These two facilities had significantly higher accident rates than those facilities with mainline barriers. Again, as with interchanges, one could reasonably assume that barriers may help prevent accidents by reducing overall speeds.

Toll bridge fatalities. The amount spent for emergency mechanical assistance and fire on toll bridges correlated positively with fatality rates (0.721 and 0.725, respectively). This is most likely due to the costs associated with clearing serious accidents.

Toll bridge accidents. The most significant finding regarding accidents on toll bridges is a negative correlation between the percentage of ETC users during peak operating times and accidents. In other words, with respect to toll bridge facilities, as the percentage of ETC users during peak operating times goes up, accident rates go down.

Toll tunnels. The only significant relationship we found relating to tunnels was a strong positive correlation between the amount budgeted for capital improvement and fatality rates. This could be due to an increase in construction work leading to more fatal accidents.

Study Conclusions

Toll facilities are safer than nontoll facilities. Toll entities in the United States have lower fatality rates than nontoll entities. There may be a number of reasons for this. For example, it may be that toll facilities are in better condition as a whole than other roads. Fatality rates may also be lower on toll facilities because of faster accident response and clearance times. At this point, however, these are only hypotheses and should be examined further in future analyses.

Some toll facilities are safer than others. Our analysis revealed that toll facilities can vary in their degree of safety based on certain features. For example, as noted above, there appears

to be a significant relationship between the use of ETC and ETC-only lanes and fatality rates indicating that the presence of ETC has a positive effect on the overall safety of a toll facility.

We also detected a relationship between fatality rates and the amount a facility has budgeted for capital improvements. This may indicate a need for additional safety measures during periods of construction.

Finally, as described above, the use of barrier toll systems at interchanges seems to yield lower fatality rates compared with facilities that lack such systems.

Accidents are costly. Fatalities and accidents have a clear impact on overall costs for a toll facility. The areas that were most significant are debris removal, emergency mechanical assistance, and fire, all of which are associated with serious accidents.

True Value

In contrast to the 2003 news reports suggesting that toll roads are dangerous, IBTTA's research shows that toll roads actually have a lower fatality rate than nontolled roads. This is true for even the safest type of roads, our interstate highways.

Our research also contradicts previous findings that the introduction of ETC-only lanes has a negative or no impact on accidents and fatalities. In fact, facilities with ETC-only lanes have much lower accident and fatality rates than do facilities that lack such lanes.

Some have also hypothesized that toll facilities are more dangerous than their nontolled counterparts because vehicles have to slow down and stop at them. In some situations, on the contrary, this appears to have a positive effect on accident and fatality rates. Indeed, our research shows that barrier systems at both mainline entrances and interchanges tend to reduce the number of accidents and fatalities. This underscores the potential benefits of forcing traffic to slow down or stop before merging with other traffic.

We will continue to maintain and update the IBTTA Data Warehouse, which has proven to be a valuable resource in illustrating the safety of U.S. toll facilities for all who use them.

Methodology

The data for this analysis come from IBTTA's Data Warehouse, which contains the most complete compilation of statistics available about the toll industry. Its information includes data gathered during IBTTA's 2006 Toll Information Survey, conducted from January through April 2006. During the survey, we collected data through online and printed surveys, telephone inquiries, and annual reports.

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