OSU STATISTICAL CONSULTING SERVICE
MEMORANDUM REPORT

To: **The Ohio State Highway Patrol**

From: **Christopher Holloman**

Subject: **Predictive Model Results for September 1, 2006**

Date: **August 23, 2006**

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1. Overview

Over the past several months, the Ohio State Highway Patrol (OSHP) and the Statistical Consulting Service (SCS) at The Ohio State University have worked together to produce a probabilistic model for forecasting the likely locations of fatal and injury crashes. The model that was developed predicts the likelihood of crashes on several Ohio metro roadways.

This report presents the model's forecasts for September 1, 2006, the Friday preceding the Labor Day holiday weekend. These results can be used to allocate troopers to different roadways throughout the day allowing OSHP to make the best use of available resources. The roadways covered in this report are:

- Cleveland Area: I-271, I-480, I-71, I-77, I-90, and I-490
- Cincinnati Area: I-275, I-75, I-71, and I-74
- Columbus Area: I-270
- Dayton Area: I-675
- Toledo Area: I-280 and I-475

2. Forecasts

Figure 1 shows the overall crash rates for fatal and injury crashes expected throughout the day. These are the crash rates across all the metro roads in the analysis. The black line in this figure shows the crash rates predicted by the model, and a smooth red curve has been superimposed to show the overall pattern. In addition, a smooth green line has been added to the plot showing the crash rates expected on an ordinary Friday in September, one not preceding a holiday weekend. Clearly, the biggest concern in planning for crash prevention will be to schedule officers during the afternoon rush hour. At this time, we observe a large spike in the crash rate that well exceeds the normal crash rate during the rush hour on ordinary Fridays. From this plot, it appears that crash rates during the middle of the day will be greater than usual also.

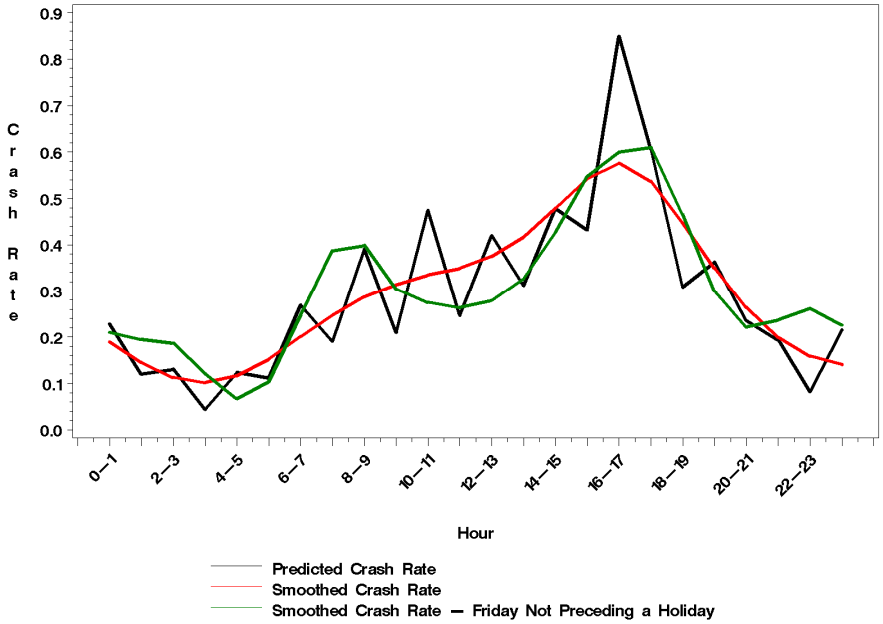

Figure 1. Overall Forecasted Fatal and Injury Crash Rates on September 1, 2006, by Hour.

While Figure 1 gives broad information on what times officers should be patrolling, it does not give much information on the types of crashes on which they should focus. By examining time-series plots of the crash rates for alcohol-related, speed-related, and commercial vehicle-related crashes, it is possible to determine which types of crashes are most likely during different hours of the day. Figure 2 through Figure 4 show the crash rates for these different groups.

Close examination of Figure 2 indicates that resources should be allocated toward preventing alcohol-related crashes during the early morning hours, during the lunch hour, between 5 and 6 PM, and after 11 PM. Comparing the red and green lines, it appears that that the crash rate for alcohol-related crashes will last longer into the morning hours on September 1st than it would on an ordinary Friday in September. Also, it appears that the increase in alcohol-related crashes that usually occurs on Friday evenings will be muted.

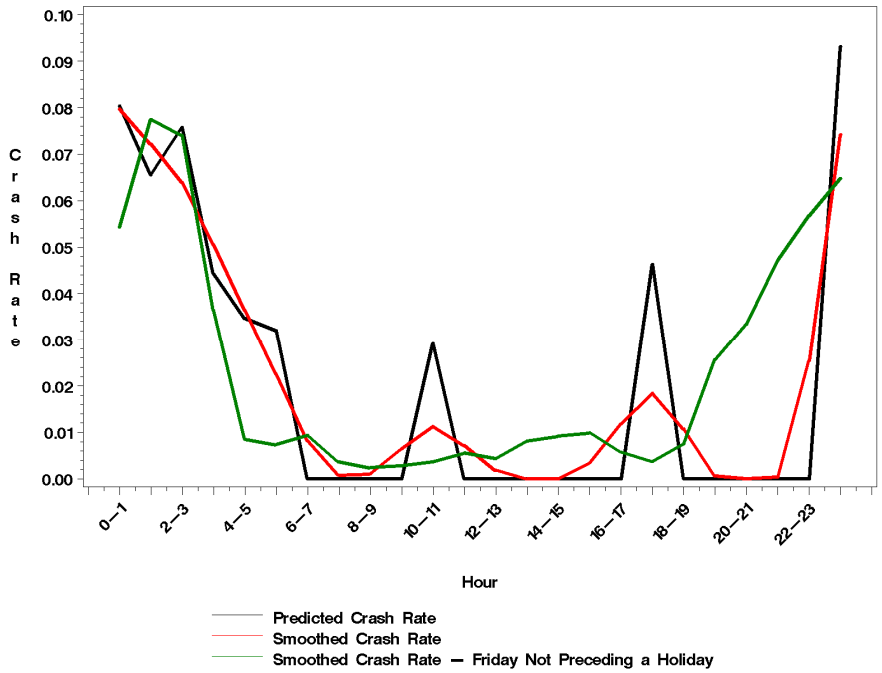

Figure 2. Forecasted Fatal and Injury Alcohol-related Crash Rates on September 1, 2006, by Hour.

Figure 3 suggests that resources for preventing speed-related crashes should be primarily allocated during two parts of the day. First, resources should be allocated to the early morning hours extending from 4AM through the morning rush hour. Second, resources should be allocated to the afternoon and evening hours with special focus on the 7 – 9 PM time range. Comparing speed-related crash rates to those on an ordinary Friday in September (green line), it appears that speed-related crashes occur at a much higher than normal rate during both of these periods.

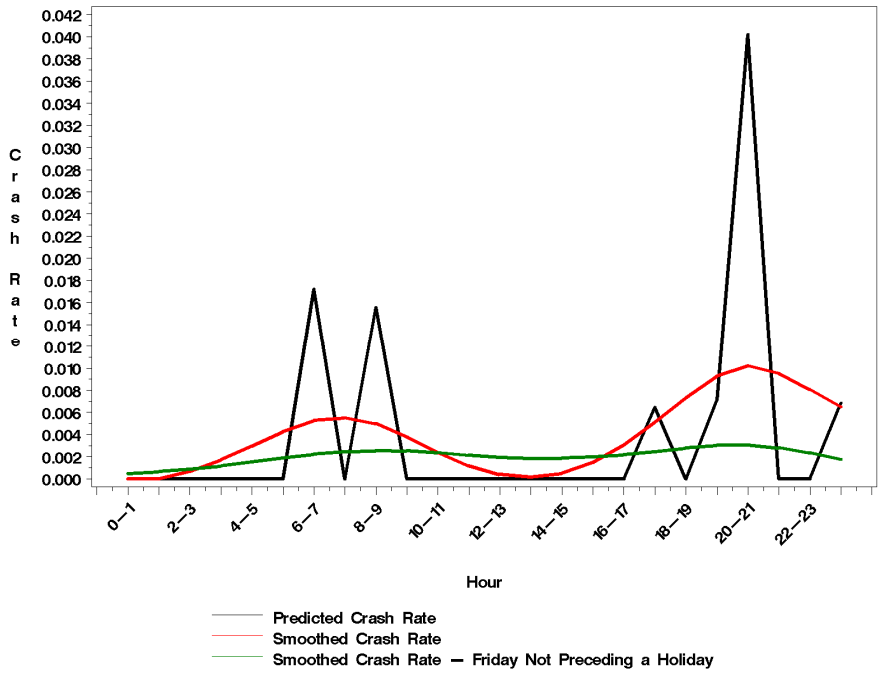

Figure 3. Forecasted Fatal and Injury Speed-related Crash Rates on September 1, 2006, by Hour.

Figure 4 suggests that commercial vehicle-related crashes are likely to occur early in the morning rush hour. Also, these types of crashes are likely to occur throughout the afternoon reaching a peak just before the evening rush hour and falling steadily from there.

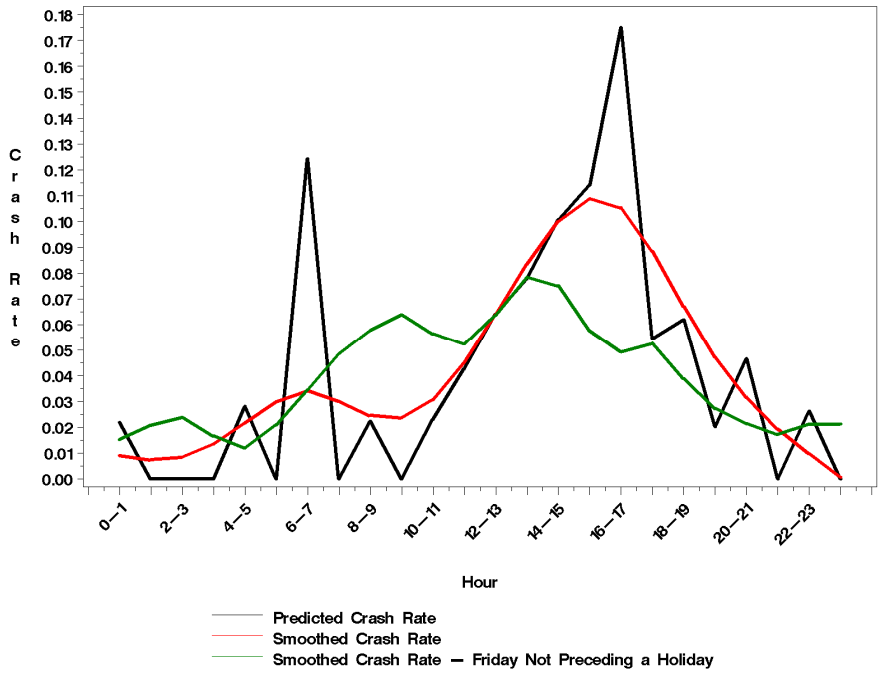

Figure 4. Forecasted Fatal and Injury Commerial Vehicle-related Crash on September 1, 2006, by Hour.

Examining these plots provides information about each of the types of crashes on its own, but it does not provide information on the relative rates at which these types of crashes will occur. Figure 5 presents the crash rates for alcohol-, speed-, and commercial vehicle-related crashes together. From this plot, it is clear that commercial vehicle-related crashes dominate the morning and afternoon rush hours as well as most of the afternoon hours. Alcohol-related crashes dominate the early morning hours. Speed-related crashes are never the highest rate, but they are more frequent than alcohol-related crashes during the morning rush-hour and the early afternoon.

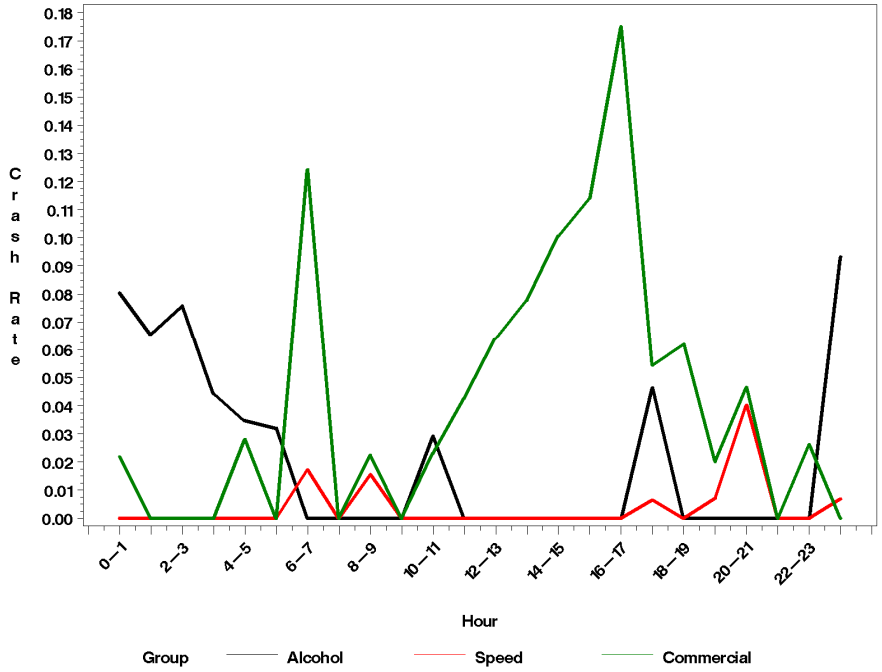

Figure 5. Overlay of Forecasted Alcohol-, Speed-, and Commercial Vehicle-related Crash Rates.

Having determined the best allocation of resources throughout the day, the next question to answer is where those resources should be allocated. The following series of figures shows different levels of danger for the categories broken out in the time-series plots above. Those roadways that fell in the top 20% of crash rates are shaded in red in the figures, those in the next 40% are shaded in yellow, and those in the lowest 40% are shaded in green. The figures are presented separately for the five metro areas in our analysis. In each case, a map is shown for alcohol-, speed-, and commercial vehicle-related crashes.

2.1. Cincinnati

The following figures show the levels of danger for three different types of crashes on roadways in Cincinnati on September 1, 2006. The county borders are shown in black to provide additional geographic information. Interstate, state, and U.S. roadways that were not included in the modeling are drawn on the map in light gray.

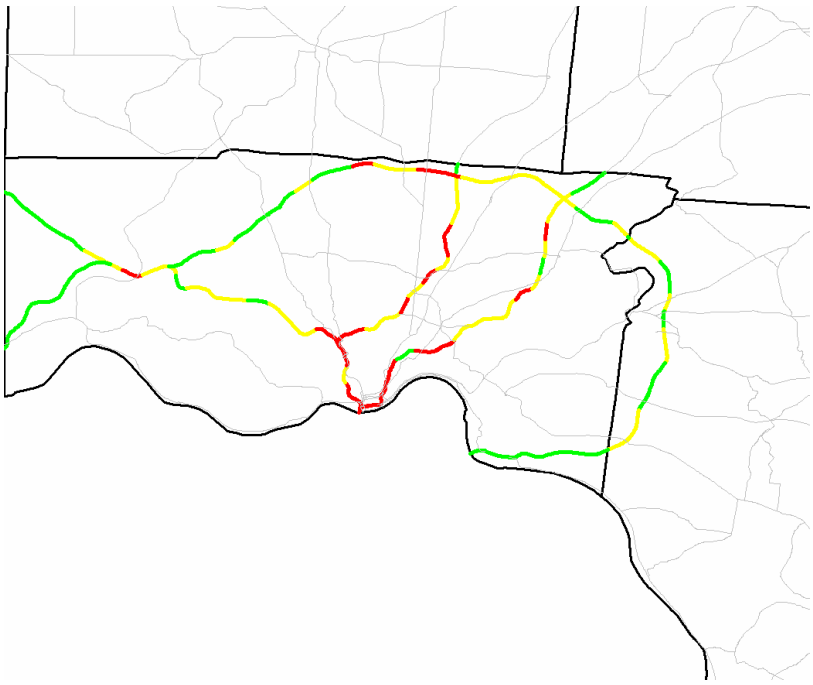

Figure 6. Forecasted Fatal and Injury Alcohol-related Crash Rates for Cincinnati on September 1, 2006.

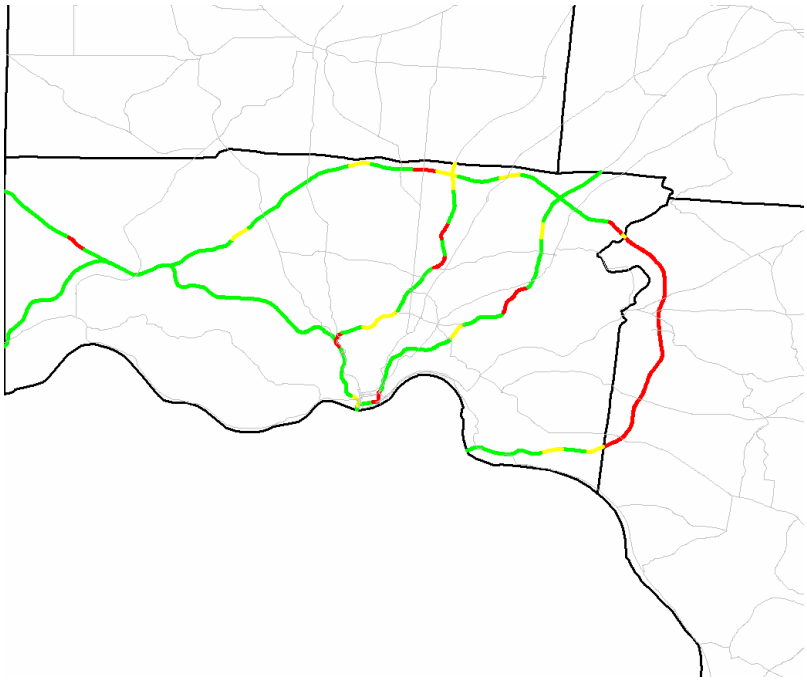

Figure 7. Forecasted Fatal and Injury Speed-related Crash Rates for Cincinnati on September 1, 2006.

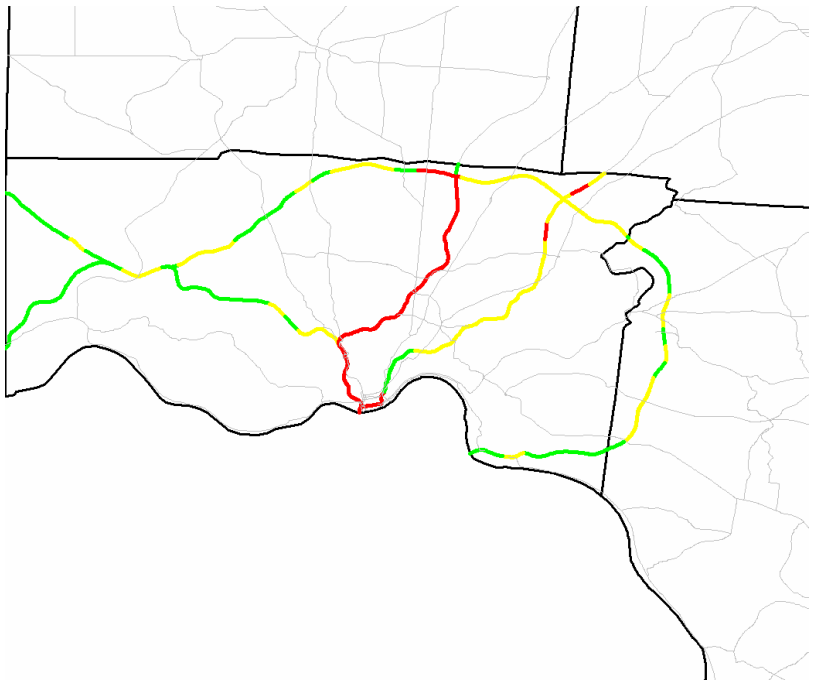

Figure 8. Forecasted Fatal and Injury Commercial Vehicle-related Crash Rates for Cincinnati on September 1, 2006.

2.2. Cleveland

The following figures show the levels of danger for three different types of crashes on roadways in Cleveland on September 1, 2006.

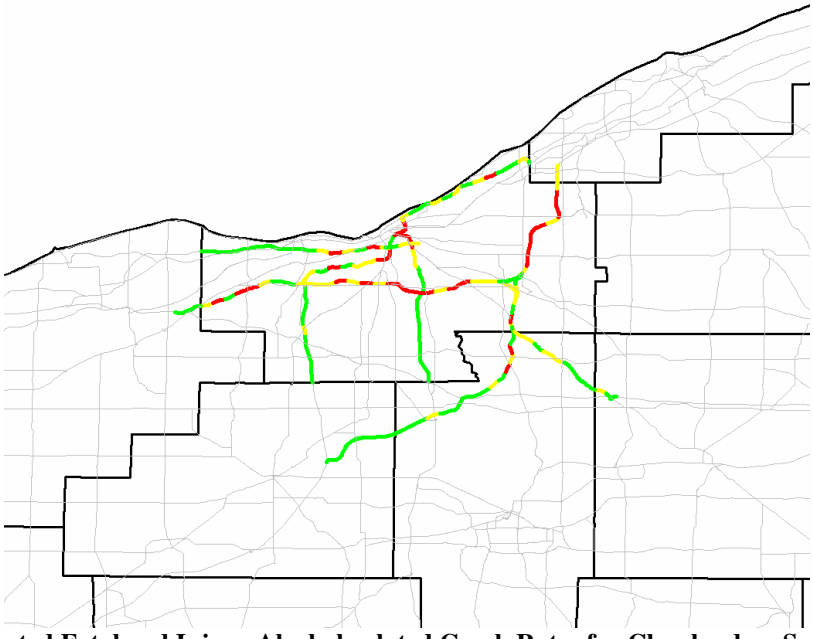

Figure 9. Forecasted Fatal and Injury Alcohol-related Crash Rates for Cleveland on September 1, 2006.

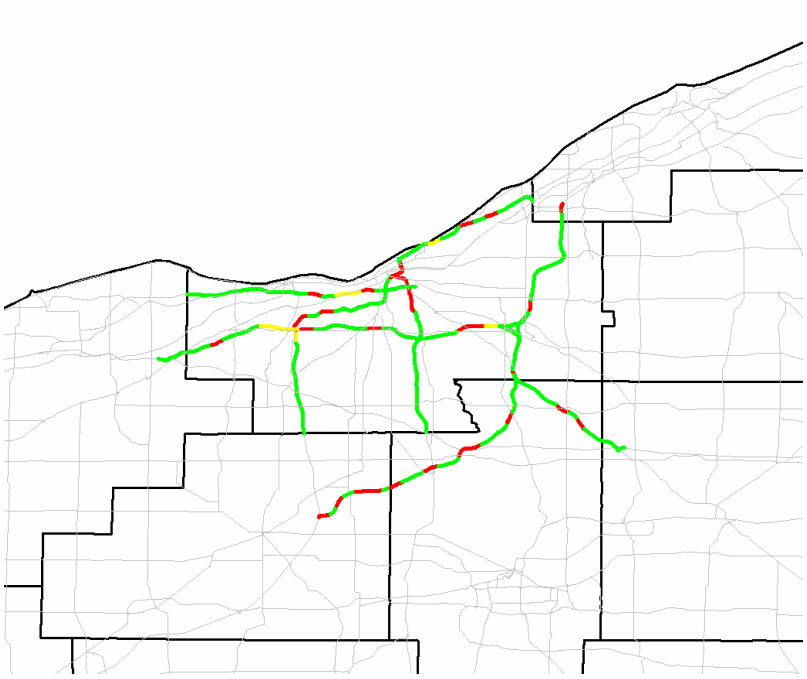

Figure 10. Forecasted Fatal and Injury Speed-related Crash Rates for Cleveland on September 1, 2006.

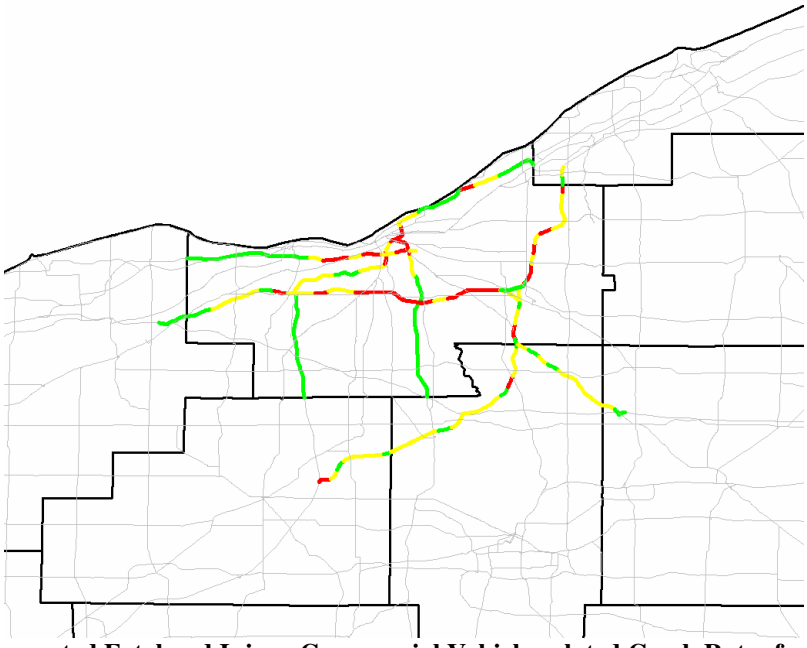

Figure 11. Forecasted Fatal and Injury Commercial Vehicle-related Crash Rates for Cleveland on September 1, 2006.

2.3. Columbus

The following figures show the levels of danger for three different types of crashes on roadways in Columbus on September 1, 2006.

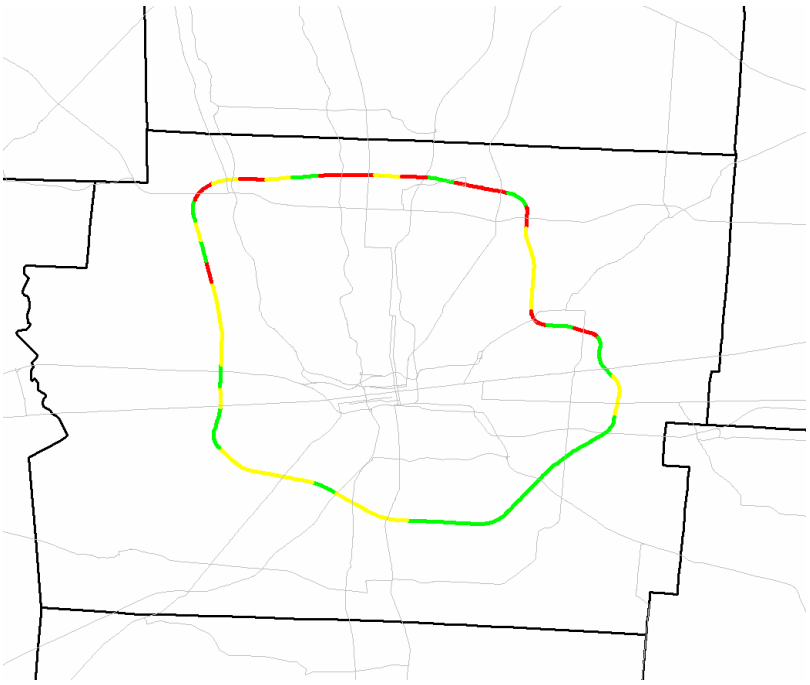

Figure 12. Forecasted Fatal and Injury Alcohol-related Crash Rates for Columbus on September 1, 2006.

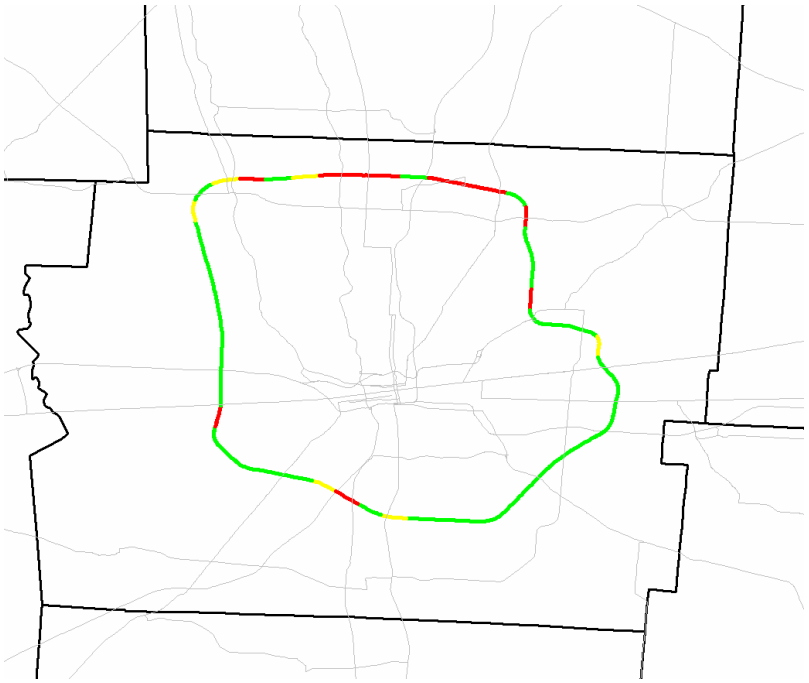

Figure 13. Forecasted Fatal and Injury Speed-related Crash Rates for Columbus on September 1, 2006.

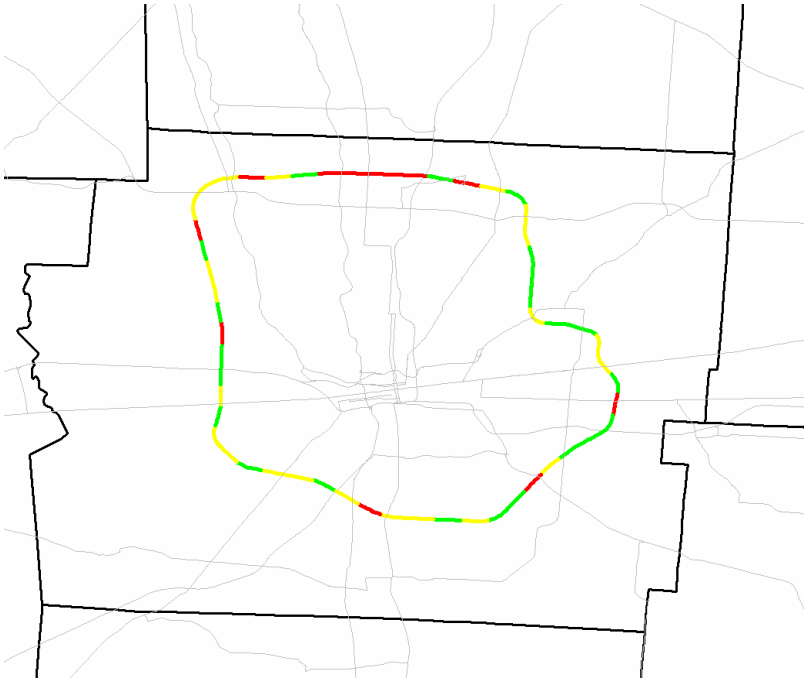

Figure 14. Forecasted Fatal and Injury Commercial Vehicle-related Crash Rates for Columbus on September 1, 2006.

2.4. Dayton

The following figures show the levels of danger for three different types of crashes on roadways in Dayton on September 1, 2006.

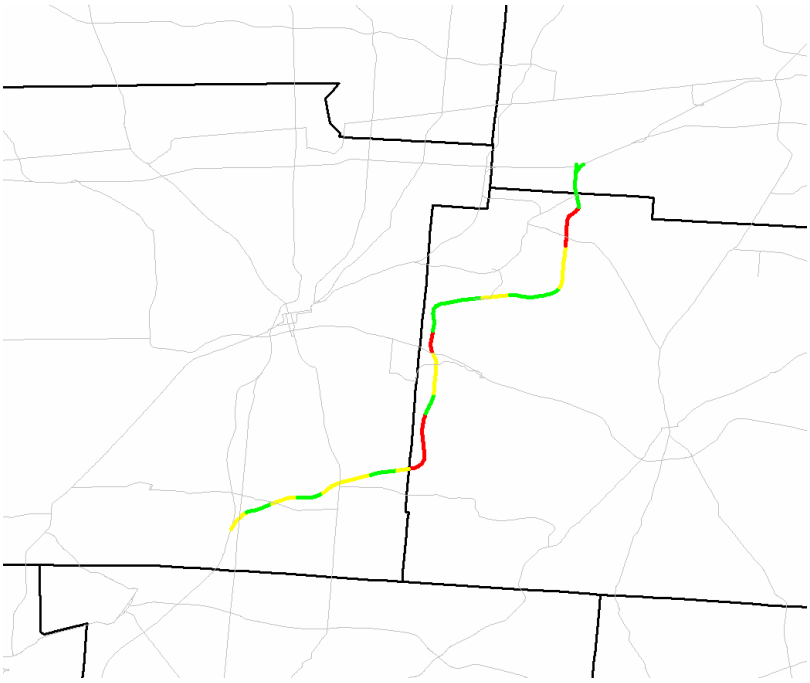

Figure 15. Forecasted Fatal and Injury Alcohol-related Crash Rates for Dayton on September 1, 2006.

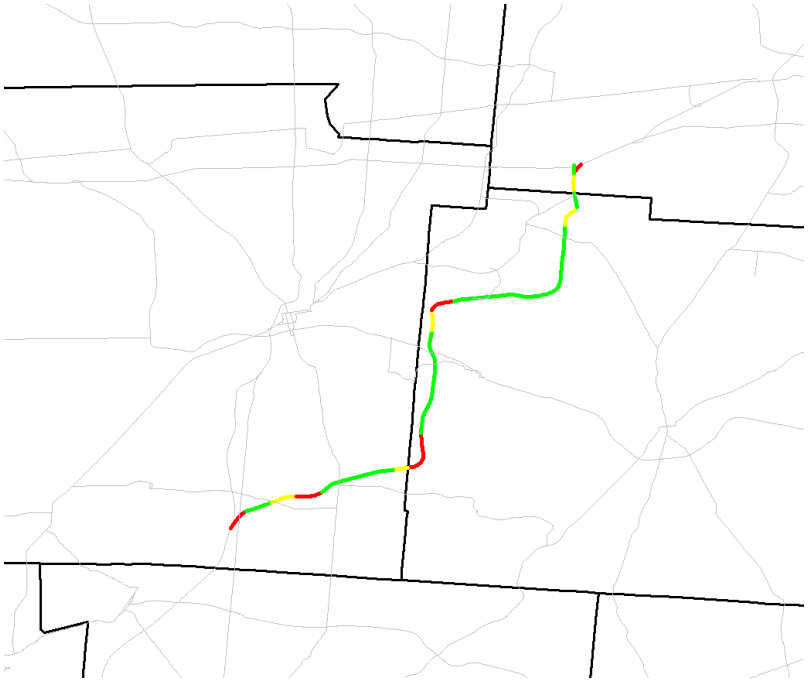

Figure 16. Forecasted Fatal and Injury Speed-related Crash Rates for Dayton on September 1, 2006.

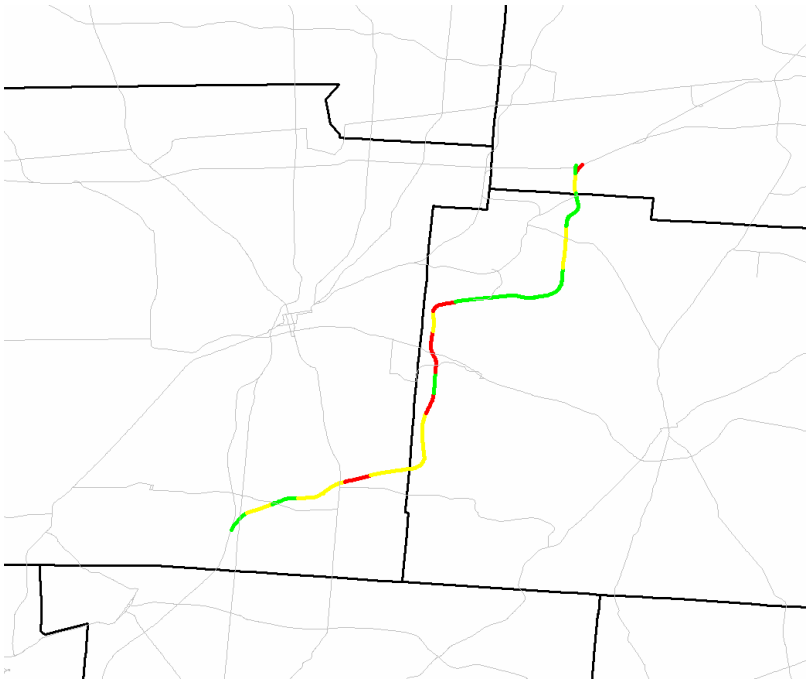

Figure 17. Forecasted Fatal and Injury Commercial Vehicle-related Crash Rates for Dayton on September 1, 2006.

2.5. Toledo

The following figures show the levels of danger for three different types of crashes on roadways in Toledo on September 1, 2006.

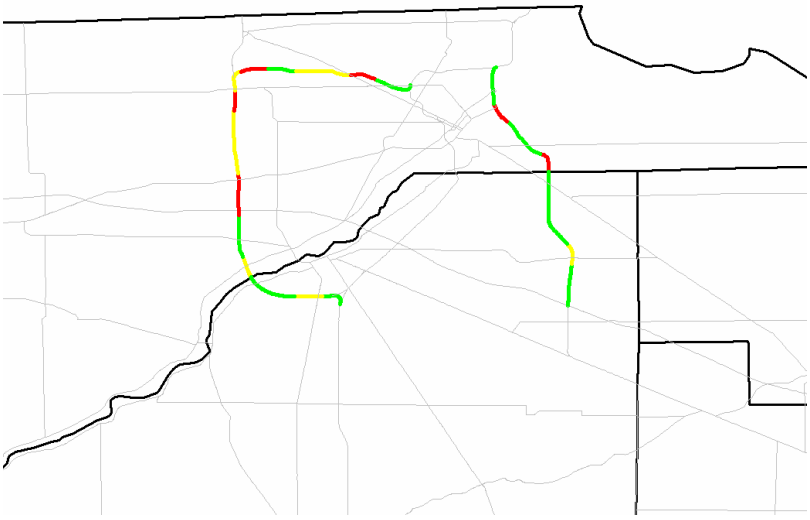

Figure 18. Forecasted Fatal and Injury Alcohol-related Crash Rates for Toledo on September 1, 2006.

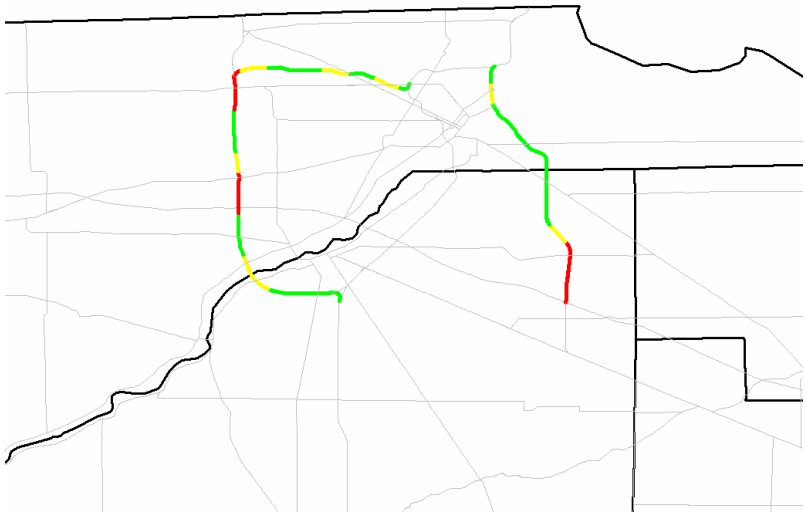

Figure 19. Forecasted Fatal and Injury Speed-related Crash Rates for Toledo on September 1, 2006.

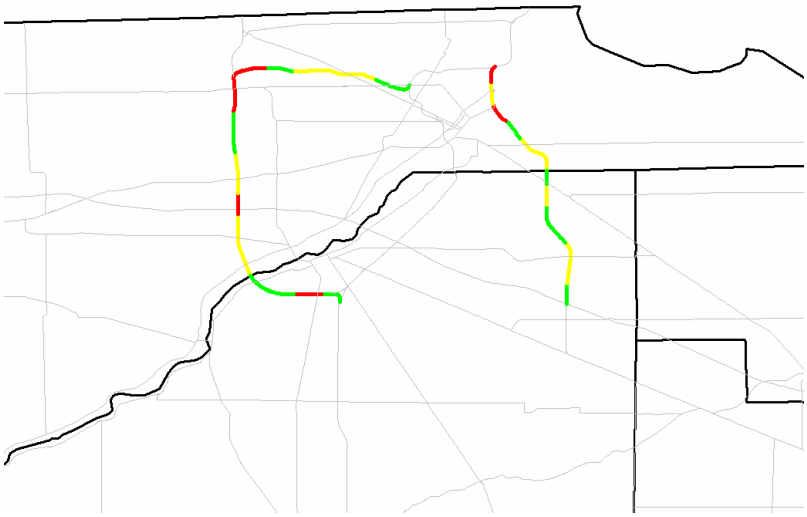

Figure 20. Forecasted Fatal and Injury Commercial Vehicle-related Crash Rates for Toledo on September 1, 2006.