# INTRODUCTION

Between 1996 and 1998, North Carolina rose to *fourth* in the nation in the number of fatal crashes involving large trucks. In an effort to better understand the nature of the problem, the North Carolina Governor's Highway Safety Program (GHSP) requested that the UNC Highway Safety Research Center (HSRC) conduct a comprehensive analysis of available state and federal crash data. The chief source of federal crash data was the Fatal Analysis System (FARS) which is maintained by the National Highway Traffic Safety Administration (NHTSA). The principle source of state data was that maintained by the North Carolina Division of Motor Vehicles (NCDMV). FARS provides information only on fatal crashes, while the NCDMV crash data provide information on all crashes irrespective of their severity.

The purpose of the GHSP analysis was twofold: (1) to define more specifically the parameters of the truck safety problem in North Carolina as a basis for subsequent countermeasure development efforts, and (2) to provide an ongoing 'yardstick' against which such programs might be evaluated on an ongoing basis. While FARS, in essence, provides a national level yardstick, its fatal-only focus and the fact that its availability is so delayed make it unsuitable for the development, management, and evaluation of day-to-day crash reduction activities at the state level.

A parallel effort funded by North Carolina's Motor Carrier Safety Assistance Program (MCSAP) and carried out by the Commercial Vehicle Enforcement Section of the NCDMV addressed the use of these same data for the purpose of documenting the impact of commercial vehicle 'enforcement' programs on truck safety. HSRC support of the MCSAP has, in large part, been in the context of the development and evaluation of North Carolina's Commercial Vehicle Safety Plan (CVSP). The goals, objectives, and strategies documented in the state's CVSP comprise the basis for the MCSAP funding provided each year by the Federal Motor Carrier Safety Administration (FMCSA).

In addition to the GHSP and MCSAP problem definition and program evaluation efforts, the North Carolina Department of Transportation in 1998 established a truck safety task force in an effort to solicit broad-based input to the development of truck safety legislation in the state. These efforts were responsible for the passage of the truck safety provisions of House Bill 303.

Since 1998, the results of the HSRC analysis work (both for GHSP and MCSAP) have been made available on the Internet on HSRC's web site: www.hsrc.unc.edu under the headings of http://www.hsrc.unc.edu/research/human_driver.htm and http://www.hsrc.unc.edu/research/human_truck.htm . A list of material available on the web is found in Appendix D. The present document provides an update to the previous GHSP analysis which covered the period 1993-1997. The current results are for the period 1995-1999.

The reader is encouraged to review the full range of analysis documents on the HSRC website; in particular, the enforcement-oriented results which document the effectiveness of a program of increased enforcement activity in specifically targeted high crash counties. As a result of these stepped up enforcement activities, North Carolina has been

successful in moving from fourth to eighth in the nation (according to the CY1999 FARS results)

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**Specific Focus on Heavy Trucks**

It is important to point our at the outset that while the CMV Enforcement Section of the NCDMV is responsible for all commercial motor vehicles (CMVs), the truck safety focus of FARS (and in turn NHTSA's 'Top Ten' list) is on 'heavy trucks.' The manner in which 'heavy trucks' are defined in state and federal crash data bases is problematic from the standpoint of permitting one to arrive at identical crash frequencies. The criteria used to define 'heavy truck' in either the FARS or NCDMV data bases are shown below.

Here is the Boolean expression used to indicate that a vehicle is a Large Truck. Any FARS vehicle that is a Large Truck then allows that crash to be counted in the FARS Large Truck total.

SAS selection statements applied to FARS data set:

if (60 <= body_typ <= 64) or body_typ=66 or (71 <= body_typ <= 72) or body_typ=78 or (body_typ=79 and (1 <= tow_veh <= 4)) then lrgtrk=1 ; *large; else lrgtrk=0 ;

Similarly, for the NCDMV data set, any vehicle type indicated as a 3 axle truck, 4 axle truck, or a truck tractor and trailer would then allow that crash to be counted in the NC Heavy Truck total.

SAS selection statement:

if vehtype in(8,9,24)

To the extent that tractor trailers comprise the majority of heavy truck crashes (by either definition), North Carolina is content that its selective focus on these vehicle types is effective in addressing the heart of the problem. It must be pointed out, however, that heavy trucks represent only a subset of all commercial motor vehicles (CMV).

The HSRC analyses have also made use of data from the Motor Carrier Management Information System (MCMIS). . . data which are essentially compiled through FMCSA's maintenance of SAFETYNET. While these data (at least in North Carolina) have until CY2000 constituted an 'underestimate' of commercial vehicle crashes in the state (due to a 'dual track' reporting system), they nevertheless provide an empirical basis for addressing the role of carrier factors in crash causation. In the case of analyses conducted by HSRC for DMV Enforcement, these data have been used to investigate the probable relationship between carrier size (number of power units) and crash risk (crashes per power unit).

## General Approach

While the purpose of the present discussion is to present the results of the analyses supported by the GHSP, reference will be made to the analysis of DMV enforcement efforts to the extent that the state's approach to CMV crash reduction cannot be understood solely in terms of the analysis work alone.

The results which follow address the use of data from both FARS and North Carolina's own vehicle crash data. FARS data are used mainly to quantify the magnitude of the problem and to provide a 'starting point,' if you will, for the subsequent analysis of the state data. Using the state data, information is provided on crash frequency and the frequency of fatal crashes for all 100 North Carolina counties.

Using a subset (1998 and 1999) of the 1995-1999 crash data, the present GHSP effort explored the use of Geographic Information Systems (GIS) technology for the visual representation of the spatial characteristics of the truck crash problem. The GIS portion of the effort was supported by the North Carolina Center for Geographic Information and Analysis (CGIA) and was based in part on prior NCDOT-funded work to develop a preliminary version of a spatially-referenced crash data system.

While financial support for the GIS portion of the work was from GHSP, the work itself was framed in the context of identifying the spatial attributes of crashes in relationship to the eight DMV enforcement districts in the state. GIS plots of the '98 and '99 fatal truck crash data are provided for each of the eight districts as well as for the 30 individual North Carolina counties comprising the 2000-2001 CVSP focus of DMV Enforcement. GHSP support of the GIS-based evaluation technology is continuing, with the current 2000-2001 focus largely on the evaluation of various GIS analysis 'tools' and their value for problem definition and geographically-targeted program development/evaluation.

GIS plots are provided of major crash 'corridors;' in particular the I40/I85 corridor, the I-95 corridor, the I-77 corridor, and the area within Buncombe and Haywood counties referred to as the 'Gorge.' The results of additional analysis work on crashes along the I-95 corridor are also provided.

CGIA's GIS capability was also utilized to address the relationship between fatal truck involved crashes and the location of trauma centers statewide. To the extent that heavy truck crashes often result in severe injuries to those involved, the proximity of trauma services to major crash sites is important. . . in terms of increasing the probability of survival associated with prompt emergency medical response.

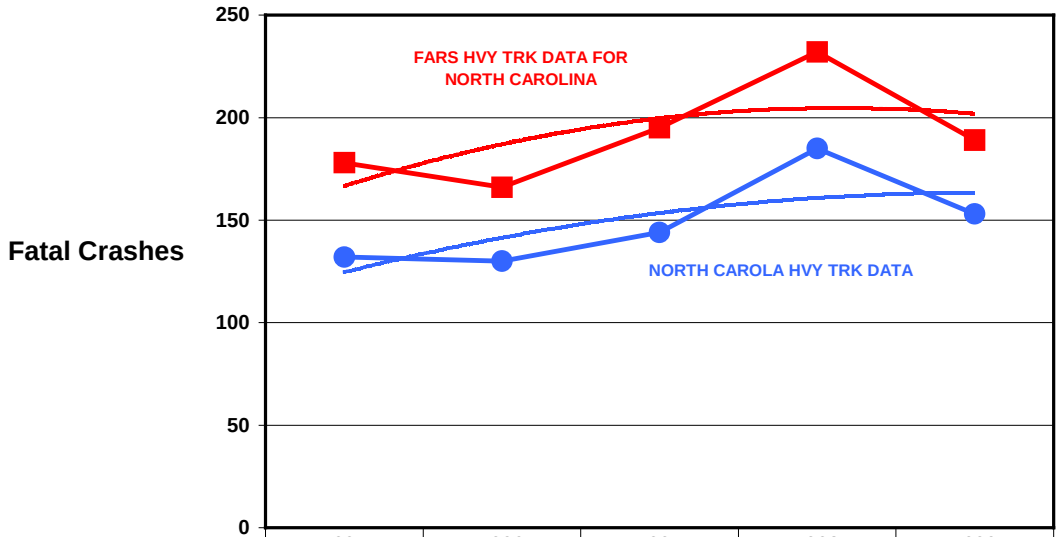
The follow-on GIS work will focus on the mile posting of CMV enforcement actions and on the use of GIS tools in enabling program development personnel to achieve a more effective spatial alignment of enforcement actions and problem locations. The CVSP focus of the HSRC work remains on the evaluation of countermeasure development and evaluation. For the results of this work, the reader is referred to the HSRC web site on the Internet.

We turn now to (a) the analyses of the FARS and North Carolina DMV crash data, (b) to their spatial representation in a GIS format, (c) to supplemental analyses on carrier related variables conducted using the FMCSA "A&I On-Line" data, and (c) to the general role of population and travel demand on crashes and the implied involvement of speed in the increased probability of fatal crashes.

## A Summary of Truck-Involved Crash Trends for the Period 1995-1999

Figure 1 shows a comparison of the number of heavy truck fatal crashes in North Carolina for the period 1995-1999. The two sources of data are the Fatal Analysis Reporting System (FARS) and the North Carolina DMV crash records system. The criteria for defining a heavy or large truck in terms of FARS are given in Appendix A. The criteria used by HSRC are based upon vehicle types 8, 9, and 24 as described in the NC data (essentially 3 and 4-axle trucks and tractor trailers). The comparison shows a consistently larger number of fatal crashes when using the FARS criteria. Trend lines have been computed (in MS Excel) for both sets of data. The data show that while the crash frequencies differ in magnitude, the year-to-year trends are indistinguishable.

**Figure 1**
**Comparison of NC and FARS 'Heavy Truck' Fatal Crash Counts for the period 1995-1999**



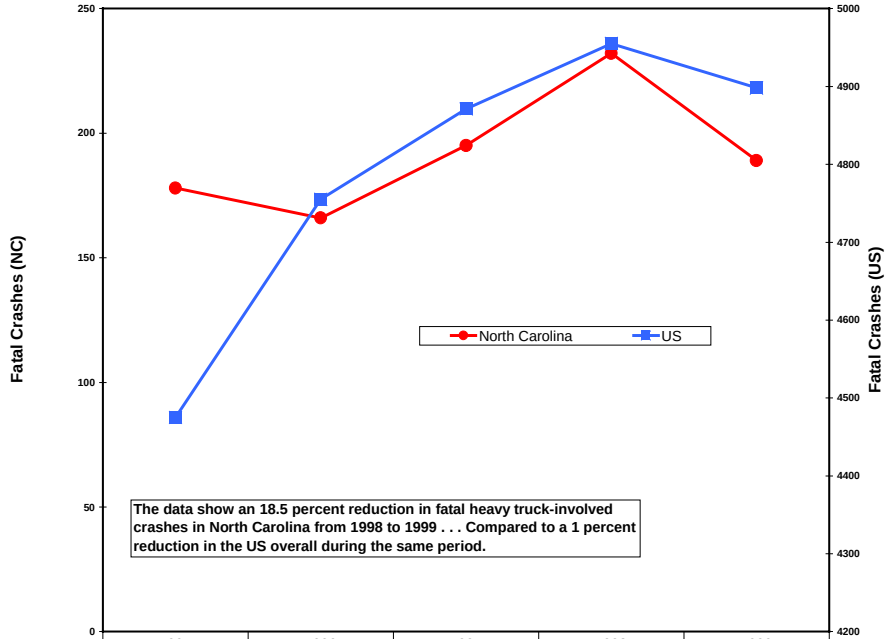

| | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|
| NC Hvy Tk Crash Data | 132 | 130 | 144 | 185 | 153 |
| FARS Hvy Tk Crash Data | 178 | 166 | 195 | 232 | 189 |

Figure 2 compares fatal crash trends between North Carolina and the US as a whole for this same time period. The North Carolina data do not show the sharp increase in fatal crashes seen nationwide from 1995 to 1996. Both the US and North Carolina show similar gains in fatal crashes between 1996 and 1998. Between 1998 and 1999, the data show that North Carolina experienced an 18.5 percent reduction in fatal truck involved crashes where the US experienced only a 1 percent reduction during this same time

period. These comparisons are based upon data from the Fatal Analysis Reporting System (FARS).

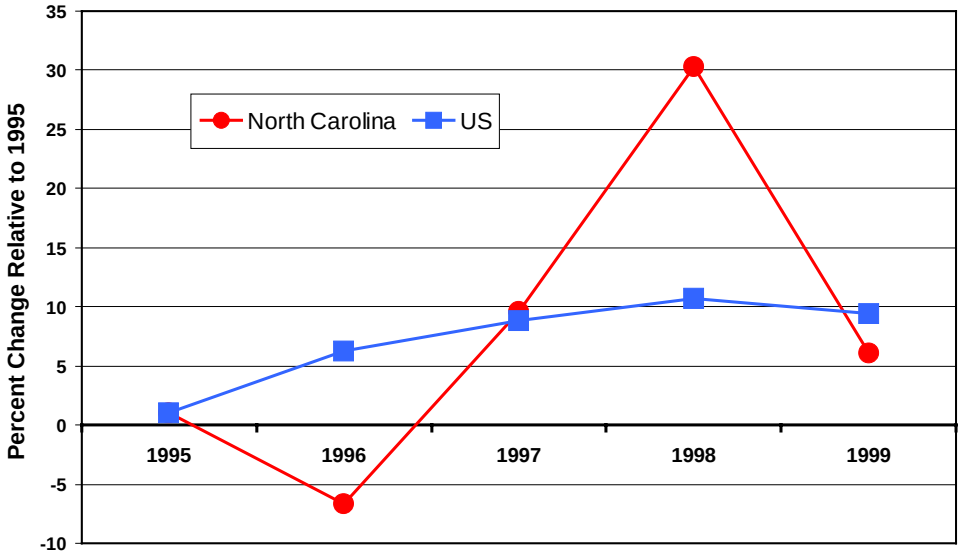
The magnitude of these differences is best seen when the state data and national data are expressed as a percentage of the 1995 level. Figure 3 shows that when viewed in this manner, the rate of increase fatal truck-involved crashes was significantly higher in North Carolina that the US between 1996 and 1998. But whereas the US showed little improvement in truck safety between 1998 and 1999, North Carolina made impressive gains in crash reduction. The magnitude of the gains made from 1998 to 1999 was sufficient to improve North Carolina's overall position nationally from 4th to 8th.

**Figure 2**
**A Comparison of Fatal Heavy Truck-Involved Crashes**
**in North Carolina and the US**
**for the Period 1995-1999**
**(Source: FARS)**




| | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|
| North Carolina | 178 | 166 | 195 | 232 | 189 |
| US | 4475 | 4755 | 4871 | 4955 | 4898 |

**Figure 3**
**Percent Change in the Number of Heavy Truck-Involved Fatal Crashes Relative to 1995: A Comparison of North Carolina and the US Overall 1995-1999**




**Month-of-the-Year, Day-of-the-Week, and Time-of-Day**

According to FARS, fatal truck-involved crashes in North Carolina showed little month-to-month variation with the exception of the months of September through November when the frequency of heavy truck fatal crashes was slightly elevated.

Figure 5 shows fatal crash frequencies for the period 1995-1999 by individual day-of-the-week. The data show a lower frequency of fatal truck-involved crashes on the weekend (most likely related to exposure). On the average, crash frequencies rise to their highest levels on Wednesdays and Thursdays.

Figure 6 shows the relative frequency of fatal truck-involved crashes in North Carolina as a function of the time-of-day. The data show peaks during the 6-9 am period, a consistent increase from 9 to noon, and another increase in crashes between 1 and 5 pm with the peak being in the neighborhood of 3pm.

**Figure 4**
**Average Percent of NC Fatal Heavy Truck-Involved Crashes as a Function of Month of the Year**
**Source: FARS 1995-1999**

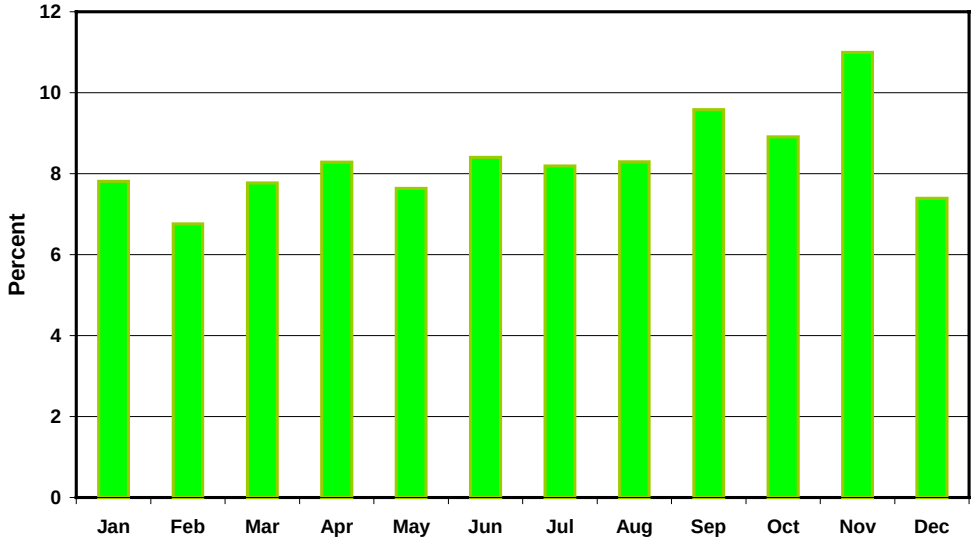
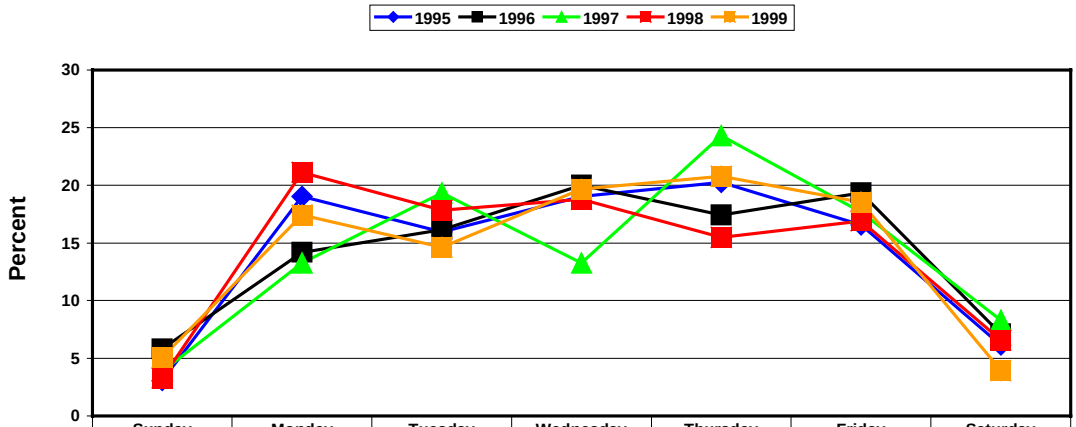
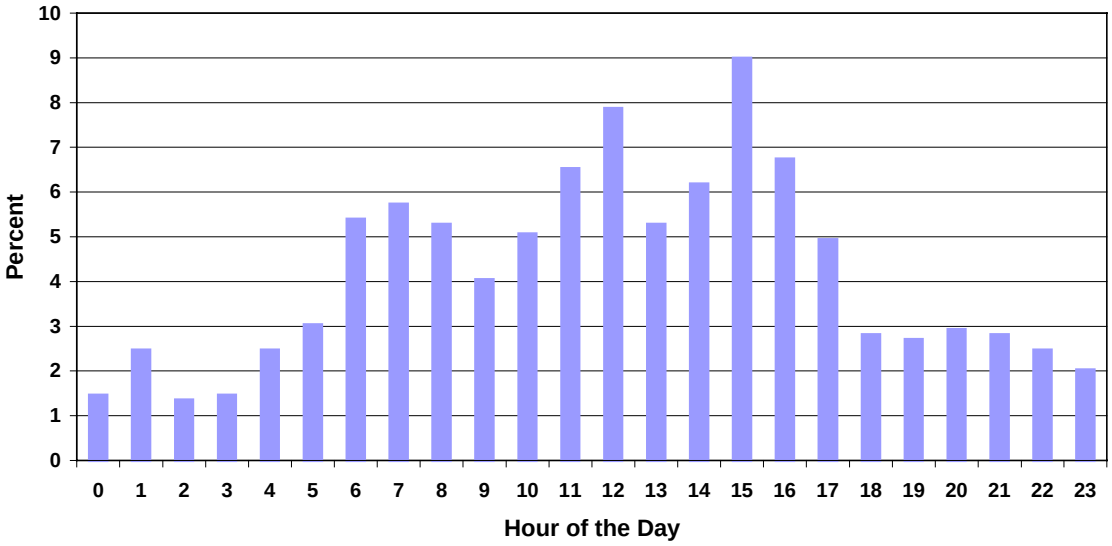



**Figure 5**
**Percent of Heavy Truck Fatal Crashes in North Carolina as a Function of Day of the Week**
**(Source: FARS 1995-1999)**




| | Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|---|
| 1995 | 3.07 | 19.02 | 15.95 | 19.02 | 20.25 | 16.56 | 6.13 |
| 1996 | 5.81 | 14.19 | 16.13 | 20 | 17.42 | 19.35 | 7.1 |
| 1997 | 3.87 | 13.26 | 19.34 | 13.26 | 24.31 | 17.68 | 8.29 |
| 1998 | 3.29 | 21.13 | 17.84 | 18.78 | 15.49 | 16.9 | 6.57 |
| 1999 | 5.06 | 17.42 | 14.61 | 19.66 | 20.79 | 18.54 | 3.93 |

**Figure 6**
**Average Percent Fatal Crashes Involving Large Trucks in North Carolina by Hour of the Day, 1995-1999**
**Source: FARS**




**Location, by Individual County and (DMV) Enforcement District**

Table 1 lists crash data by individual North Carolina county. Data are presented by year for the period 1995-1999 showing (a) total number of truck-involved crashes, (b) total number of fatal truck-involved crashes, and (c) the percent of truck-involved crashes that were fatal. The data are presented alphabetically by county. According to the table, there were a total of 41,025 truck-involved crashes, of which 744 involved a fatality. Overall, 1.82 percent of all truck-involved crashes during this period involved one or more fatalities each.

Table 2 presents an expanded picture of these data in terms of crash severity, this time arranged in terms of DMV enforcement districts (Districts 1-8), and by level of injury severity. (Refer to the bottom portion of Figure 7 for a graphic display of DMV Enforcement districts). The number of fatal crashes is plotted in Figure 7, by year, and by district. Districts 2, 3, and 5 were well) the average 17 percent statewide trend in crash reduction. Statewide crash severity totals are presented in Table 3. Table 4 presents these same data where the frequencies associated with each injury level are expressed as percentages of total truck-involved crashes. The reductions (1 each per year) in Districts 4, 6, and 8 are likely not significant. District 1 was the only district to show a marked (62 percent) increase in fatal crashes between 1998 and 1999 (from 13 to 21 crashes).

# Table 1

## Heavy Truck-Involved Crashes in North Carolina, by County

## Souce of Data: NCDMV Crash Data 1995-1999

| | 1995 | | | 1996 | | | 1997 | | | 1998 | | | 1999 | | | 5-Yr Overall | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| All Counties | Crashes | Fatals | % Fatal | Crashes | Fatals | % Fatal | Crashes | Fatals | % Fatal | Crashes | Fatals | % Fatal | Crashes | Fatals | % Fatal | Crashes | Fatals | Mean %Fatal |
| Alamance | 126 | 3 | 0.024 | 98 | 2 | 2.00% | 97 | 1 | 1.00% | 116 | 1 | 0.80% | 122 | 3 | 2.40% | 559 | 10 | 1.72% |
| Alexander | 19 | 0 | 0.00% | 12 | 0 | 0.00% | 21 | 1 | 4.76% | 15 | 0 | 0.00% | 16 | 1 | 6.25% | 83 | 2 | 2.20% |
| Alleghany | 9 | 0 | 0.00% | 12 | 1 | 8.33% | 7 | 1 | 14.29% | 8 | 0 | 0.00% | 8 | 0 | 0.00% | 44 | 2 | 4.52% |
| Anson | 46 | 1 | 2.17% | 38 | 1 | 2.63% | 52 | 1 | 1.92% | 46 | 1 | 2.17% | 57 | 2 | 3.51% | 239 | 6 | 2.48% |
| Ashe | 17 | 1 | 5.88% | 9 | 0 | 0.00% | 17 | 2 | 11.76% | 21 | 1 | 4.76% | 19 | 1 | 5.26% | 83 | 5 | 5.53% |
| Avery | 15 | 0 | 0.00% | 21 | 0 | 0.00% | 10 | 0 | 0.00% | 9 | 0 | 0.00% | 12 | 1 | 8.33% | 67 | 1 | 1.67% |
| Beaufort | 51 | 3 | 5.88% | 31 | 0 | 0.00% | 48 | 0 | 0.00% | 41 | 2 | 4.88% | 38 | 1 | 2.63% | 209 | 6 | 2.68% |
| Bertie | 38 | 0 | 0.00% | 25 | 2 | 8.00% | 40 | 0 | 0.00% | 29 | 2 | 6.90% | 32 | 2 | 6.25% | 164 | 6 | 4.23% |
| Bladen | 43 | 1 | 2.33% | 57 | 0 | 0.00% | 39 | 1 | 2.56% | 54 | 2 | 3.70% | 47 | 1 | 2.13% | 240 | 5 | 2.14% |
| Brunswick | 39 | 1 | 2.56% | 49 | 3 | 6.12% | 52 | 2 | 3.85% | 44 | 2 | 4.55% | 49 | 2 | 4.08% | 233 | 10 | 4.23% |
| Buncombe | 176 | 0 | 0.00% | 183 | 1 | 0.55% | 205 | 1 | 0.49% | 167 | 2 | 1.20% | 184 | 2 | 1.09% | 915 | 6 | 0.66% |
| Burke | 84 | 1 | 1.19% | 93 | 2 | 2.15% | 90 | 4 | 4.44% | 86 | 2 | 2.33% | 129 | 4 | 3.10% | 482 | 13 | 2.64% |
| Cabarrus | 128 | 1 | 0.78% | 119 | 2 | 1.68% | 141 | 2 | 1.42% | 151 | 1 | 0.66% | 159 | 0 | 0.00% | 698 | 6 | 0.91% |
| Caldwell | 64 | 1 | 1.56% | 59 | 2 | 3.39% | 56 | 1 | 1.79% | 54 | 1 | 1.85% | 59 | 1 | 1.69% | 292 | 6 | 2.06% |
| Camden | 7 | 0 | 0.00% | 5 | 0 | 0.00% | 4 | 0 | 0.00% | 6 | 0 | 0.00% | 5 | 0 | 0.00% | 27 | 0 | 0.00% |
| Carteret | 19 | 1 | 5.26% | 22 | 1 | 4.55% | 24 | 0 | 0.00% | 29 | 1 | 3.45% | 27 | 0 | 0.00% | 121 | 3 | 2.65% |
| Caswell | 19 | 0 | 0.00% | 16 | 0 | 0.00% | 8 | 0 | 0.00% | 12 | 1 | 8.33% | 17 | 0 | 0.00% | 72 | 1 | 1.67% |
| Catawba | 178 | 4 | 2.25% | 175 | 4 | 2.29% | 175 | 0 | 0.00% | 179 | 3 | 1.68% | 141 | 0 | 0.00% | 848 | 11 | 1.24% |
| Chatham | 67 | 2 | 2.99% | 63 | 3 | 4.76% | 63 | 2 | 3.17% | 75 | 3 | 4.00% | 66 | 5 | 7.58% | 334 | 15 | 4.50% |
| Cherokee | 12 | 0 | 0.00% | 11 | 0 | 0.00% | 15 | 0 | 0.00% | 10 | 0 | 0.00% | 6 | 0 | 0.00% | 54 | 0 | 0.00% |
| Chowan | 17 | 1 | 5.88% | 5 | 0 | 0.00% | 12 | 1 | 8.33% | 15 | 0 | 0.00% | 10 | 1 | 10.00% | 59 | 3 | 4.84% |
| Clay | 6 | 0 | 0.00% | 3 | 0 | 0.00% | 5 | 0 | 0.00% | 5 | 0 | 0.00% | 5 | 0 | 0.00% | 24 | 0 | 0.00% |
| Cleveland | 99 | 2 | 2.02% | 94 | 1 | 1.06% | 98 | 4 | 4.08% | 97 | 3 | 3.09% | 94 | 1 | 1.06% | 482 | 11 | 2.26% |
| Columbus | 60 | 3 | 5.00% | 57 | 1 | 1.75% | 52 | 2 | 3.85% | 69 | 5 | 7.25% | 71 | 3 | 4.23% | 309 | 14 | 4.41% |
| Craven | 68 | 4 | 5.88% | 58 | 1 | 1.72% | 70 | 1 | 1.43% | 67 | 2 | 2.99% | 76 | 1 | 1.32% | 339 | 9 | 2.67% |
| Cumberland | 210 | 5 | 2.38% | 205 | 4 | 1.95% | 154 | 4 | 2.60% | 189 | 1 | 0.53% | 195 | 7 | 3.59% | 953 | 21 | 2.21% |
| Currituck | 12 | 0 | 0.00% | 12 | 0 | 0.00% | 10 | 1 | 10.00% | 13 | 0 | 0.00% | 9 | 0 | 0.00% | 56 | 1 | 2.00% |
| Dare | 5 | 0 | 0.00% | 16 | 0 | 0.00% | 12 | 0 | 0.00% | 19 | 0 | 0.00% | 20 | 0 | 0.00% | 72 | 0 | 0.00% |
| Davidson | 110 | 2 | 1.82% | 127 | 2 | 1.57% | 117 | 1 | 0.85% | 124 | 5 | 4.03% | 132 | 3 | 2.27% | 610 | 13 | 2.11% |
| Davie | 34 | 1 | 2.94% | 43 | 1 | 2.33% | 35 | 1 | 2.86% | 37 | 2 | 5.41% | 46 | 0 | 0.00% | 195 | 5 | 2.71% |
| Duplin | 82 | 2 | 2.44% | 84 | 2 | 2.38% | 83 | 2 | 2.41% | 84 | 3 | 3.57% | 93 | 3 | 3.23% | 426 | 12 | 2.81% |
| Durham | 198 | 2 | 1.01% | 206 | 3 | 1.46% | 224 | 5 | 2.23% | 217 | 4 | 1.84% | 195 | 1 | 0.51% | 1040 | 15 | 1.41% |
| Edgecombe | 54 | 0 | 0.00% | 58 | 2 | 3.45% | 53 | 1 | 1.89% | 36 | 0 | 0.00% | 44 | 1 | 2.27% | 245 | 4 | 1.52% |
| Forsythe | 275 | 3 | 1.09% | 255 | 1 | 0.39% | 276 | 1 | 0.36% | 256 | 4 | 1.56% | 258 | 4 | 1.55% | 1320 | 13 | 0.99% |
| Franklin | 21 | 1 | 4.76% | 44 | 0 | 0.00% | 35 | 0 | 0.00% | 39 | 1 | 2.56% | 30 | 2 | 6.67% | 169 | 4 | 2.80% |
| Gaston | 243 | 4 | 1.65% | 196 | 0 | 0.00% | 187 | 1 | 0.53% | 234 | 2 | 0.85% | 239 | 1 | 0.42% | 1099 | 8 | 0.69% |
| Gates | 19 | 0 | 0.00% | 20 | 0 | 0.00% | 15 | 2 | 13.33% | 10 | 0 | 0.00% | 16 | 0 | 0.00% | 80 | 2 | 2.67% |
| Graham | 3 | 0 | 0.00% | 6 | 0 | 0.00% | 6 | 1 | 16.67% | 2 | 0 | 0.00% | 2 | 0 | 0.00% | 19 | 1 | 3.33% |
| Granville | 43 | 1 | 2.33% | 70 | 2 | 2.86% | 54 | 1 | 1.85% | 72 | 4 | 5.56% | 65 | 3 | 4.62% | 304 | 11 | 3.44% |
| Greene | 14 | 0 | 0.00% | 25 | 0 | 0.00% | 23 | 0 | 0.00% | 27 | 0 | 0.00% | 16 | 0 | 0.00% | 105 | 0 | 0.00% |
| Guilford | 623 | 3 | 0.48% | 574 | 4 | 0.70% | 541 | 7 | 1.29% | 566 | 6 | 1.06% | 628 | 10 | 1.59% | 2932 | 30 | 1.02% |
| Halifax | 60 | 3 | 5.00% | 107 | 2 | 1.87% | 88 | 0 | 0.00% | 83 | 2 | 2.41% | 63 | 1 | 1.59% | 401 | 8 | 2.17% |
| Harnett | 83 | 1 | 1.20% | 85 | 2 | 2.35% | 84 | 2 | 2.38% | 84 | 1 | 1.19% | 61 | 2 | 3.28% | 397 | 8 | 2.08% |
| Haywood | 111 | 0 | 0.00% | 190 | 2 | 1.05% | 85 | 0 | 0.00% | 84 | 4 | 4.76% | 102 | 0 | 0.00% | 572 | 6 | 1.16% |
| Henderson | 75 | 1 | 1.33% | 52 | 0 | 0.00% | 62 | 0 | 0.00% | 55 | 0 | 0.00% | 70 | 5 | 7.14% | 314 | 6 | 1.70% |
| Hertford | 21 | 2 | 9.52% | 21 | 1 | 4.76% | 17 | 0 | 0.00% | 19 | 2 | 10.53% | 22 | 1 | 4.55% | 100 | 6 | 5.87% |
| Hoke | 22 | 0 | 0.00% | 20 | 0 | 0.00% | 17 | 1 | 5.88% | 16 | 0 | 0.00% | 15 | 0 | 0.00% | 90 | 1 | 1.18% |
| Hyde | 3 | 0 | 0.00% | 1 | 0 | 0.00% | 4 | | 0.00% | 3 | 0 | 0.00% | 6 | 0 | 0.00% | 17 | 0 | 0.00% |

# Table 1

## Heavy Truck-Involved Crashes in North Carolina, by County

## Souce of Data: NCDMV Crash Data 1995-1999

| | 1995 | | | 1996 | | | 1997 | | | 1998 | | | 1999 | | | 5-Yr Overall | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| All Counties | Crashes | Fatals | % Fatal | Crashes | Fatals | % Fatal | Crashes | Fatals | % Fatal | Crashes | Fatals | % Fatal | Crashes | Fatals | % Fatal | Crashes | Fatals | lean %Fat |
| Iredell | 146 | 1 | 0.68% | 189 | 2 | 1.06% | 160 | 4 | 2.50% | 203 | 5 | 2.46% | 185 | 1 | 0.54% | 883 | 13 | 1.45% |
| Jackson | 19 | 1 | 5.26% | 16 | 0 | 0.00% | 30 | 0 | 0.00% | 37 | 2 | 5.41% | 31 | 0 | 0.00% | 133 | 3 | 2.13% |
| Johnston | 160 | 10 | 6.25% | 183 | 2 | 1.09% | 159 | 5 | 3.14% | 168 | 8 | 4.76% | 178 | 5 | 2.81% | 848 | 30 | 3.61% |
| Jones | 13 | 0 | 0.00% | 10 | 1 | 10.00% | 13 | 0 | 0.00% | 12 | 1 | 8.33% | 13 | 0 | 0.00% | 61 | 2 | 3.67% |
| Lee | 43 | 0 | 0.00% | 57 | 2 | 3.51% | 61 | 1 | 1.64% | 56 | 4 | 7.14% | 71 | 1 | 1.41% | 288 | 8 | 2.74% |
| Lenoir | 64 | 0 | 0.00% | 62 | 1 | 1.61% | 62 | 3 | 4.84% | 62 | 1 | 1.61% | 69 | 3 | 4.35% | 319 | 8 | 2.48% |
| Lincoln | 48 | 1 | 2.08% | 42 | 3 | 7.14% | 38 | 0 | 0.00% | 34 | 4 | 11.76% | 43 | 1 | 2.33% | 205 | 9 | 4.66% |
| Macon | 21 | 1 | 4.76% | 18 | 0 | 0.00% | 17 | 2 | 11.76% | 21 | 2 | 9.52% | 26 | 1 | 3.85% | 103 | 6 | 5.98% |
| Madison | 20 | 0 | 0.00% | 26 | 1 | 3.85% | 60 | 3 | 5.00% | 18 | 0 | 0.00% | 21 | 1 | 4.76% | 145 | 5 | 2.72% |
| Martin | 52 | 1 | 1.92% | 52 | 3 | 5.77% | 51 | 1 | 1.96% | 44 | 1 | 2.27% | 26 | 1 | 3.85% | 225 | 7 | 3.15% |
| McDowell | 64 | 2 | 3.13% | 91 | 3 | 3.30% | 73 | 1 | 1.37% | 75 | 3 | 4.00% | 96 | 0 | 0.00% | 399 | 9 | 2.36% |
| Mecklenburg | 1132 | 4 | 0.35% | 953 | 4 | 0.42% | 967 | 5 | 0.52% | 979 | 4 | 0.41% | 995 | 5 | 0.50% | 5026 | 22 | 0.44% |
| Mitchell | 10 | 0 | 0.00% | 12 | 0 | 0.00% | 11 | 1 | 9.09% | 2 | 0 | 0.00% | 4 | 0 | 0.00% | 39 | 1 | 1.82% |
| Montgomery | 23 | 1 | 4.35% | 25 | 0 | 0.00% | 28 | 1 | 3.57% | 33 | 1 | 3.03% | 33 | 1 | 3.03% | 142 | 4 | 2.80% |
| Moore | 68 | 1 | 1.47% | 64 | 0 | 0.00% | 58 | 1 | 1.72% | 60 | 1 | 1.67% | 58 | 3 | 5.17% | 308 | 6 | 2.01% |
| Nash | 96 | 0 | 0.00% | 92 | 4 | 4.35% | 79 | 1 | 1.27% | 75 | 3 | 4.00% | 93 | 2 | 2.15% | 435 | 10 | 2.35% |
| New Hanover | 138 | 2 | 1.45% | 154 | 1 | 0.65% | 154 | 2 | 1.30% | 129 | 2 | 1.55% | 118 | 0 | 0.00% | 693 | 7 | 0.99% |
| Northhampton | 34 | 0 | 0.00% | 39 | 1 | 2.56% | 42 | 1 | 2.38% | 31 | 2 | 6.45% | 31 | 1 | 3.23% | 177 | 5 | 2.92% |
| Onslow | 71 | 1 | 1.41% | 90 | 0 | 0.00% | 69 | 1 | 1.45% | 69 | 0 | 0.00% | 79 | 6 | 7.59% | 378 | 8 | 2.09% |
| Orange | 105 | 3 | 2.86% | 92 | 2 | 2.17% | 91 | 0 | 0.00% | 73 | 0 | 0.00% | 100 | 0 | 0.00% | 461 | 5 | 1.01% |
| Pamlico | 8 | 0 | 0.00% | 7 | 1 | 14.29% | 7 | 1 | 14.29% | 6 | 0 | 0.00% | 6 | 0 | 0.00% | 34 | 2 | 5.71% |
| Pasquotank | 15 | 0 | 0.00% | 22 | 0 | 0.00% | 18 | 0 | 0.00% | 28 | 0 | 0.00% | 25 | 2 | 8.00% | 108 | 2 | 1.60% |
| Pender | 46 | 2 | 4.35% | 54 | 4 | 7.41% | 53 | 1 | 1.89% | 38 | 3 | 7.89% | 24 | 1 | 4.17% | 215 | 11 | 5.14% |
| Perquimans | 8 | 0 | 0.00% | 12 | 0 | 0.00% | 10 | 0 | 0.00% | 12 | 0 | 0.00% | 5 | 1 | 20.00% | 47 | 1 | 4.00% |
| Person | 18 | 1 | 5.56% | 17 | 0 | 0.00% | 23 | 1 | 4.35% | 32 | 1 | 3.13% | 32 | 1 | 3.13% | 122 | 4 | 3.23% |
| Pitt | 87 | 2 | 2.30% | 83 | 3 | 3.61% | 96 | 2 | 2.08% | 85 | 1 | 1.18% | 98 | 1 | 1.02% | 449 | 9 | 2.04% |
| Polk | 17 | 0 | 0.00% | 25 | 0 | 0.00% | 18 | 0 | 0.00% | 28 | 2 | 7.14% | 17 | 2 | 11.76% | 105 | 4 | 3.78% |
| Randolph | 103 | 2 | 1.94% | 83 | 4 | 4.82% | 98 | 2 | 2.04% | 93 | 5 | 5.38% | 118 | 2 | 1.69% | 495 | 15 | 3.17% |
| Richmond | 89 | 1 | 1.12% | 71 | 0 | 0.00% | 75 | 1 | 1.33% | 85 | 3 | 3.53% | 79 | 1 | 1.27% | 399 | 6 | 1.45% |
| Robeson | 123 | 4 | 3.25% | 133 | 7 | 5.26% | 147 | 5 | 3.40% | 161 | 8 | 4.97% | 159 | 1 | 0.63% | 723 | 25 | 3.50% |
| Rockingham | 88 | 0 | 0.00% | 99 | 5 | 5.05% | 77 | 2 | 2.60% | 54 | 3 | 5.56% | 77 | 1 | 1.30% | 395 | 11 | 2.90% |
| Rowan | 125 | 4 | 3.20% | 133 | 1 | 0.75% | 146 | 2 | 1.37% | 167 | 2 | 1.20% | 172 | 3 | 1.74% | 743 | 12 | 1.65% |
| Rutherford | 37 | 2 | 5.41% | 28 | 0 | 0.00% | 35 | 0 | 0.00% | 46 | 0 | 0.00% | 38 | 2 | 5.26% | 184 | 4 | 2.13% |
| Sampson | 91 | 4 | 4.40% | 95 | 2 | 2.11% | 83 | 4 | 4.82% | 71 | 4 | 5.63% | 79 | 4 | 5.06% | 419 | 18 | 4.40% |
| Scotland | 35 | 1 | 2.86% | 40 | 3 | 7.50% | 32 | 0 | 0.00% | 31 | 3 | 9.68% | 34 | 2 | 5.88% | 172 | 9 | 5.18% |
| Stanly | 50 | 0 | 0.00% | 45 | 0 | 0.00% | 33 | 0 | 0.00% | 41 | 1 | 2.44% | 35 | 1 | 2.86% | 204 | 2 | 1.06% |
| Stokes | 15 | 0 | 0.00% | 17 | 1 | 5.88% | 29 | 1 | 3.45% | 13 | 1 | 7.69% | 23 | 1 | 4.35% | 97 | 4 | 4.27% |
| Surry | 95 | 1 | 1.05% | 89 | 0 | 0.00% | 107 | 3 | 2.80% | 84 | 2 | 2.38% | 120 | 3 | 2.50% | 495 | 9 | 1.75% |
| Swain | 7 | 1 | 14.29% | 8 | 0 | 0.00% | 12 | 1 | 8.33% | 3 | 0 | 0.00% | 4 | 0 | 0.00% | 34 | 2 | 4.52% |
| Transylvania | 10 | 0 | 0.00% | 10 | 0 | 0.00% | 13 | 0 | 0.00% | 10 | 0 | 0.00% | 17 | 0 | 0.00% | 60 | 0 | 0.00% |
| Tyrrell | 1 | 0 | 0.00% | 2 | 0 | 0.00% | 2 | 0 | 0.00% | 4 | 0 | 0.00% | 6 | 0 | 0.00% | 15 | 0 | 0.00% |
| Union | 140 | 3 | 2.14% | 134 | 2 | 1.49% | 142 | 2 | 1.41% | 160 | 4 | 2.50% | 140 | 2 | 1.43% | 716 | 13 | 1.79% |
| Vance | 61 | 1 | 1.64% | 73 | 2 | 2.74% | 48 | 1 | 2.08% | 63 | 1 | 1.59% | 46 | 2 | 4.35% | 291 | 7 | 2.48% |
| Wake | 576 | 6 | 1.04% | 572 | 5 | 0.87% | 586 | 8 | 1.37% | 561 | 7 | 1.25% | 557 | 3 | 0.54% | 2852 | 29 | 1.01% |
| Warren | 26 | 0 | 0.00% | 20 | 0 | 0.00% | 21 | 3 | 14.29% | 15 | 0 | 0.00% | 21 | 0 | 0.00% | 103 | 3 | 2.86% |
| Washington | 18 | 1 | 5.56% | 12 | 1 | 8.33% | 16 | 1 | 6.25% | 14 | 0 | 0.00% | 17 | 1 | 5.88% | 77 | 4 | 5.20% |
| Watauga | 31 | 0 | 0.00% | 38 | 0 | 0.00% | 42 | 0 | 0.00% | 40 | 0 | 0.00% | 43 | 2 | 4.65% | 194 | 2 | 0.93% |
| Wayne | 105 | 2 | 1.90% | 96 | 1 | 1.04% | 90 | 2 | 2.22% | 99 | 2 | 2.02% | 121 | 2 | 1.65% | 511 | 9 | 1.77% |
| Wilkes | 55 | 0 | 0.00% | 51 | 1 | 1.96% | 50 | 1 | 2.00% | 63 | 4 | 6.35% | 56 | 0 | 0.00% | 275 | 6 | 2.06% |
| Wilson | 96 | 3 | 3.13% | 106 | 0 | 0.00% | 113 | 5 | 4.42% | 86 | 4 | 4.65% | 79 | 2 | 2.53% | 480 | 14 | 2.95% |
| Yadkin | 32 | 1 | 3.13% | 45 | 0 | 0.00% | 43 | 3 | 6.98% | 45 | 4 | 8.89% | 42 | 2 | 4.76% | 207 | 10 | 4.75% |
| Yancey | 9 | 0 | 0.00% | 8 | 2 | 25.00% | 11 | 1 | 9.09% | 6 | 0 | 0.00% | 9 | 0 | 0.00% | 43 | 3 | 6.82% |

## Table 2

## Injury Severity in Heavy Truck-Involved Crashes in North Carolina

## Source: NCDMV Crash Data 1995-1999

| | District 1 | | | | |
|---|---|---|---|---|---|
| | 1995 | 1996 | 1997 | 1998 | 1999 |
| No Injury | 375 | 304 | 328 | 330 | 337 |
| Class C | 113 | 157 | 156 | 144 | 145 |
| Class B | 73 | 85 | 85 | 93 | 92 |
| Class A | 34 | 32 | 40 | 34 | 26 |
| Fatal | 16 | 15 | 14 | 13 | 21 |
| *Totals* | ***611*** | ***593*** | ***623*** | ***614*** | ***621*** |

| | District 2 | | | | |
|---|---|---|---|---|---|
| | 1995 | 1996 | 1997 | 1998 | 1999 |
| No Injury | 492 | 505 | 468 | 484 | 478 |
| Class C | 230 | 268 | 200 | 196 | 246 |
| Class B | 98 | 102 | 122 | 125 | 104 |
| Class A | 44 | 46 | 52 | 48 | 32 |
| Fatal | 25 | 27 | 24 | 33 | 24 |
| *Totals* | ***889*** | ***2944*** | ***2863*** | ***2884*** | ***2883*** |

| | District 3 | | | | |
|---|---|---|---|---|---|
| | 1995 | 1996 | 1997 | 1998 | 1999 |
| No Injury | 917 | 895 | 862 | 823 | 842 |
| Class C | 289 | 399 | 327 | 321 | 322 |
| Class B | 129 | 173 | 171 | 167 | 147 |
| Class A | 52 | 55 | 62 | 66 | 52 |
| Fatal | 28 | 23 | 30 | 35 | 26 |
| *Totals* | ***1415*** | ***1545*** | ***1452*** | ***1412*** | ***1389*** |

| | District 4 | | | | |
|---|---|---|---|---|---|
| | 1995 | 1996 | 1997 | 1998 | 1999 |
| No Injury | 838 | 736 | 752 | 756 | 810 |
| Class C | 266 | 280 | 238 | 263 | 308 |
| Class B | 121 | 118 | 131 | 117 | 122 |
| Class A | 48 | 67 | 45 | 42 | 48 |
| Fatal | 14 | 21 | 19 | 23 | 22 |
| *Totals* | ***1287*** | ***1222*** | ***1185*** | ***1201*** | ***1310*** |

| | District 5 | | | | |
|---|---|---|---|---|---|
| | 1995 | 1996 | 1997 | 1998 | 1999 |
| No Injury | 502 | 482 | 505 | 497 | 568 |
| Class C | 157 | 145 | 175 | 161 | 186 |
| Class B | 73 | 108 | 105 | 99 | 91 |
| Class A | 43 | 47 | 52 | 37 | 48 |
| Fatal | 14 | 10 | 14 | 25 | 18 |
| *Totals* | ***789*** | ***792*** | ***851*** | ***819*** | ***911*** |

| | District 6 | | | | |
|---|---|---|---|---|---|
| | 1995 | 1996 | 1997 | 1998 | 1999 |
| No Injury | 1115 | 882 | 941 | 949 | 987 |
| Class C | 352 | 344 | 654 | 368 | 355 |
| Class B | 141 | 145 | 122 | 166 | 144 |
| Class A | 56 | 69 | 66 | 56 | 55 |
| Fatal | 12 | 9 | 13 | 16 | 15 |
| *Totals* | ***1676*** | ***1449*** | ***1796*** | ***1555*** | ***1556*** |

| | District 7 | | | | |
|---|---|---|---|---|---|
| | 1995 | 1996 | 1997 | 1998 | 1999 |
| No Injury | 642 | 605 | 584 | 626 | 652 |
| Class C | 181 | 206 | 207 | 222 | 210 |
| Class B | 115 | 96 | 95 | 117 | 114 |
| Class A | 40 | 47 | 36 | 44 | 43 |
| Fatal | 15 | 16 | 19 | 25 | 13 |
| *Totals* | ***993*** | ***970*** | ***941*** | ***1034*** | ***1032*** |

| | District 8 | | | | |
|---|---|---|---|---|---|
| | 1995 | 1996 | 1997 | 1998 | 1999 |
| No Injury | 405 | 454 | 411 | 374 | 415 |
| Class C | 102 | 135 | 123 | 101 | 122 |
| Class B | 70 | 83 | 89 | 59 | 64 |
| Class A | 27 | 27 | 34 | 29 | 29 |
| Fatal | 8 | 9 | 11 | 15 | 14 |
| *Totals* | ***612*** | ***708*** | ***668*** | ***578*** | ***644*** |

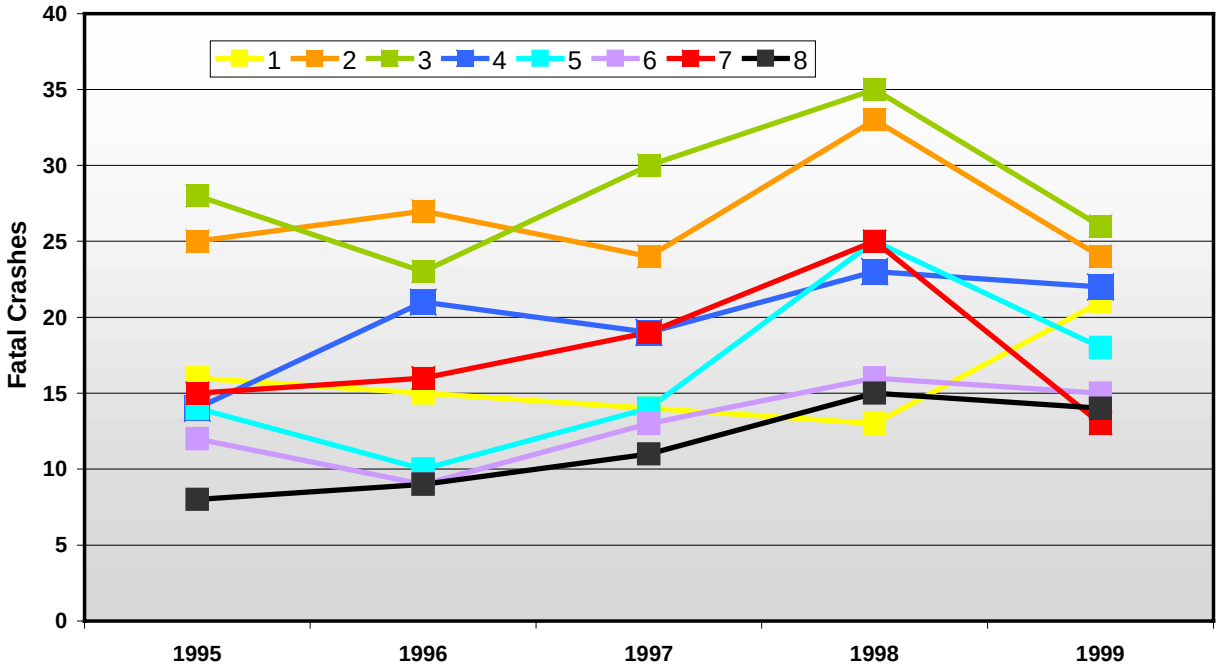
## Table 3
## Heavy Truck Crash Severity Statewide in North Carolina 1995-1999

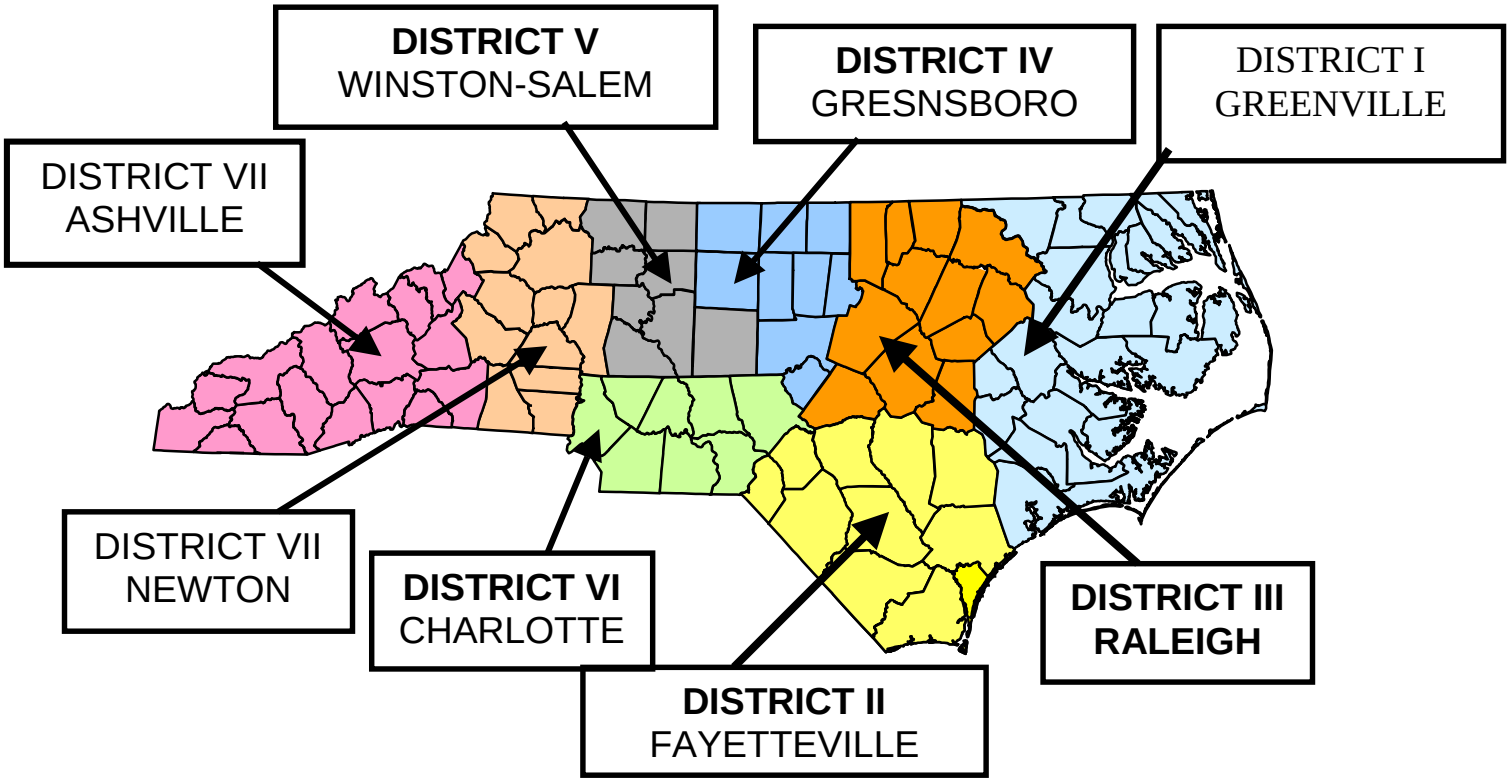
| | Statewide (all districts) | | | | |
|---|---|---|---|---|---|
| | **1995** | **1996** | **1997** | **1998** | **1999** |
| **No Injury** | 5286 | 4863 | 4851 | 4839 | 5089 |
| **Class C** | 1690 | 1934 | 2080 | 1776 | 1894 |
| **Class B** | 820 | 910 | 920 | 943 | 878 |
| **Class A** | 344 | 390 | 387 | 356 | 333 |
| **Fatal** | 132 | 130 | 144 | 185 | 153 |
| ***Totals*** | ***8272*** | ***8227*** | ***8382*** | ***8099*** | ***8347*** |

## Table 4
## Heavy Truck Crash Severity Levels as a Percentage of Total Statewide Heavy Truck Crashes 1995-1999

| | Statewide | | | | |
|---|---|---|---|---|---|
| | **1995** | **1996** | **1997** | **1998** | **1999** |
| **No Injury** | 64% | 59% | 58% | 60% | 61% |
| **Class C** | 20% | 24% | 25% | 22% | 23% |
| **Class B** | 10% | 11% | 11% | 12% | 11% |
| **Class A** | 4% | 5% | 5% | 4% | 4% |
| **Fatal** | 2% | 2% | 2% | 2% | 2% |
| ***Total*** | ***100%*** | ***100%*** | ***100%*** | ***100%*** | ***100%*** |

**Figure 7**
**Fatal Crashes by Year, by Enforcement District**
**1995-1999**



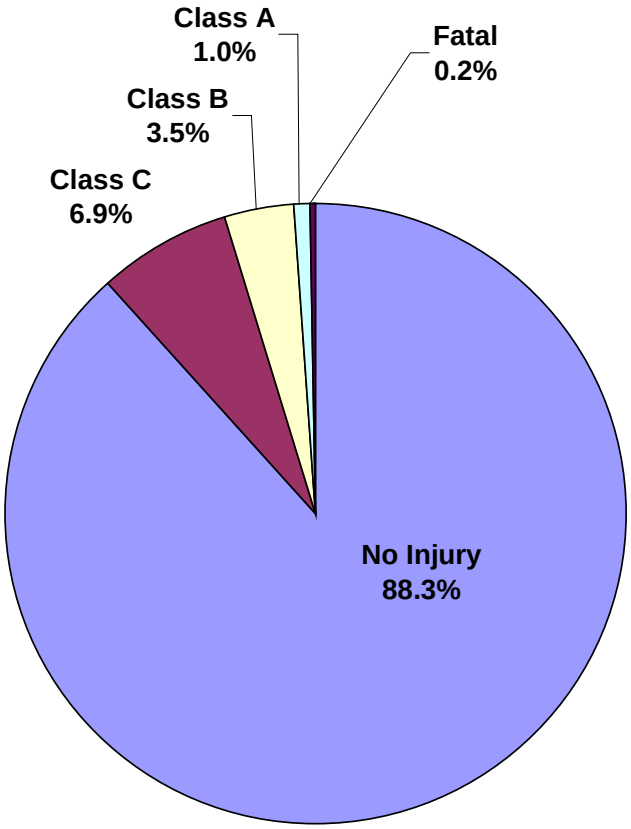


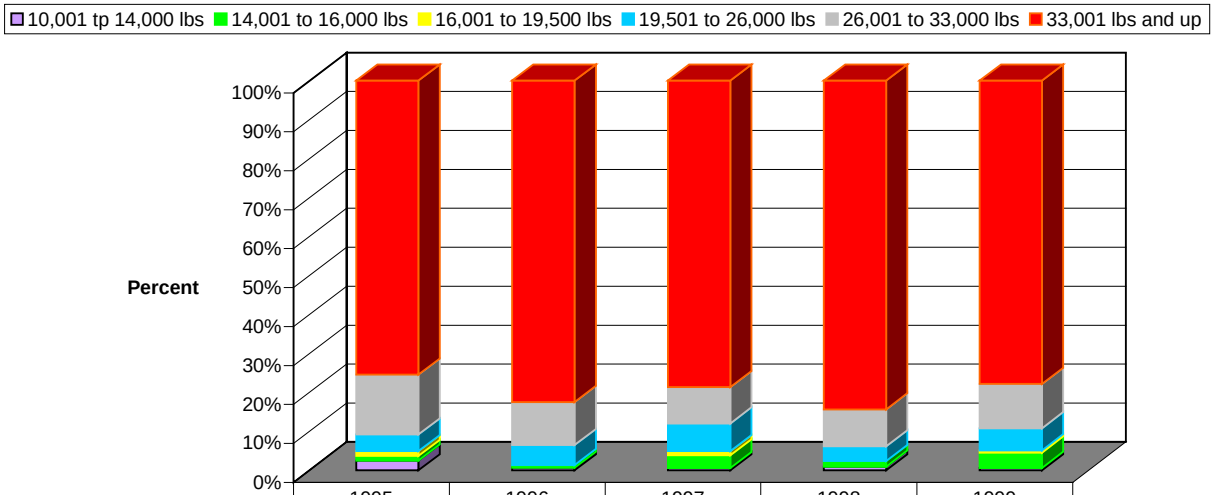

**Figure 8**
**Severity of Injury Incurred By Truck Driver**
**NC Crash Data, 1995-1999**

The injury severity data in the above tables does not distinguish 'who' was injured. . . the driver of the truck or the driver of the 'other' vehicle. Figure 8 reports the severity of injuries received by the truck driver. The data show that in over 88 percent of the truck-involved crashes, the driver of the truck was not injured, and in less than 1 percent of crashes was the driver of the truck killed.

**Vehicle Characteristics of Trucks Involved in Crashes**

Figure 9 reports the distribution of gross vehicle weights (GVW) for large trucks involved in fatal crashes in North Carolina between 1995 and 1999. It is clear from these data that while 'heavy' trucks are defined as those having GVWs of 10,000 pounds or greater, the vast majority of 'heavy' trucks involved in fatal crashes have GVWs of 26,000 pounds or greater.

## Figure 9
## Distribution of Gross Vehicle Weights (GVW) for Large Trucks Involved in Fatal Crashes in North Carolina 1995-1999




| | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|
| 33,001 lbs and up | 75.46 | 82.47 | 78.69 | 84.36 | 77.84 |
| 26,001 to 33,000 lbs | 15.34 | 11.04 | 9.29 | 9.48 | 11.36 |
| 19,501 to 26,000 lbs | 4.29 | 5.19 | 7.1 | 3.79 | 5.68 |
| 16,001 to 19,500 lbs | 1.23 | 0 | 1.09 | 0 | 0.57 |
| 14,001 to 16,000 lbs | 1.23 | 0.65 | 3.28 | 1.42 | 3.98 |
| 10,001 tp 14,000 lbs | 2.45 | 0.65 | 0.55 | 0.95 | 0.57 |

In terms of body type, Figure 10 reports the relative frequency of occurrence of various body types in fatal truck-involved crashes between 1995 and 1999. The body type data reflect the previous GVW data showing that the two classes of heavy trucks most often involved in crashes involving a fatality were (a) high GVW single unit trucks (SUTs), and (b) truck/tractor (i.e., tractor trailers). The general trends toward the involvement of these types of vehicles in fatal crashes are shown in Figure 11. The trend for tractor trailer involvement mirrors closely the overall trend shown earlier. A similar trend is not seen in the involvement patterns over time of the high GVW single unit truck.

**Figure 10**
**Percent of NC Fatal Truck-Involved Crashes as a Function of Body Type**
**Source: FARS 1995-1999**

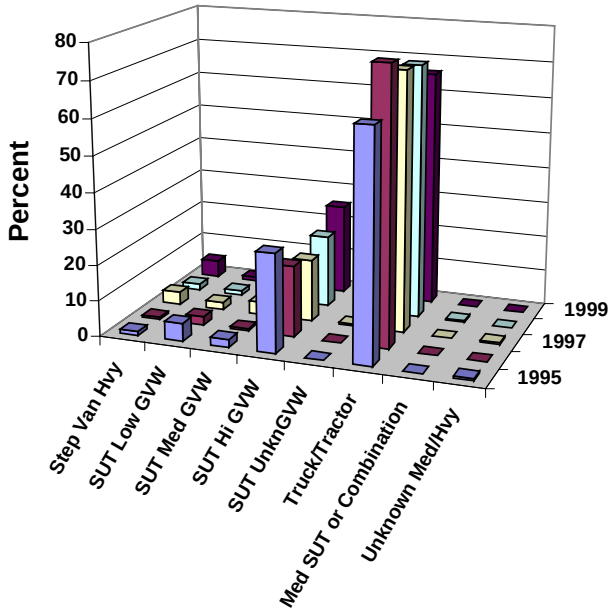
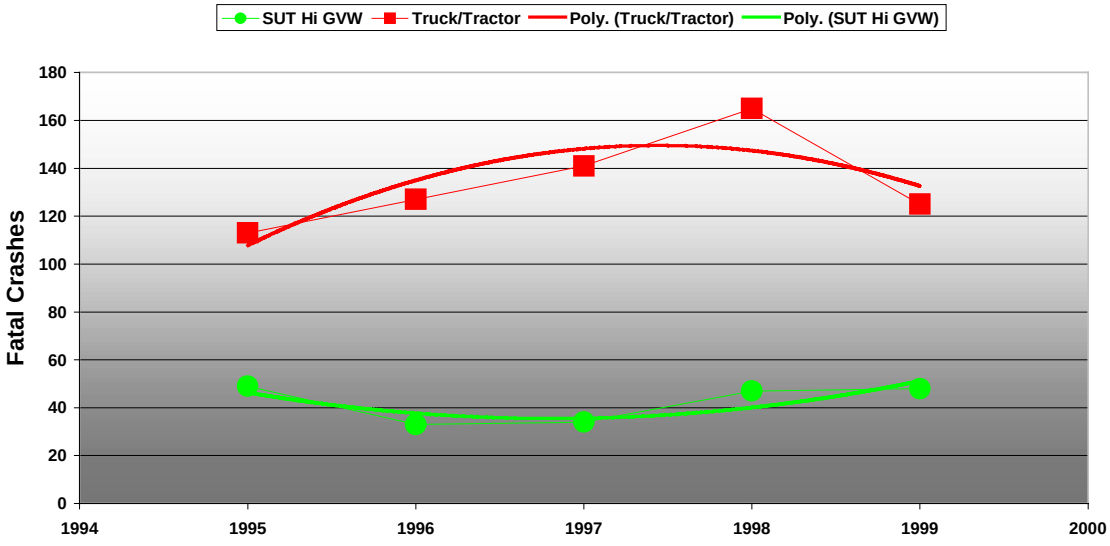


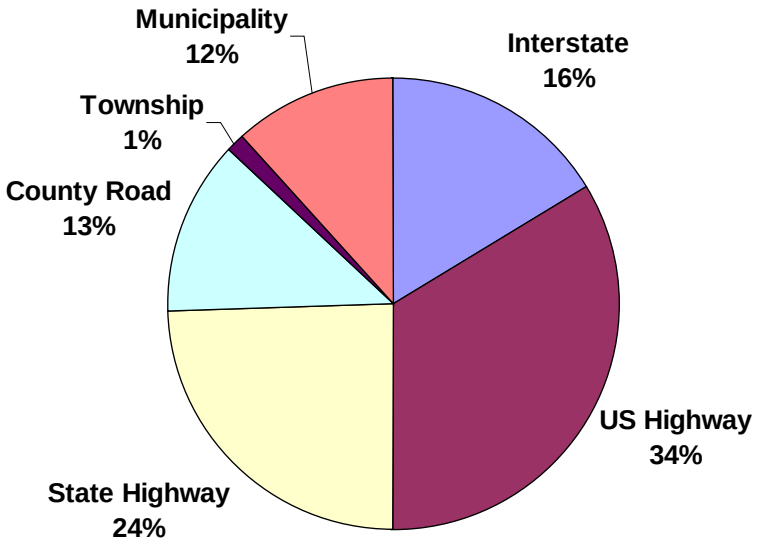

**Figure 11**
**Fatal Crashes Involving Single Unit High GVW and Truck/Tractor Vehicle Types in North Carolina 1995-1999**
**(Source: FARS)**



**Roadway Factors**

Figure 12 provides data on fatal heavy truck-involved crashes as a function of the type of route. According to these data, over half (58 percent) of all fatal truck-involved crashes during the period 1995-1999 occurred on NC or US numbered highways. Only 16 percent of all fatal truck-involved crashes occurred on Interstate type roads.

## Figure 12
## Fatal Heavy Truck-Involved Crashes as a Function of Type of Route
## Source: FARS 1995-1999




Figures 13 and 14 differentiate roads in terms of their 'class.' On rural roads (see Figure 13), the highest frequency of fatal truck-involved crash occurred on (rural) principle arterials, followed by major collectors, and minor arterials. In 1999, only rural minor collectors experienced fewer fatal truck-involved crashes than rural interstates. On urban roads (see Figure 14), the data show trends toward an increase in fatal truck-involved crashes on urban interstates, urban freeways and expressways, principal and minor urban arterials.

**Figure 13**
**Fatal Heavy Truck-Involved Crashes as a Function of Rural Road Class**
**Source: FARS 1995-1999**

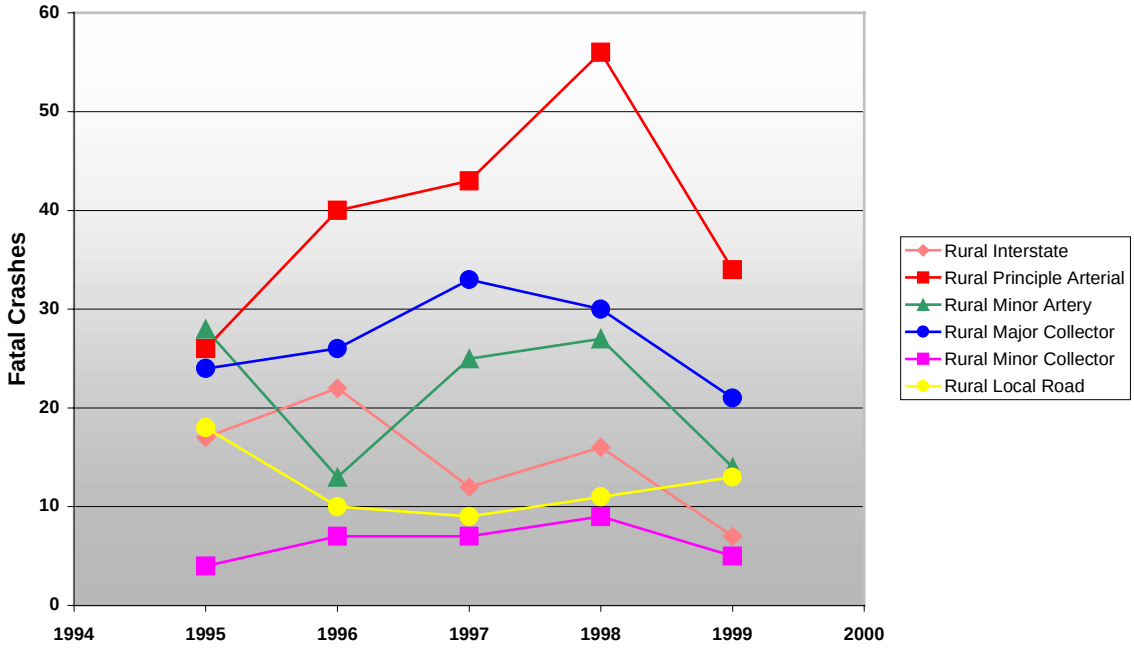
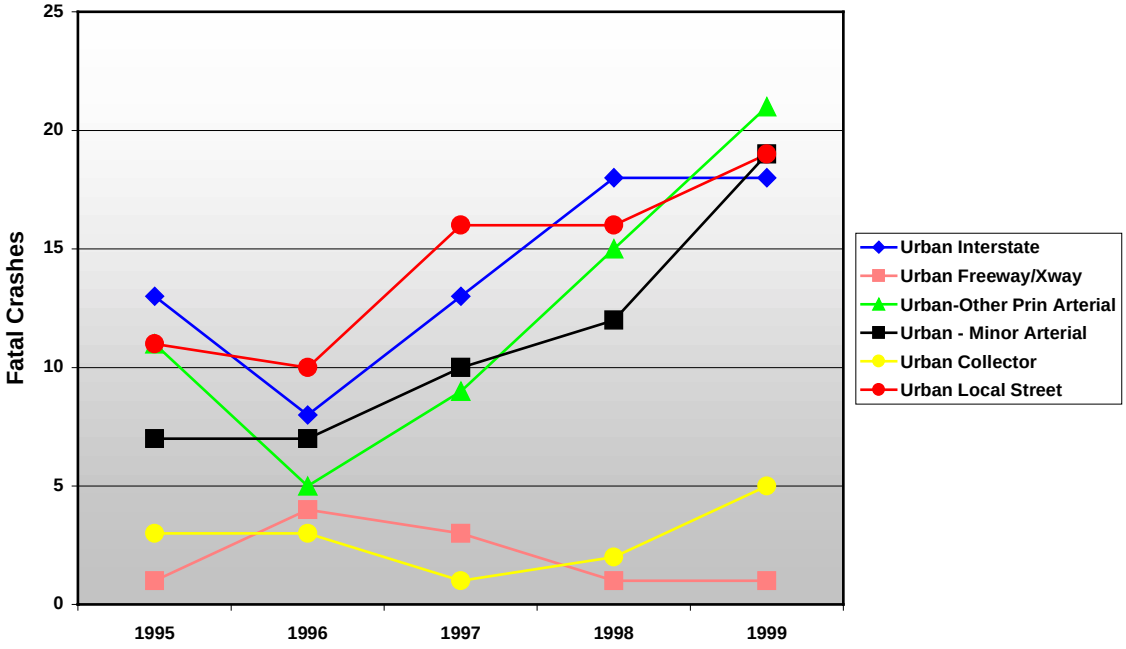


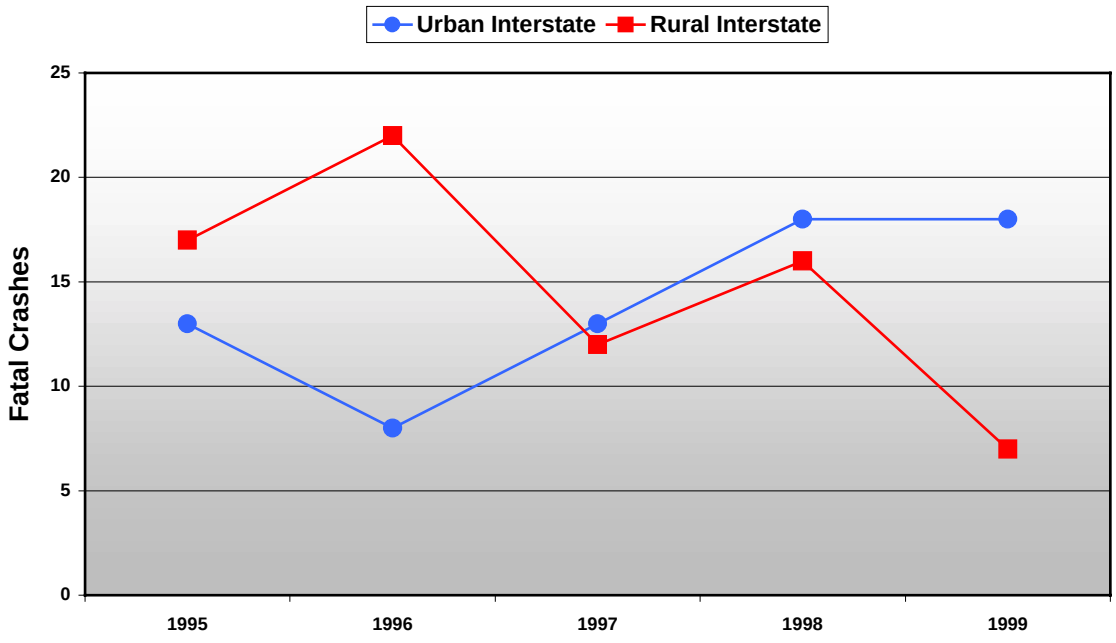

**Figure 14**
**Fatal Truck-Involved Crashes as a Function of Urban Road Class**
**Source: FARS 1995-1999**



With respect to the relative safety of rural and urban freeways (in terms of the likelihood of fatal truck-involved crashes), Figure 15 shows that the 'urban interstate' is overtaking the rural interstate in terms of total truck-involved fatal crashes. When one considers that there are almost twice as many miles of rural interstate in North Carolina as there are miles of urban interstate, these data point to a much greater risk of severe truck-involved crashes in the urban environment. It is also instructive to point out that between 1998 and 1999, the statewide crash reduction trend appears to reflect more the crash reduction trend on rural interstates than that on urban interstates. This is not to say that the statewide crash reduction improvements in 1999 can be totally attributed to gains on rural interstates.

Overall, however, considering the combined data in Figures 13 and 14, it appears that crash reduction improvements statewide appear to have been achieved almost totally in the rural as opposed to urban roadway environment.

**Figure 15**
**Fatal Truck-Involved Crashes on Rural and Urban Interstates in North Carolina**
**Source: FARS 1995-1999**



## Number of Lanes and Traffic Flow Control

Figure 16 shows that fatal truck-involved crashes during the period 1995-1999 were most likely to have occurred on either two or four-lane roadways. While more than twice as many fatal crashes occurred on 2 lane roads as on 4 lane roads, the four lane road showed the greatest increase in fatal crashes over the five year period (from 33 fatal crashes in 1995 to 51 crashes in 1999). The 5-lane roadway, while accounting for only 23 or the 890 fatal truck-involved crashes during this period showed an eight fold increase over the period from 1995 to 1999 (refer to Figure 17).

**Figure 16**
**Number of Fatal Truck-Involved Crashes in NC as a Function of Number of Lanes**
**Source: FARS 1995-1999**

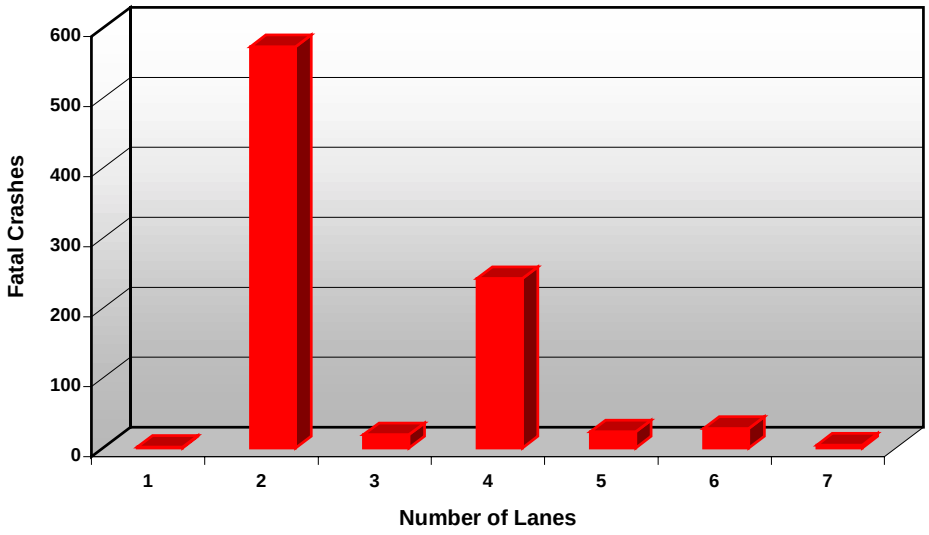
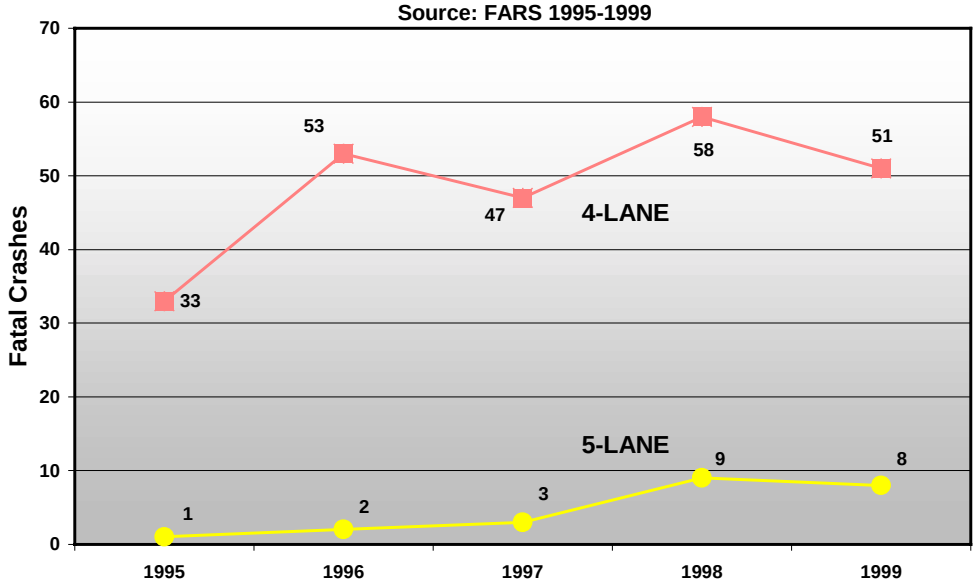
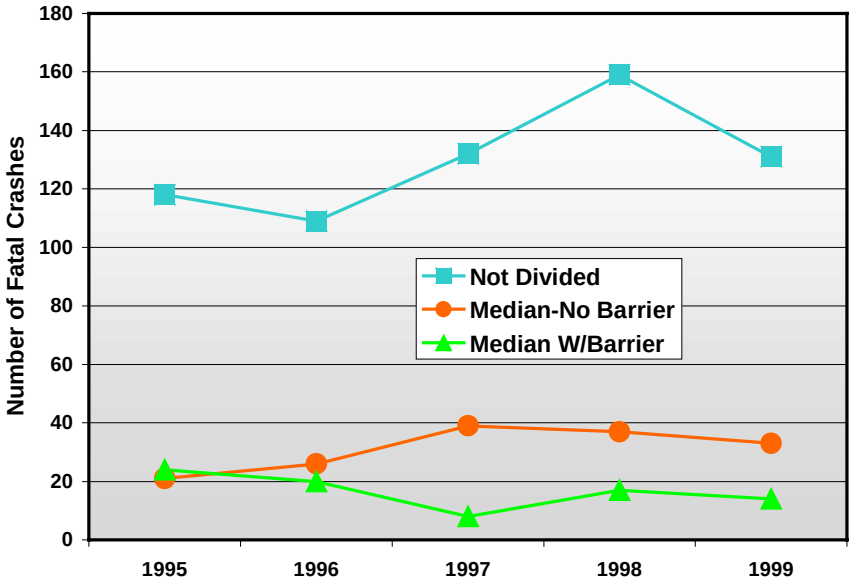



**Figure 17**
**Increase in Fatal Truck-Involved Crashes on 4 and 5-Lane Roads in North Carolina**
**Source: FARS 1995-1999**



With respect to traffic flow (i.e., separation of directions of travel), the data in Figure 18 supports the rather obvious fact that serious (in this case, fatal) crashes are more likely on roads where the directions of travel are not divided. Over the period 1995-1999, the data show a four to five-fold reduction in the frequency of fatal truck-involved crashes with the addition of a median. The data suggest that a median-with-barrier can lead an additional three to four-fold reduction in crashes beyond what is achieved with the median alone. These conclusions should not be taken as definitive since exposure and operational traffic variables were not controlled for in these observations.

**Figure 18**
**Fatal Heavy Truck-Involved Crashes in NC as a Function of Traffic Flow Control**
**Source: FARS 1995-1999**




## High Crash Locations

Tables 5 and 6 provides information on the actual roadway locations of truck-involved crashes. Table 5 provides data on fatal truck-involved crash locations statewide for the period 1995-1999. Table 6 provides data on the ten (10) locations within each of the 30 counties targeted by DMV or increased CMV enforcement in FY2001 (Oct '2000 through Sep '2001). Actual crash frequencies over the five-year period are shown for each of the high crash locations in Table 6.

# Table 5

## Fatal Crash Locations by County
## 1995-1999

| OUNTY | ACCTOWN | ONROAD | TOROAD |
|---|---|---|---|
| ALAMANCE | MEBANE | 5TH ST | CRAWFORD ST |
| ALAMANCE | GRAHAM | I40 | NC49 |
| ALAMANCE | GRAHAM | I40 | NC54 |
| ALAMANCE | GRAHAM | I40 | NC54 |
| ALAMANCE | | I40 | ORANG |
| ALAMANCE | BURLINGTON | I40 | RP1154 |
| ALAMANCE | | NC49 | RP1105 |
| ALAMANCE | | NC49 | RP1753 |
| ALAMANCE | | NC87 | RP1562 |
| ALAMANCE | | RP1001 | RP1607 |
| ALEXANDER | | US64 | RP1111 |
| ALEXANDER | | US64 | RP1165 |
| ALLEGHANY | | NC18 | RU1150 |
| ALLEGHANY | | US221 | RU1328 |
| ANSON | WADESBORO | CASWELL ST | RUTHERFORD ST |
| ANSON | | NC218 | RP1438 |
| ANSON | | NC742 | RP1120 |
| ANSON | | US52 | RP1664 |
| ANSON | | US74 | RP1730 |
| ANSON | | US74 | RP1733 |
| ASHE | | NC16 | RP1576 |
| ASHE | | NC163 | RP1201 |
| ASHE | | RP1118 | WATAU |
| ASHE | | RP1315 | RP1310 |
| ASHE | | RP1315 | RP1320 |
| AVERY | | US221 | RP1524 |
| BEAUFORT | | NC33 | RP1100 |
| BEAUFORT | | NC33 | RP1140 |
| BEAUFORT | | US17 | RP1152 |
| BEAUFORT | | US17 | RP1421 |
| BEAUFORT | | US17 | RU1419 |
| BEAUFORT | | US264 | RU1608 |
| BERTIE | | NC11 | RP1145 |
| BERTIE | | NC308 | WINDSOR |
| BERTIE | | US13 | RP1303 |
| BERTIE | | US13 | RP1500 |
| BERTIE | | US13 | RU1154 |
| BERTIE | | US17 | RP1504 |
| BLADEN | | NC41 | RP1100 |
| BLADEN | | NC41 | RP1108 |
| BLADEN | | NC87 | RP1336 |
| BLADEN | | NC87 | RP1743 |
| BLADEN | | RP1318 | RP1316 |
| BRUNSWICK | BELVILLE | NC133 | RP1554 |
| BRUNSWICK | | NC211 | RP1500 |
| BRUNSWICK | | NC211 | RU1341 |
| BRUNSWICK | | RP1115 | RP1125 |
| BRUNSWICK | | US17 | NC130 |
| BRUNSWICK | | US17 | RP1115 |
| BRUNSWICK | | US17 | RP1514 |
| BRUNSWICK | | US17 | US17B |
| BRUNSWICK | | US17 | US17B |
| BRUNSWICK | SHALLOTTE | WHITEVILLE RD | MAIN ST |
| BUNCOMBE | | I40 | MILE061 |
| BUNCOMBE | ASHEVILLE | I40 | US19 |
| BUNCOMBE | | NC112 | RP3635 |
| BUNCOMBE | | NC63 | RP1620 |
| BUNCOMBE | | NC63 | RP1843 |
| BUNCOMBE | | RP2776 | RP2785 |
| BURKE | | I40 | MILE109 |
| BURKE | | I40 | MILE114 |
| BURKE | | I40 | MILE114 |
| BURKE | | I40 | RP1102 |
| BURKE | | I40 | US64 |

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| BURKE | | NC181 | NC183 |
| BURKE | | NC181 | RP1265 |
| BURKE | | NC181 | RP1402 |
| BURKE | | NC181 | RP1405 |
| BURKE | | NC181 | RP1406 |
| BURKE | | RP1233 | RP1223 |
| BURKE | | US64 | RP1949 |
| BURKE | | US70 | RP1233 |
| CABARRUS | | I85 | SPEEDWAY BLVD |
| CABARRUS | | NC24 | RP1132 |
| CABARRUS | | NC49 | RP2600 |
| CABARRUS | | NC73 | |
| CABARRUS | | NC73 | RP1529 |
| CABARRUS | | US601 | RP1147 |
| CALDWELL | LENOIR | CREEKWAY DR | MEADOW LANE DR |
| CALDWELL | LENOIR | MORGANTON BLVD | HOOVER ST |
| CALDWELL | | NC18 | RP1709 |
| CALDWELL | GRANITE FALLS | US321 | PINECREST AVE |
| CALDWELL | | US321 | RP1346 |
| CALDWELL | | US321 | US321A |
| CARTERET | | NC24 | RP1660 |
| CARTERET | | US70 | RP1141 |
| CARTERET | | US70 | RP1411 |
| CASWELL | | NC57 | RP1542 |
| CATAWBA | LONG VIEW | 2ND AVE | |
| CATAWBA | | I40 | NC16 |
| CATAWBA | | I40 | NC16 |
| CATAWBA | HICKORY | I40 | RP1007 |
| CATAWBA | | I40 | RP1717 |
| CATAWBA | NEWTON | NC10 | NOTTINGHAM DR |
| CATAWBA | | NC150 | IREDE |
| CATAWBA | | NC150 | RP1848 |
| CATAWBA | | NC16 | RP1810 |
| CATAWBA | NEWTON | US321 | NC10 |
| CATAWBA | MAIDEN | US321 | PINEHURST ST |
| CHATHAM | | NC22 | NC902 |
| CHATHAM | | NC87 | RP1515 |
| CHATHAM | | RP2303 | RP2309 |
| CHATHAM | | US1 | WAKE |
| CHATHAM | PITTSBORO | US15 | LOG BARN ACRES |
| CHATHAM | | US421 | RANDO |
| CHATHAM | | US421 | RP2119 |
| CHATHAM | SILER CITY | US421 | RP2120 |
| CHATHAM | | US421 | RP2126 |
| CHATHAM | | US421 | RP2135 |
| CHATHAM | | US421 | RP2135 |
| CHATHAM | | US421 | RP2139 |
| CHATHAM | | US64 | NC751 |
| CHATHAM | | US64 | RP1500 |
| CHATHAM | | US64 | RP1700 |
| CHOWAN | | NC32 | RP1316 |
| CHOWAN | | NC32 | RP1317 |
| CHOWAN | | RP1303 | RP1322 |
| CLEVELAND | SHELBY | DEKALB ST | BUFFALO ST |
| CLEVELAND | SHELBY | DIXON BLVD | LINK RD |
| CLEVELAND | SHELBY | DIXON BLVD | POST RD |
| CLEVELAND | SHELBY | FALLSTON RD | |
| CLEVELAND | | I85 | SC |
| CLEVELAND | | NC150 | RP1149 |
| CLEVELAND | | NC18 | RP1107 |
| CLEVELAND | | RP1313 | RP1340 |
| CLEVELAND | | US74 | RP1162 |
| CLEVELAND | | US74 | RP1316 |
| CLEVELAND | | US74 | RP2238 |
| COLUMBUS | WHITEVILLE | J K POWELL BLVD | COLLEGE ST |
| COLUMBUS | | NC410 | US74 |
| COLUMBUS | | NC905 | SC |
| COLUMBUS | | US701 | RP1168 |
| COLUMBUS | | US701 | RP1551 |
| COLUMBUS | | US74 | RP1506 |
| COLUMBUS | | US74 | RP1562 |
| COLUMBUS | | US74 | RP1562 |
| COLUMBUS | | US74 | RP1572 |
| COLUMBUS | | US74 | RP1700 |

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| COLUMBUS | | US74 | RP1731 |
| COLUMBUS | | US76 | RP1504 |
| COLUMBUS | | US76 | SC |
| COLUMBUS | | US76 | SC |
| CRAVEN | | NC101 | RP1824 |
| CRAVEN | | NC43 | RP1504 |
| CRAVEN | | NC43 | RP1644 |
| CRAVEN | | RP1262 | RU1272 |
| CRAVEN | | RP1436 | US17 |
| CRAVEN | | US17 | RP1616 |
| CRAVEN | | US17 | RP1628 |
| CRAVEN | | US70 | RP1176 |
| CRAVEN | | US70 | RP1225 |
| CUMBERLAND | FAYETTEVILLE | EASTERN BLVD | GILLESPIE |
| CUMBERLAND | FAYETTEVILLE | GILLESPIE ST | MOUNTAIN DR |
| CUMBERLAND | | I95 | MILE069 |
| CUMBERLAND | | I95 | RP1806 |
| CUMBERLAND | | I95 | RP1832 |
| CUMBERLAND | | I95 | RP2215 |
| CUMBERLAND | FAYETTEVILLE | MURCHISON RD | DURHAM ST |
| CUMBERLAND | FAYETTEVILLE | MURCHISON RD | MATHEWS ST |
| CUMBERLAND | | NC24 | RP1006 |
| CUMBERLAND | | NC87 | HARNE |
| CUMBERLAND | | NC87 | RP2237 |
| CUMBERLAND | | NC87 | RP2238 |
| CUMBERLAND | FAYETTEVILLE | OWEN DR | EASTERN BLVD |
| CUMBERLAND | FAYETTEVILLE | OWEN DR | RAEFORD RD |
| CUMBERLAND | FAYETTEVILLE | RANKIN ST | RUSSELL ST |
| CUMBERLAND | | RP1141 | RP2995 |
| CUMBERLAND | | RP1704 | CHALLENGER DR |
| CUMBERLAND | | RP2273 | RP2219 |
| CUMBERLAND | | US13 | RP1821 |
| CUMBERLAND | | US13 | RP1828 |
| CUMBERLAND | | US301 | RP2220 |
| CURRITUCK | | NC168 | RP1214 |
| DAVIDSON | | I85 | RP1295 |
| DAVIDSON | | I85 | RP2085 |
| DAVIDSON | | I85 | RP2183 |
| DAVIDSON | | I85 | US29 |
| DAVIDSON | | NC8 | RP1118 |
| DAVIDSON | | NC8 | RP1848 |
| DAVIDSON | | NC8 | RU2412 |
| DAVIDSON | | RP1147 | RP1151 |
| DAVIDSON | | RP1708 | RP1961 |
| DAVIDSON | | RP2205 | RP2229 |
| DAVIDSON | | RP3010 | RP1412 |
| DAVIDSON | | US64 | DAVIE |
| DAVIDSON | | US64 | RANDO |
| DAVIE | | I40 | FORSY |
| DAVIE | | I40 | MILE179 |
| DAVIE | | US601 | RP1135 |
| DAVIE | | US64 | DAVID |
| DAVIE | | US64 | IREDE |
| DUPLIN | | I40 | MILE376 |
| DUPLIN | | I40 | US117 |
| DUPLIN | | NC111 | RP1546 |
| DUPLIN | | NC24 | NC11 |
| DUPLIN | | NC24 | RP1723 |
| DUPLIN | | NC24 | RP1923 |
| DUPLIN | | NC241 | RP1711 |
| DUPLIN | | NC41 | I40 |
| DUPLIN | WALLACE | NC41 | NC11 |
| DUPLIN | | NC41 | RP1967 |
| DUPLIN | | RP1519 | RU1526 |
| DUPLIN | | US117 | RP1912 |
| DURHAM | DURHAM | ELLIS RD | RIDDLE RD |
| DURHAM | DURHAM | GEER ST | |
| DURHAM | DURHAM | I40 | MILE272 |
| DURHAM | DURHAM | I40 | NC751 |
| DURHAM | DURHAM | I85 | AVONDALE DR |
| DURHAM | DURHAM | I85 | NC147 |
| DURHAM | | I85 | RP1632 |
| DURHAM | DURHAM | PLUM ST | VALE ST |
| DURHAM | DURHAM | ROXBORO RD | OAK HILL DR |

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| DURHAM | | RP1464 | US501 |
| DURHAM | | RP1838 | DURHA |
| DURHAM | | US501 | RP1628 |
| DURHAM | | US501 | RP1629 |
| DURHAM | | US501 | RP1640 |
| DURHAM | | US70 | RP1926 |
| EDGECOMBE | PRINCEVILLE | MUTUAL BLVD | OLD NC44 |
| EDGECOMBE | | NC42 | NC111 |
| EDGECOMBE | | NC42 | RP1608 |
| EDGECOMBE | | US64A | TARBORO |
| FORSYTH | | I40 | MILE201 |
| FORSYTH | W SALEM | I40 | NC150 |
| FORSYTH | CLEMMONS | I40 | RP1101 |
| FORSYTH | W SALEM | I40 | US158 |
| FORSYTH | W SALEM | I40 | US52 |
| FORSYTH | KERNERSVILLE | I40B | NC66 |
| FORSYTH | W SALEM | OLD WALKERTOWN RD | OAKDALE TER |
| FORSYTH | | RP1003 | RP2687 |
| FORSYTH | | RP2643 | RP2794 |
| FORSYTH | W SALEM | SPRAGUE ST | WAUGHTOWN ST |
| FORSYTH | | US158 | GUILF |
| FORSYTH | CLEMMONS | US158 | HAMPTON RD |
| FORSYTH | | US158 | RP1971 |
| FRANKLIN | | NC56 | RP1109 |
| FRANKLIN | | NC56 | RP1622 |
| FRANKLIN | | NC98 | RP1101 |
| FRANKLIN | | US401 | RU1702 |
| GASTON | GASTONIA | I85 | MILE016 |
| GASTON | GASTONIA | I85 | MODENA ST |
| GASTON | | I85 | NC7 |
| GASTON | | I85 | RP1302 |
| GASTON | | I85 | US74 |
| GASTON | | NC16 | DEAD END RD |
| GASTON | | RP2400 | NC274 |
| GASTON | | RP2400 | RP2403 |
| GATES | GATESVILLE | US13 | RP1131 |
| GATES | | US13 | US158 |
| GRAHAM | | US129 | RP1103 |
| GRANVILLE | BUTNER | GATE 2 RD | |
| GRANVILLE | | I85 | US15 |
| GRANVILLE | | I85 | US15 |
| GRANVILLE | | I85 | US15 |
| GRANVILLE | BUTNER | NC56 | BIRCH DR |
| GRANVILLE | | NC56 | RP1625 |
| GRANVILLE | | NC96 | RP1422 |
| GRANVILLE | | NC96 | RP1623 |
| GRANVILLE | | RP1445 | RP1505 |
| GRANVILLE | | US15 | RP1443 |
| GRANVILLE | | US158 | US15 |
| GUILFORD | GREENSBORO | BATTLEGROUND AVE | DAVID CALDWELL RD |
| GUILFORD | GREENSBORO | FRIENDLY AVE | DOWN WIND RD |
| GUILFORD | GREENSBORO | GALLIMORE DAIRY RD | ALBERT PICK RD |
| GUILFORD | GREENSBORO | HOLDEN RD | COLLIER DR |
| GUILFORD | GREENSBORO | I40 | BURNT POPLAR RD |
| GUILFORD | GREENSBORO | I40 | FREEMAN MILL RD |
| GUILFORD | | I40 | GREEN |
| GUILFORD | GREENSBORO | I40 | GUILFORD COLLEGE RD |
| GUILFORD | GREENSBORO | I40 | WENDOVER AVE |
| GUILFORD | GREENSBORO | I85 | CREEK RIDGE RD |
| GUILFORD | | I85 | NC62 |
| GUILFORD | GREENSBORO | I85 | RANDLEMAN RD |
| GUILFORD | | I85 | RP1129 |
| GUILFORD | GREENSBORO | MARKET ST | BOEING DR |
| GUILFORD | | NC150 | RP2501 |
| GUILFORD | | NC61 | RP3224 |
| GUILFORD | | NC62 | RP1137 |
| GUILFORD | | NC68 | KELLY FORD RD |
| GUILFORD | | NC68 | NC65 |
| GUILFORD | | NC68 | RP2023 |
| GUILFORD | | NC68 | RP2048 |
| GUILFORD | HIGH POINT | NC68 | WILLARD DAIRY RD |
| GUILFORD | | RP3549 | RP3317 |
| GUILFORD | GREENSBORO | TRENT ST | SAINT CHARLES LN |
| GUILFORD | | US158 | RP2037 |

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| GUILFORD | GREENSBORO | US29 | CONE BLVD |
| GUILFORD | | US29 | RP1145 |
| GUILFORD | GREENSBORO | US421 | ALAMANCE CHURCH RD |
| GUILFORD | | US421 | RP3394 |
| GUILFORD | GREENSBORO | WENDOVER AVE | SPRING GARDEN ST |
| HALIFAX | | I95 | NASH |
| HALIFAX | | I95 | NC903 |
| HALIFAX | | I95 | RP1002 |
| HALIFAX | | NC125 | RU1814 |
| HALIFAX | | NC43 | NC561 |
| HALIFAX | | NC48 | RP1555 |
| HALIFAX | | NC903 | SCOTLAND NECK |
| HALIFAX | ROANOKE RAPIDS | US158 | CHURCH ST |
| HARNETT | | I95 | DUNN |
| HARNETT | | I95 | RP1709 |
| HARNETT | | I95 | RP1808 |
| HARNETT | | NC217 | RP2021 |
| HARNETT | | NC24 | RP1117 |
| HARNETT | | NC87 | RP1207 |
| HARNETT | | US401 | RP1403 |
| HARNETT | LILLINGTON | US421 | RP1269 |
| HAYWOOD | | I40 | MILE012 |
| HAYWOOD | | I40 | MILE017 |
| HAYWOOD | | I40 | MILE030 |
| HAYWOOD | | I40 | US276 |
| HAYWOOD | | PVA WELCOME CENTER | |
| HAYWOOD | | US19 | RP1361 |
| HAYWOOD | | US23 | US276 |
| HENDERSON | | I26 | MILE017 |
| HENDERSON | | I26 | MILE024 |
| HENDERSON | | I26 | MILE025 |
| HENDERSON | | I26 | MILE026 |
| HENDERSON | HENDERSONVILLE | US25 | STONEY MTN RD |
| HENDERSON | HENDERSONVILLE | US64 | KING ST |
| HERTFORD | | NC11 | RP1108 |
| HERTFORD | | NC11 | RP1213 |
| HERTFORD | | NC561 | RP1198 |
| HERTFORD | | RP1212 | RP1213 |
| HERTFORD | | US13 | GATES |
| HERTFORD | | US158 | RP1179 |
| HOKE | | NC211 | RP1203 |
| IREDELL | | I40 | RP1502 |
| IREDELL | | I40 | RP1512 |
| IREDELL | | I77 | MECKL |
| IREDELL | | I77 | RP1109 |
| IREDELL | | I77 | RP1311 |
| IREDELL | | I77 | RP1312 |
| IREDELL | STATESVILLE | I77 | RP2171 |
| IREDELL | | I77 | RP2342 |
| IREDELL | | I77 | US21 |
| IREDELL | | I77 | US21 |
| IREDELL | | I77 | US70 |
| IREDELL | | NC115 | RP2948 |
| IREDELL | MOORESVILLE | PLAZA DR | LOCK DOCK PL |
| JACKSON | | RP1120 | RU1121 |
| JACKSON | | US23 | US23B |
| JACKSON | | US441 | US19 |
| JOHNSTON | KENLY | CHURCH ST | EDGERTON ST |
| JOHNSTON | | I40 | MILE319 |
| JOHNSTON | | I40 | RP1322 |
| JOHNSTON | BENSON | I95 | I40 |
| JOHNSTON | | I95 | RP1007 |
| JOHNSTON | SMITHFIELD | I95 | RP1007 |
| JOHNSTON | | I95 | RP1171 |
| JOHNSTON | | I95 | RP2130 |
| JOHNSTON | | I95 | US701 |
| JOHNSTON | SMITHFIELD | MARKET ST | 5TH ST |
| JOHNSTON | SMITHFIELD | MARKET ST | SECOND ST |
| JOHNSTON | | NC242 | RP1117 |
| JOHNSTON | | NC39 | RU1734 |
| JOHNSTON | | NC42 | RP1524 |
| JOHNSTON | | NC42 | RP2117 |
| JOHNSTON | | NC50 | RP1378 |
| JOHNSTON | | RP1003 | US70 |

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| JOHNSTON | | RP2320 | RP2360 |
| JOHNSTON | | RP2398 | US70 |
| JOHNSTON | SELMA | US70 | |
| JOHNSTON | CLAYTON | US70 | |
| JOHNSTON | | US70 | RP1002 |
| JOHNSTON | | US70 | RP2308 |
| JOHNSTON | | US70 | RP2522 |
| JOHNSTON | | US70 | RP2556 |
| JOHNSTON | | US70 | RP2556 |
| JOHNSTON | | US70 | RU2314 |
| JOHNSTON | | US701 | RP1137 |
| JOHNSTON | | US701 | RP1181 |
| JOHNSTON | | US70B | RP1918 |
| JONES | | NC58 | RP1122 |
| JONES | | US17 | A ST |
| LEE | SANFORD | HORNER BLVD | WALL ST |
| LEE | | NC87 | RP1139 |
| LEE | | RP1166 | RP1175 |
| LEE | | US1 | CHATH |
| LEE | | US1 | MOORE |
| LEE | | US1 | RP1198 |
| LEE | | US1 | RP1466 |
| LEE | | US421 | RP1531 |
| LENIOR | | NC11 | RP1168 |
| LENIOR | | NC11 | RP1353 |
| LENIOR | | NC58 | RP1920 |
| LENIOR | | RP1514 | RP1513 |
| LENIOR | | RP1573 | RP1607 |
| LENIOR | | US70 | RP1603 |
| LENIOR | | US70 | RP1603 |
| LENIOR | | US70 | RP2001 |
| LINCOLN | LINCOLNTON | GENERALS BLVD | ASPEN ST |
| LINCOLN | | NC150 | RP1367 |
| LINCOLN | | NC16 | RP1388 |
| LINCOLN | | NC16 | RP1390 |
| LINCOLN | | NC182 | RP1168 |
| LINCOLN | | NC27 | NC150 |
| LINCOLN | | NC27 | RP1138 |
| LINCOLN | | NC27 | RP1712 |
| LINCOLN | | NC27 | RP1712 |
| MACON | | US23 | RP1152 |
| MACON | | US23 | RP1682 |
| MACON | FRANKLIN | US441 | |
| MACON | | US64 | RP1448 |
| MACON | | US64 | RP1448 |
| MACON | | US64 | RP1448 |
| MADISON | | US23 | RP1347 |
| MADISON | | US23 | RP1506 |
| MADISON | | US23 | RP1508 |
| MADISON | | US23 | RU1352 |
| MADISON | | US25 | RP1140 |
| MARTIN | WILLIAMSTON | EAST BLVD | WILLOW DR |
| MARTIN | WILLIAMSTON | HAUGHTON ST | LIBERTY ST |
| MARTIN | | NC11 | BERTI |
| MARTIN | | NC11 | BERTI |
| MARTIN | | NC11 | BERTI |
| MARTIN | | PVA FERTILIZER COMPA | |
| MARTIN | | US13 | RP1139 |
| MARTIN | | US13 | RP1405 |
| MCDOWELL | | I40 | BURKE |
| MCDOWELL | | I40 | MILE073 |
| MCDOWELL | | I40 | MILE093 |
| MCDOWELL | | I40 | RP1001 |
| MCDOWELL | | RP1001 | RP1183 |
| MCDOWELL | MARION | US221 | HANKINS RD |
| MCDOWELL | | US221 | RP1555 |
| MCDOWELL | | US221 | RP1589 |
| MCDOWELL | | US64 | RUTHE |
| MECKLENBERG | CHARLOTTE | BROOKSHIRE BLVD | HONEYWOOD AVE |
| MECKLENBERG | CHARLOTTE | BROOKSHIRE FRWY | BEATTIES FORD RD |
| MECKLENBERG | CHARLOTTE | I77 | NC16 |
| MECKLENBERG | CHARLOTTE | I77 | REMOUNT RD |
| MECKLENBERG | CHARLOTTE | I77 | WOODLAWN RD |
| MECKLENBERG | CHARLOTTE | I85 | BILLY GRAHAM PKWY |

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| MECKLENBERG | CHARLOTTE | I85 | I77 |
| MECKLENBERG | CHARLOTTE | I85 | RP2074 |
| MECKLENBERG | CHARLOTTE | I85 | STATESVILLE RD |
| MECKLENBERG | CHARLOTTE | INDEPENCDENCE BLVD | ALBEMARLE RD |
| MECKLENBERG | CHARLOTTE | INDEPENDENCE BLVD | GLENDORA DR |
| MECKLENBERG | MATTHEWS | INDEPENDENCE BLVD | WINDSOR SQUARE DR |
| MECKLENBERG | CHARLOTTE | PARK RD | MOCKINGBIRD LN |
| MECKLENBERG | CHARLOTTE | PARKWOOD AVE | 16TH ST |
| MECKLENBERG | CHARLOTTE | PVA COTTWONWOOD ST | |
| MECKLENBERG | CHARLOTTE | ROZZELLES FERRY RD | CORNONET WAY |
| MECKLENBERG | | RP0000 | FAYETTE RD |
| MECKLENBERG | HUNTERSVILLE | SAM FURR RD | GLENHURST DR |
| MECKLENBERG | CHARLOTTE | STARITA RD | I85 |
| MECKLENBERG | CHARLOTTE | THE PLAZA | JAMES RD |
| MECKLENBERG | CHARLOTTE | US21 | LAKEVIEW RD |
| MECKLENBERG | CHARLOTTE | W T HARRIS BLVD | DEMILL LN |
| MECKLENBERG | CHARLOTTE | W T HARRIS BLVD | STATESVILLE RD |
| MITCHELL | | NC226 | RP1116 |
| MONTGOMERY | | I73 | NC24 |
| MONTGOMERY | | I73 | US220A |
| MONTGOMERY | | US220 | NC211 |
| MONTGOMERY | | US220 | RANDO |
| MOORE | | NC24 | MONTG |
| MOORE | | NC24 | RP1825 |
| MOORE | | NC24 | RU1279 |
| MOORE | | RP1229 | RP1230 |
| MOORE | SOUTHERN PINES | US1 | MORGANTON RD |
| MOORE | | US1 | RP1825 |
| NASH | | I95 | NC58 |
| NASH | | I95 | RP1604 |
| NASH | | I95 | RP1717 |
| NASH | ROCKY MOUNT | NC4 | US301 |
| NASH | | NC58 | RP1425 |
| NASH | | NC97 | RP1940 |
| NASH | | RP1524 | I95 |
| NASH | | US264 | RP1105 |
| NASH | | US264 | WILSO |
| NASH | ROCKY MOUNT | WESLEYAN BLVD | COLLEGE RD |
| NEW HANOVER | WILMINGTON | OLEANDER DR | HAWTHORNE PL |
| NEW HANOVER | | RP1187 | US421 |
| NEW HANOVER | | RP1322 | RP1321 |
| NEW HANOVER | | US17 | PENDER |
| NEW HANOVER | | US17 | RP1399 |
| NEW HANOVER | | US421 | NC132 |
| NEW HANOVER | | US421 | PENDE |
| NORTHAMPTON | | I95 | NC46 |
| NORTHAMPTON | | I95 | NC46 |
| NORTHAMPTON | | NC48 | RP1296 |
| NORTHAMPTON | CONWAY | US158 | |
| NORTHAMPTON | GARYSBURG | US158 | RP1239 |
| ONSLOW | | NC53 | RP1216 |
| ONSLOW | JACKSONVILLE | PVA JACKSONVILLE | |
| ONSLOW | | RP1413 | RP1848 |
| ONSLOW | JACKSONVILLE | US17 | RIVERVIEW ST |
| ONSLOW | | US17 | RP1327 |
| ONSLOW | | US17 | RP1410 |
| ONSLOW | | US17 | RP1439 |
| ONSLOW | | US258 | RP1235 |
| ONSLOW | | US258 | RP1263 |
| ORANGE | CHAPEL HILL | AIRPORT RD | HOMESTEAD RD |
| ORANGE | CHAPEL HILL | CAMERON AVE | MCCAULEY ST |
| ORANGE | | I40 | RP1120 |
| ORANGE | | I40 | RP1723 |
| ORANGE | | US70 | RP1560 |
| PAMLICO | | NC306 | BEAUF |
| PAMLICO | | RP1322 | RP1321 |
| PASQUOTANK | ELIZABETH CITY | HUGHES BLVD | SAWYER ST |
| PASQUOTANK | ELIZABETH CITY | WEEKSVILLE RD | PITTS CHAPEL RD |
| PENDER | | I40 | NEW H |
| PENDER | | NC210 | RP1409 |
| PENDER | | NC53 | NC50 |
| PENDER | | NC53 | RP1122 |
| PENDER | | NC53 | RP1128 |
| PENDER | | NC53 | RP1520 |

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|---|---|---|---|
| PENDER | | RP1002 | NC210 |
| PENDER | | RP1336 | RP1345 |
| PENDER | | US17 | RP1561 |
| PENDER | | US421 | RP1113 |
| PENDER | | US421 | RP1209 |
| PERQUIMANS | HERTFORD | US17 | |
| PERSON | | US158 | RU1725 |
| PERSON | | US501 | RP1330 |
| PERSON | | US501 | RP1500 |
| PERSON | | US501 | RP1715 |
| PITT | GREENVILLE | DICKINSON AVE | GRACE ST |
| PITT | GREENVILLE | MEMORIAL DR | IONE ST |
| PITT | | NC33 | RP1403 |
| PITT | | RP1529 | RP1541 |
| PITT | | RP1753 | RP1922 |
| PITT | GREENVILLE | STANTONSBURG RD | BS BARBECUE RD |
| PITT | | US264 | RP1529 |
| PITT | | US264 | RP1529 |
| PITT | | US264A | RP2102 |
| POLK | | I26 | MILE031 |
| POLK | | I26 | MILE032 |
| POLK | | I26 | MILE036 |
| POLK | | I26 | US74 |
| RANDOLPH | ASHEBORO | DIXIE DR | DUBLIN RD |
| RANDOLPH | LIBERTY | GREENSBORO ST | LIBERTY GROVE RD |
| RANDOLPH | | I73,R | RP1121 |
| RANDOLPH | ARCHDALE | I85 | TRINITY |
| RANDOLPH | | NC49 | RP1194 |
| RANDOLPH | | RP2114 | RP2113 |
| RANDOLPH | LIBERTY | RP2407 | RP2409 |
| RANDOLPH | | US220 | MONTG |
| RANDOLPH | | US220 | RP1217 |
| RANDOLPH | SEAGROVE | US220 | RP2856 |
| RANDOLPH | | US421 | RP2261 |
| RANDOLPH | | US64 | RP1003 |
| RANDOLPH | | US64 | RP1416 |
| RANDOLPH | | US64 | RP1419 |
| RANDOLPH | | US64 | RP1424 |
| RICHMOND | ROCKINGHAM | BROAD AVE | MANESS AVE |
| RICHMOND | | RP1486 | RP1424 |
| RICHMOND | | US1 | MOORE |
| RICHMOND | | US1 | RP1100 |
| RICHMOND | | US1 | RP1203 |
| RICHMOND | | US1 | RP1696 |
| ROBESON | SAINT PAULS | FIFTH ST | BLUE ST |
| ROBESON | | I95 | NC72 |
| ROBESON | LUMBERTON | I95 | NC72 |
| ROBESON | | I95 | RP1155 |
| ROBESON | | I95 | RP1529 |
| ROBESON | | I95 | US301 |
| ROBESON | | I95 | US301 |
| ROBESON | | I95 | US74 |
| ROBESON | LUMBERTON | I95 | US74 |
| ROBESON | | NC211 | RP1001 |
| ROBESON | ROWLAND | PVA PARKING LOT | |
| ROBESON | | RP1004 | RP1968 |
| ROBESON | | RP1352 | RP1355 |
| ROBESON | | RP1589 | NC72 |
| ROBESON | | RP1752 | US301 |
| ROBESON | | RP2100 | NC211 |
| ROBESON | | US74 | NC130 |
| ROBESON | | US74 | NC72 |
| ROBESON | | US74 | RP1165 |
| ROBESON | | US74 | RP1197 |
| ROBESON | | US74 | RP1373 |
| ROBESON | | US74 | RP1550 |
| ROBESON | | US74 | RP2210 |
| ROBESON | | US74 | RP2225 |
| ROBESON | | US74 | RP2245 |
| ROBESON | LUMBERTON | US74 | RP2500 |
| ROCKINGHAM | REIDSVILLE | FREEWAY DR | GOLDWATER TR |
| ROCKINGHAM | | NC135 | RP2154 |
| ROCKINGHAM | | NC135 | RP2205 |
| ROCKINGHAM | | NC68 | RP1103 |

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|---|---|---|---|
| ROCKINGHAM | REIDSVILLE | RICHARDSON DR | COACH ST |
| ROCKINGHAM | | US158 | RP2394 |
| ROCKINGHAM | | US158 | RP2670 |
| ROCKINGHAM | | US220 | RP1360 |
| ROCKINGHAM | | US220 | RP1378 |
| ROCKINGHAM | | US220 | RU1391 |
| ROCKINGHAM | EDEN | VAN BUREN RD | ARBOR LN |
| ROWAN | SALISBURY | I85 | RP1002 |
| ROWAN | | I85 | RP1002 |
| ROWAN | | I85 | RP2114 |
| ROWAN | | I85 | RP2538 |
| ROWAN | SALISBURY | JAKE ALEXANDER BLVD | I85 |
| ROWAN | | PVA DERRICK TRUCK ST | |
| ROWAN | | RP1221 | RP2335 |
| ROWAN | | RP1560 | US29 |
| ROWAN | | RP1728 | RP1526 |
| ROWAN | | RP1984 | RP2019 |
| ROWAN | | RP2539 | RP1002 |
| ROWAN | ROCKWELL | US52 | GOLD HILL AVE |
| ROWAN | | US52 | RP2340 |
| RUTHERFORD | | NC226 | RP1727 |
| RUTHERFORD | | RP2210 | RP2147 |
| RUTHERFORD | | US74 | RP1954 |
| RUTHERFORD | SPINDALE | US74B | ELM ST |
| SAMPSON | ROSEBORO | EAST ST | NC242 |
| SAMPSON | | NC24 | RP1240 |
| SAMPSON | | NC24 | RP1262 |
| SAMPSON | | NC24 | RP1301 |
| SAMPSON | | NC24 | RP1406 |
| SAMPSON | | NC24 | RP1420 |
| SAMPSON | | NC41 | BLADE |
| SAMPSON | | NC55 | RP1801 |
| SAMPSON | | RP1004 | RP1930 |
| SAMPSON | NEWTON GROVE | US13 | ALEX BENTON RD |
| SAMPSON | | US13 | RP1658 |
| SAMPSON | HARRELLS | US421 | RP1115 |
| SAMPSON | | US421 | RP1128 |
| SAMPSON | | US421 | RP1141 |
| SAMPSON | HARRELLS | US421 | RP1152 |
| SAMPSON | | US421 | RP1933 |
| SAMPSON | | US701 | JOHNS |
| SAMPSON | | US701 | RP1734 |
| SCOTLAND | | NC79 | RP1119 |
| SCOTLAND | | RP1001 | RP1392 |
| SCOTLAND | | RP1323 | RP1369 |
| SCOTLAND | | RP1323 | RP1425 |
| SCOTLAND | | RP1323 | RP1425 |
| SCOTLAND | | US401 | RP1305 |
| SCOTLAND | | US401 | US401B |
| SCOTLAND | | US74 | US74B |
| SCOTLAND | | US74 | US74B |
| STANLY | | NC24 | NC205 |
| STANLY | | NC49 | RP1508 |
| STOKES | KING | MOUNTAIN VIEW RD | HELSABECK RD |
| STOKES | | NC65 | RP2084 |
| STOKES | | NC8 | RP1001 |
| STOKES | | US52 | RP1106 |
| SURRY | | NC104 | RP1923 |
| SURRY | ELKIN | NC268 | PLEASANT HILL DR |
| SURRY | | NC89 | NC18 |
| SURRY | | NC89 | RP1607 |
| SURRY | | NC89 | RP1639 |
| SURRY | | NC89 | RP1755 |
| SURRY | | NC89 | VA |
| SURRY | MOUNT AIRY | US52 | |
| SURRY | | US52 | RP1856 |
| SWAIN | | US19 | NC28 |
| SWAIN | | US74 | RU1305 |
| UNION | MONROE | ROOSEVELT BLVD | DICKERSON BLVD |
| UNION | | RP1001 | RP1620 |
| UNION | | RP1301 | RP1307 |
| UNION | MONROE | SKYWAY DR | CEDAR ST |
| UNION | | US601 | RP1003 |
| UNION | | US601 | RP1004 |

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|---|---|---|---|
| UNION | | US601 | RP1622 |
| UNION | | US601 | RP2112 |
| UNION | | US601 | SC |
| UNION | MARSHVILLE | US74 | |
| UNION | | US74 | RP1373 |
| UNION | INDIAN TRAIL | US74 | RP1520 |
| UNION | | US74 | RP1754 |
| VANCE | HENDERSON | I85 | NC39 |
| VANCE | | I85 | RP1371 |
| VANCE | | I85 | US1 |
| VANCE | | I85 | US158 |
| VANCE | | RP1533 | RP1596 |
| VANCE | | RP1577 | NC39 |
| VANCE | | US1 | RP1502 |
| WAKE | RALEIGH | BARWELL RD | DAMON CT |
| WAKE | RALEIGH | BIG OAK ST | SOURWOOD ST |
| WAKE | MORRISVILLE | CHAPEL HILL RD | WATKINS RD |
| WAKE | CARY | CHATHAM ST | WEST ST |
| WAKE | | I40 | MILE301 |
| WAKE | | I40 | NC54 |
| WAKE | | I40 | RP1795 |
| WAKE | | I40 | RP2547 |
| WAKE | | I40 | US1 |
| WAKE | RALEIGH | I440 | WAKE FOREST RD |
| WAKE | RALEIGH | LEESVILLE RD | RAY RD |
| WAKE | FUQUAY VARINA | MAIN ST | ACADEMY ST |
| WAKE | MORRISVILLE | MORRISVILLE CARPENTE | DAVIS DR |
| WAKE | | NC55 | RP1301 |
| WAKE | | NC55 | RP1624 |
| WAKE | | RP1101 | RP1125 |
| WAKE | | RP1152 | RP1539 |
| WAKE | | RP1664 | ROCKWOOD DR |
| WAKE | | RP2555 | RP2542 |
| WAKE | CARY | US1 | KILDAIRE FARM RD |
| WAKE | | US1 | RP1010 |
| WAKE | | US1 | US64 |
| WAKE | | US264 | NC97 |
| WAKE | | US401 | RP2036 |
| WAKE | | US401 | RP2041 |
| WAKE | KNIGHTDALE | US64 | |
| WAKE | | US64 | NC55 |
| WAKE | | US64B | US64 |
| WAKE | | US70 | RP3052 |
| WARREN | | I85 | RP1210 |
| WARREN | | US158 | RP1317 |
| WARREN | | US158 | RP1325 |
| WASHINGTON | | NC32 | NC45 |
| WASHINGTON | | NC45 | US64 |
| WASHINGTON | PLYMOUTH | US64 | PEMBROKE CIR |
| WASHINGTON | | US64 | TYRRE |
| WATAUGA | | NC105 | RP1113 |
| WATAUGA | | US321 | COUNTRY CLUB DR |
| WAYNE | | NC111 | RP1911 |
| WAYNE | | NC55 | RP1105 |
| WAYNE | | NC55 | RP1784 |
| WAYNE | | NC581 | RP1002 |
| WAYNE | | NC581 | RP1343 |
| WAYNE | | RP1002 | RP1353 |
| WAYNE | | US117 | RP1926 |
| WAYNE | | US13 | RP1127 |
| WAYNE | | US70 | LENOI |
| WILKES | WILKESBORO | NC16 | CORPORATION ST |
| WILKES | | NC18 | RP1726 |
| WILKES | | NC18 | RP1763 |
| WILKES | | NC268 | RP2090 |
| WILKES | | PVA JOHNSTON LUMBER | |
| WILKES | | US421 | RP1152 |
| WILKES | | US421 | RP2402 |
| WILSON | | I95 | RP1103 |
| WILSON | | NC222 | NC111 |
| WILSON | | NC42 | RP1500 |
| WILSON | | PVA BENCHMARK CAROLI | |
| WILSON | | RP1001 | RP1156 |
| WILSON | | RP1003 | RP1418 |

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|---|---|---|
| WILSON | RP1103 | RP1175 |
| WILSON | RP1136 | RP1131 |
| WILSON | US264 | RP1507 |
| WILSON | US264 | RP1622 |
| WILSON | US264A | RP1001 |
| WILSON | US301 | RP1003 |
| WILSON | US301 | RP1340 |
| WILSON | US301 | RP1648 |
| WILSON | US301 | RP1658 |
| YADKIN | I77 | MILE073 |
| YADKIN | I77 | SURRY |
| YADKIN | NC67 | RP1510 |
| YADKIN | NC67 | RP1542 |
| YADKIN | US421 | I77 |
| YADKIN | US421 | RP1112 |
| YADKIN | US421 | RP1141 |
| YADKIN | US421 | RP1166 |
| YADKIN | US421 | RU1113 |
| YADKIN | US421 | RU1126 |
| YANCEY | US19E | RP1196 |
| YANCEY | US19E | RP1307 |
| YANCEY | US19E | RP1454 |

## Table 6
## Ten Locations Having the Highest Number of Truck-Involved Crashes Within Each of the 30 Counties Targeted for Increased CMV Enforcement in FY2001

| COUNTY | ACCTOWN | ONROAD | FROMRD | FREQ |
|---|---|---|---|---|
| ALAMANCE | BURLINGTON | I40 | NC62 | 31 |
| ALAMANCE | GRAHAM | I40 | NC87 | 26 |
| ALAMANCE | GRAHAM | I40 | NC49 | 25 |
| ALAMANCE | GRAHAM | I40 | NC54 | 25 |
| ALAMANCE | MEBANE | I40 | RP1928 | 24 |
| ALAMANCE | BURLINGTON | I40 | RP1158 | 22 |
| ALAMANCE | MEBANE | I40 | RP1007 | 12 |
| ALAMANCE | BURLINGTON | I40 | RP1149 | 11 |
| ALAMANCE | GRAHAM | I40 | RP1981 | 10 |
| ALAMANCE | | I40 | GUILF | 9 |
| BUNCOMBE | ASHEVILLE | I40 | US19 | 21 |
| BUNCOMBE | ASHEVILLE | I26 | NC191 | 20 |
| BUNCOMBE | ASHEVILLE | I40 | US25 | 18 |
| BUNCOMBE | ASHEVILLE | I26 | NC146 | 14 |
| BUNCOMBE | ASHEVILLE | I40 | NC191 | 13 |
| BUNCOMBE | ASHEVILLE | I240 | US19 | 8 |
| BUNCOMBE | | I26 | NC280 | 8 |
| BUNCOMBE | ASHEVILLE | I40 | I26 | 8 |
| BUNCOMBE | | I40 | RP1205 | 8 |
| BUNCOMBE | ASHEVILLE | I40 | RP1220 | 8 |
| BURKE | MORGANTON | I40 | US64 | 20 |
| BURKE | | NC181 | RP1405 | 20 |
| BURKE | | I40 | RP1001 | 18 |
| BURKE | MORGANTON | I40 | NC18 | 17 |
| BURKE | | I40 | RP1761 | 17 |
| BURKE | MORGANTON | I40 | RP1142 | 12 |
| BURKE | | I40 | RP1704 | 11 |
| BURKE | | I40 | RP1755 | 9 |
| BURKE | HILDEBRAN | I40 | RP1002 | 8 |
| BURKE | | I40 | RP1758 | 8 |
| CABARRUS | CONCORD | I85 | RP1394 | 49 |
| CABARRUS | CONCORD | I85 | NC73 | 40 |
| CABARRUS | CONCORD | I85 | US29 | 22 |
| CABARRUS | KANNAPOLIS | I85 | RP2180 | 11 |
| CABARRUS | KANNAPOLIS | I85 | RP2126 | 10 |
| CABARRUS | CONCORD | US601 | OLD CHARLOTTE RD | 8 |
| CABARRUS | CONCORD | I85 | RP2894 | 7 |
| CABARRUS | CONCORD | NC73 | I85 | 7 |
| CABARRUS | CONCORD | US601 | CABARRUS AVE | 7 |
| CABARRUS | | US601 | NC24 | 7 |
| CATAWBA | HICKORY | I40 | RP1007 | 23 |
| CATAWBA | HICKORY | I40 | RP1476 | 14 |
| CATAWBA | CLAREMONT | I40 | RP1717 | 13 |
| CATAWBA | CLAREMONT | I40 | RP1715 | 12 |
| CATAWBA | HICKORY | US321 | US70 | 10 |
| CATAWBA | HICKORY | 1ST AVE | 1ST ST | 9 |
| CATAWBA | HICKORY | I40 | US321 | 9 |
| CATAWBA | HICKORY | US70 | US321 | 9 |
| CATAWBA | HICKORY | FAIRGROVE CHURCH RD | US70 | 8 |
| CLEVELAND | | I85 | NC161 | 22 |
| CLEVELAND | KINGS MOUNTAIN | I85 | RP2283 | 19 |
| CLEVELAND | | I85 | NC216 | 15 |
| CLEVELAND | | US74 | RP2238 | 12 |
| CLEVELAND | MOORESBORO | US74 | US74B | 12 |
| CLEVELAND | SHELBY | DIXON BLVD | EARL RD | 10 |
| CLEVELAND | | US74 | RP1161 | 7 |
| CLEVELAND | SHELBY | DIXON BLVD | POST RD | 6 |
| CLEVELAND | | I85 | US29 | 6 |
| CLEVELAND | | US74 | NC226 | 6 |
| CUMBERLAND | FAYETTEVILLE | EASTERN BLVD | GROVE ST | 14 |
| CUMBERLAND | FAYETTEVILLE | I95 | US13 | 14 |
| CUMBERLAND | | I95 | NC82 | 13 |
| CUMBERLAND | FAYETTEVILLE | I95 | NC53 | 12 |
| CUMBERLAND | | I95 | RP1806 | 12 |
| CUMBERLAND | | I95 | NC87 | 11 |

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|---|---|---|---|---|
| CUMBERLAND | FAYETTEVILLE | GROVE ST | B ST | 9 |
| CUMBERLAND | FAYETTEVILLE | GROVE ST | EASTERN BLVD | 9 |
| CUMBERLAND | | I95 | RP1815 | 9 |
| CUMBERLAND | SPRING LAKE | BRAGG BLVD | SPRING AVE | 8 |
| DAVIDSON | LEXINGTON | I85 | US64 | 22 |
| DAVIDSON | LEXINGTON | I85 | NC150 | 15 |
| DAVIDSON | | I85 | RP2205 | 14 |
| DAVIDSON | LEXINGTON | I85 | US29 | 13 |
| DAVIDSON | | I85 | RP1133 | 12 |
| DAVIDSON | THOMASVILLE | I85 | NC109 | 11 |
| DAVIDSON | LEXINGTON | I85 | NC8 | 10 |
| DAVIDSON | | I85 | RP1295 | 9 |
| DAVIDSON | | US64 | RP2099 | 9 |
| DAVIDSON | | I85 | RP2010 | 7 |
| DURHAM | DURHAM | I85 | GUESS RD | 27 |
| DURHAM | DURHAM | I85 | US70 | 23 |
| DURHAM | DURHAM | I85 | RP1637 | 22 |
| DURHAM | DURHAM | I85 | HILLANDALE RD | 21 |
| DURHAM | DURHAM | I40 | NC55 | 20 |
| DURHAM | DURHAM | ERWIN RD | MAIN ST | 19 |
| DURHAM | DURHAM | I40 | RP1999 | 19 |
| DURHAM | DURHAM | I85 | DUKE ST | 19 |
| DURHAM | DURHAM | I40 | NC54 | 18 |
| DURHAM | DURHAM | I85 | RP1632 | 17 |
| FORSYTH | WINSTON SALEM | I40 | US52 | 36 |
| FORSYTH | WINSTON SALEM | I40 | US311 | 23 |
| FORSYTH | WINSTON SALEM | I40 | NC109 | 21 |
| FORSYTH | WINSTON SALEM | US52 | US421 | 19 |
| FORSYTH | WINSTON SALEM | US52 | AKRON DR | 18 |
| FORSYTH | CLEMMONS | I40 | RP1101 | 15 |
| FORSYTH | WINSTON SALEM | US52 | LIBERTY ST | 15 |
| FORSYTH | WINSTON SALEM | US52 | PATTERSON AVE | 15 |
| FORSYTH | KERNERSVILLE | I40 | NC66 | 14 |
| FORSYTH | CLEMMONS | I40 | RP1103 | 13 |
| GASTON | GASTONIA | I85 | RP1307 | 60 |
| GASTON | MCADENVILLE | I85 | NC7 | 46 |
| GASTON | GASTONIA | I85 | CHESTER ST | 33 |
| GASTON | MCADENVILLE | I85 | NC273 | 30 |
| GASTON | KINGS MOUNTAIN | I85 | US74 | 28 |
| GASTON | MCADENVILLE | I85 | RP2000 | 22 |
| GASTON | GASTONIA | I85 | OZARK AVE | 21 |
| GASTON | GASTONIA | I85 | NC274 | 19 |
| GASTON | BELMONT | I85 | RP2093 | 18 |
| GASTON | GASTONIA | I85 | COX RD | 15 |
| GUILFORD | GREENSBORO | I40 | WENDOVER AVE | 75 |
| GUILFORD | GREENSBORO | I85 | ELM EUGENE ST | 50 |
| GUILFORD | GREENSBORO | I40 | CHIMNEY ROCK RD | 43 |
| GUILFORD | GREENSBORO | I40 | RP3000 | 40 |
| GUILFORD | GREENSBORO | I40 | HIGH POINT RD | 38 |
| GUILFORD | GREENSBORO | I40 | GUILFORD COLLEGE RD | 36 |
| GUILFORD | GREENSBORO | I40 | NC6 | 36 |
| GUILFORD | GREENSBORO | I40 | NC68 | 36 |
| GUILFORD | | I40 | NC61 | 31 |
| GUILFORD | GREENSBORO | I40 | RP3045 | 31 |
| HALIFAX | | I95 | US158 | 36 |
| HALIFAX | | I95 | NC481 | 26 |
| HALIFAX | ROANOKE RAPIDS | I95 | NC903 | 26 |
| HALIFAX | ROANOKE RAPIDS | I95 | NC561 | 18 |
| HALIFAX | ROANOKE RAPIDS | I95 | NC125 | 16 |
| HALIFAX | | I95 | RP1600 | 7 |
| HALIFAX | | I95 | RP1002 | 5 |
| HALIFAX | WELDON | US158 | I95 | 5 |
| HALIFAX | ENFIELD | I95 | NASH | 4 |
| HALIFAX | | NC125 | US301 | 4 |
| HARNETT | | I95 | RP1808 | 25 |
| HARNETT | | I95 | RP1002 | 24 |
| HARNETT | DUNN | I95 | US421 | 20 |
| HARNETT | | I95 | RP1709 | 8 |
| HARNETT | DUNN | CUMBERLAND ST | ELLIS AVE | 6 |
| HARNETT | | I95 | RP1793 | 6 |
| HARNETT | | I95 | RP1811 | 5 |
| HARNETT | LILLINGTON | MAIN ST | FRONT ST | 5 |
| HARNETT | | NC210 | RP2072 | 5 |
| HARNETT | LILLINGTON | US421 | NC210 | 5 |

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|---|---|---|---|---|
| HAYWOOD | | I40 | RP1338 | 41 |
| HAYWOOD | CANTON | I40 | MILE035 | 28 |
| HAYWOOD | MAGGIE VALLEY | I40 | MILE019 | 22 |
| HAYWOOD | | I40 | NC215 | 22 |
| HAYWOOD | | I40 | US276 | 22 |
| HAYWOOD | WAYNESVILLE | I40 | MILE017 | 19 |
| HAYWOOD | | I40 | RP1004 | 19 |
| HAYWOOD | | I40 | MILE008 | 18 |
| HAYWOOD | | I40 | MILE018 | 16 |
| HAYWOOD | MAGGIE VALLEY | I40 | MILE016 | 15 |
| IREDELL | STATESVILLE | I77 | US21 | 54 |
| IREDELL | STATESVILLE | I77 | US70 | 37 |
| IREDELL | STATESVILLE | I77 | I40 | 25 |
| IREDELL | | I40 | RP1502 | 24 |
| IREDELL | STATESVILLE | I40 | US21 | 21 |
| IREDELL | | I77 | RP1890 | 18 |
| IREDELL | | US21 | I77 | 18 |
| IREDELL | STATESVILLE | I40 | RP1005 | 16 |
| IREDELL | | I77 | NC901 | 16 |
| JOHNSTON | SMITHFIELD | I95 | US701 | 34 |
| JOHNSTON | BENSON | I95 | NC50 | 24 |
| JOHNSTON | SMITHFIELD | I95 | US70B | 22 |
| JOHNSTON | SMITHFIELD | I95 | RP1007 | 16 |
| JOHNSTON | | I95 | RP1927 | 16 |
| JOHNSTON | SMITHFIELD | I95 | US70 | 15 |
| JOHNSTON | SMITHFIELD | US70 | US70B | 15 |
| JOHNSTON | | I40 | NC42 | 13 |
| JOHNSTON | MICRO | I95 | RP2137 | 12 |
| JOHNSTON | | I95 | RP2399 | 12 |
| MECKLENBERG | CHARLOTTE | I77 | I85 | 76 |
| MECKLENBERG | CHARLOTTE | I85 | GRAHAM ST | 71 |
| MECKLENBERG | CHARLOTTE | I77 | LASALLE ST | 61 |
| MECKLENBERG | CHARLOTTE | I85 | NC16 | 60 |
| MECKLENBERG | CHARLOTTE | I77 | I277 | 58 |
| MECKLENBERG | CHARLOTTE | I77 | TYVOLA RD | 58 |
| MECKLENBERG | CHARLOTTE | I77 | NC16 | 57 |
| MECKLENBERG | CHARLOTTE | I77 | ARROWOOD RD | 39 |
| MECKLENBERG | CHARLOTTE | I77 | CLANTON RD | 35 |
| MECKLENBERG | CHARLOTTE | I77 | NATIONS FORD RD | 35 |
| NASH | ROCKY MOUNT | I95 | NC4 | 12 |
| NASH | ROCKY MOUNT | I95 | US64 | 11 |
| NASH | | I95 | NC97 | 10 |
| NASH | ROCKY MOUNT | I95 | NC58 | 9 |
| NASH | DORTCHES | I95 | RP1544 | 9 |
| NASH | ROCKY MOUNT | I95 | RP1717 | 9 |
| NASH | DORTCHES | I95 | NC43 | 7 |
| NASH | | I95 | NC33 | 6 |
| NASH | | I95 | RP1700 | 6 |
| NASH | | I95 | RP1745 | 6 |
| NEW HANOVER | | US421 | US117 | 15 |
| NEW HANOVER | WILMINGTON | US17 | 3RD ST | 10 |
| NEW HANOVER | | US117 | RP1310 | 9 |
| NEW HANOVER | WILMINGTON | COLLEGE RD | NEW CENTRE DR | 8 |
| NEW HANOVER | | NC132 | RP2649 | 7 |
| NEW HANOVER | WILMINGTON | SHIPYARD BLVD | RUTLEDGE DR | 7 |
| NEW HANOVER | WILMINGTON | US117 | RP1302 | 7 |
| NEW HANOVER | | US421 | RP1352 | 7 |
| NEW HANOVER | WILMINGTON | MARKET ST | KERR AVE | 6 |
| NEW HANOVER | | US421 | RP2145 | 6 |
| ORANGE | | I40 | RP1120 | 41 |
| ORANGE | MEBANE | I40 | RP1114 | 26 |
| ORANGE | HILLSBOROUGH | I85 | NC86 | 20 |
| ORANGE | | I40 | RP1009 | 16 |
| ORANGE | | I85 | US70 | 12 |
| ORANGE | | I40 | NC86 | 9 |
| ORANGE | | I40 | RP1007 | 8 |
| ORANGE | | I40 | I85 | 7 |
| ORANGE | | I40 | RP1144 | 7 |
| ORANGE | CHAPEL HILL | FORDHAM BLVD | MANNING DR | 6 |
| PITT | GREENVILLE | MEMORIAL DR | DICKINSON AVE | 33 |
| PITT | | US264 | NC33 | 9 |
| PITT | GREENVILLE | MEMORIAL DR | GREENVILLE BLVD | 8 |
| PITT | | US258 | US264 | 6 |
| PITT | | NC11 | NC102 | 5 |

| | | | | |
|---|---|---|---|---|
| PITT | GREENVILLE | GREENVILLE BLVD | 10TH ST | 4 |
| PITT | GREENVILLE | MEMORIAL DR | 5TH ST | 4 |
| PITT | GREENVILLE | MEMORIAL DR | WESTHAVEN RD | 4 |
| PITT | | NC11 | RP1110 | 4 |
| PITT | | RP1401 | RP1403 | 4 |
| RANDOLPH | | I85 | RP1558 | 13 |
| RANDOLPH | ARCHDALE | I85 | US311 | 12 |
| RANDOLPH | ASHEBORO | DIXIE DR | PARK ST | 8 |
| RANDOLPH | | I85 | RP1547 | 7 |
| RANDOLPH | | US421 | RP2407 | 6 |
| RANDOLPH | ASHEBORO | DIXIE DR | NC42 | 5 |
| RANDOLPH | ASHEBORO | NC49 | RP1163 | 5 |
| RANDOLPH | | US220 | RP1504 | 5 |
| RANDOLPH | | US421 | RP2261 | 5 |
| RANDOLPH | ASHEBORO | DIXIE DR | CLIFF RD | 4 |
| ROBESON | LUMBERTON | I95 | US301 | 49 |
| ROBESON | | I95 | NC20 | 29 |
| ROBESON | LUMBERTON | I95 | US74 | 18 |
| ROBESON | | I95 | RP1726 | 16 |
| ROBESON | | I95 | RP1723 | 15 |
| ROBESON | LUMBERTON | I95 | NC72 | 12 |
| ROBESON | LUMBERTON | I95 | RP1529 | 11 |
| ROBESON | | I95 | RP1758 | 11 |
| ROBESON | LUMBERTON | I95 | NC711 | 10 |
| ROBESON | | I95 | RP1718 | 10 |
| ROWAN | SALISBURY | I85 | RP2528 | 22 |
| ROWAN | | I85 | RP2120 | 21 |
| ROWAN | | I85 | RP2538 | 21 |
| ROWAN | SALISBURY | I85 | RP1505 | 19 |
| ROWAN | SPENCER | I85 | RP1915 | 18 |
| ROWAN | SALISBURY | I85 | US52 | 18 |
| ROWAN | | I85 | RP1500 | 16 |
| ROWAN | SALISBURY | I85 | RP1002 | 13 |
| ROWAN | | I85 | RP2539 | 13 |
| ROWAN | SALISBURY | I85 | RP1526 | 11 |
| SURRY | MOUNT AIRY | I77 | NC89 | 20 |
| SURRY | ELKIN | I77 | RP1138 | 19 |
| SURRY | MT AIRY | US52 | NEWSOME ST | 17 |
| SURRY | MT AIRY | US52 | RP1815 | 15 |
| SURRY | DOBSON | I77 | RP1001 | 13 |
| SURRY | | NC89 | I77 | 11 |
| SURRY | | NC89 | NC752 | 11 |
| SURRY | PILOT MOUNTAIN | US52 | NC268 | 11 |
| SURRY | | I77 | NC752 | 10 |
| SURRY | MT AIRY | US52 | ROCKFORD ST | 9 |
| UNION | STALLINGS | US74 | RP1365 | 25 |
| UNION | INDIAN TRAIL | US74 | RP1367 | 22 |
| UNION | INDIAN TRAIL | US74 | RP1008 | 19 |
| UNION | INDIAN TRAIL | US74 | RP2356 | 18 |
| UNION | INDIAN TRAIL | US74 | RP1377 | 17 |
| UNION | MONROE | US74 | STAFFORD ST | 11 |
| UNION | MONROE | US74 | DICKERSON BLVD | 10 |
| UNION | | US74 | RP1754 | 10 |
| UNION | MONROE | US74 | ROCKY RIVER RD | 9 |
| UNION | MONROE | US74 | US601 | 9 |
| WAKE | CARY | I40 | RP1652 | 50 |
| WAKE | RALEIGH | NEW BERN AVE | TRAWICK RD | 41 |
| WAKE | RALEIGH | NEW BERN AVE | CORPORATION PKWY | 40 |
| WAKE | RALEIGH | I440 | CAPITAL BLVD | 29 |
| WAKE | RALEIGH | WAKE FOREST RD | I440 | 29 |
| WAKE | CARY | US1 | CARY PKWY | 28 |
| WAKE | RALEIGH | I440 | GLENWOOD AVE | 26 |
| WAKE | RALEIGH | NEW BERN AVE | I440 | 26 |
| WAKE | RALEIGH | I40 | US70 | 25 |
| WAKE | | I40 | RP3015 | 24 |
| WAYNE | GOLDSBORO | US117 | RP1926 | 13 |
| WAYNE | GOLDSBORO | US70 | NC581 | 13 |
| WAYNE | | US117 | RP1915 | 10 |
| WAYNE | GOLDSBORO | US70 | NC111 | 9 |
| WAYNE | | NC55 | RP1110 | 8 |
| WAYNE | GOLDSBORO | US117 | ELM ST | 8 |
| WAYNE | | US70 | RP1242 | 7 |
| WAYNE | | RP1938 | RP1120 | 6 |
| WAYNE | | US117 | RP1120 | 6 |

| | | | | |
|---|---|---|---|---|
| WAYNE | GOLDSBORO | US70 | US117 | 6 |
| WILSON | WILSON | I95 | US264 | 16 |
| WILSON | WILSON | RALEIGH RD | WARD BLVD | 13 |
| WILSON | | I95 | NC42 | 12 |
| WILSON | WILSON | WARD BLVD | NASH ST | 11 |
| WILSON | WILSON | NASH ST | WARD BLVD | 10 |
| WILSON | | US264 | NC58 | 10 |
| WILSON | WILSON | US264 | NC91 | 10 |
| WILSON | WILSON | US301 | FOREST HILLS RD | 10 |
| WILSON | WILSON | HERRING AVE | WARD BLVD | 9 |
| WILSON | WILSON | US264 | I95 | 9 |

**Maneuvers and Contributing Factors**

Table 7 ranks from high to low the percent of time that a specific factor (on the part of the CMV driver) was reported as 'contributing' in some way to the crash. Factors have been ranked separately for 1998 and 1999. The 'average' has been calculated across the entire five year period of 1995-1999. It is instructive to point out that in two thirds or more of the time, there is *no* contributing factor reported on the part of the CMV driver. Where a contributing factor was reported, it was most likely to have been for (a) erratic/reckless driving, (b) driving too fast, (c) driving on the wrong side of the road. . . lane encroachment, (d) failure to yield or to obey traffic control device, or (e) run off road.

With respect to what the CMV driver was doing (in terms of a maneuver) at the time of the crash, the data are not extremely informative (see Table 8). Going straight and negotiating a curve are likely exposure factors and not risk factors per se. To the extent that crashes associated with having to avoid an animal are not that common, the relatively high crash frequencies associated with this condition suggests that it presents a high maneuver risk. Likewise 'slowing/stopping in lane,' 'starting in lane and/or stopped in lane' suggest that unexpected maneuvers occasioned by sudden or unexpected accelerations and/or deccelerations are also problematic.

## Table 7

## Percent of Fatal Truck-Involved Crashes Where Specific Contributing Factor Was Attributed to CMV Driver

## Source: FARS 1995-1999

| | 1998 | | 1999 | | AVG |
|---|---|---|---|---|---|
| None | 65.95 | None | 73.54 | None | 65.878 |
| Erratic/Reckless | 13.36 | Erratic/Reckless | 11.11 | Erratic/Reckless | 11.056 |
| Driving Too Fast | 6.03 | Driving Too Fast | 4.76 | Driving Too Fast | 6.336 |
| Homocide | 3.45 | Wrong Side of Road | 2.65 | Wrong Side of Road | 4.342 |
| Run Off Rd | 3.45 | Failure to Yield | 2.12 | Homocide | 3.65 |
| Wrong Side of Road | 3.02 | Failure to Obey | 1.59 | Failure to Yield | 2.292 |
| Failure to Yield | 2.59 | Homocide | 1.06 | Failure to Obey | 1.806 |
| Failure to Obey | 1.29 | Run Off Rd | 1.06 | Run Off Rd | 1.254 |
| W/O Req Equip | 0.43 | W/O Req Equip | 1.06 | Other Viol | 0.526 |
| Improper Loading | 0.43 | Unlawful Noise | 0.53 | W/O Req Equip | 0.4 |
| Unlawful Noise | 0 | Other Viol | 0.53 | Unknown | 0.338 |
| Other Viol | 0 | Improper Loading | 0 | Veh Unattended | 0.308 |
| Unknown | 0 | Unknown | 0 | Improper Loading | 0.3 |
| Veh Unattended | 0 | Veh Unattended | 0 | Hit and Run | 0.224 |
| Hit and Run | 0 | Hit and Run | 0 | Improper Lane Change | 0.222 |
| Improper Lane Change | 0 | Improper Lane Change | 0 | Improper Tailing | 0.206 |
| Improper Tailing | 0 | Improper Tailing | 0 | Insuff Pass Dist | 0.12 |
| Insuff Pass Dist | 0 | Insuff Pass Dist | 0 | Other Impr Turn | 0.112 |
| Other Impr Turn | 0 | Other Impr Turn | 0 | Flat Tire | 0.112 |
| Flat Tire | 0 | Flat Tire | 0 | Unlawful Noise | 0.11 |
| Fail to Signal | 0 | Fail to Signal | 0 | Operator Inexperience | 0.11 |
| Wrong Way | 0 | Wrong Way | 0 | Fail to Signal | 0.102 |
| Locked Wheel | 0 | Locked Wheel | 0 | Wrong Way | 0.102 |
| Impr Start/Back | 0 | Impr Start/Back | 0 | Locked Wheel | 0.102 |
| Operator Inexperience | 0 | Operator Inexperience | 0 | Impr Start/Back | 0.1 |

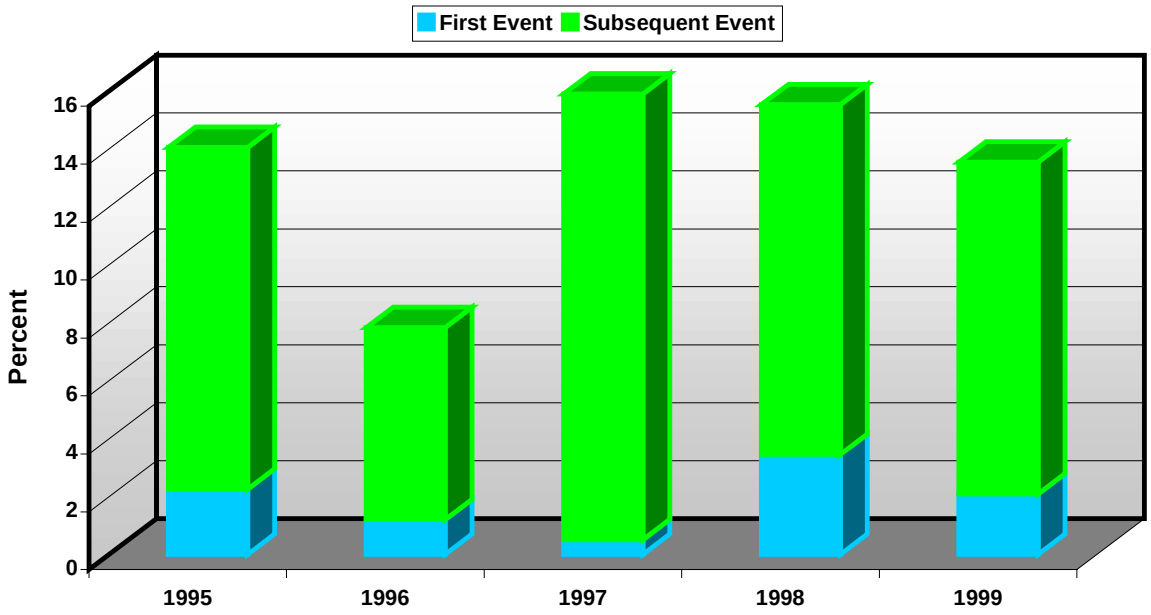
## Table 8
## Commercial Vehicle Maneuver Associated With Fatal Heavy Truck-Involved Crashes in North Carolina Source: FARS 1995-1999

| | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|
| Going Straight | 126 | 113 | 127 | 157 | 125 |
| Negotiate Curve | 15 | 12 | 29 | 34 | 29 |
| Avoid Animal | 11 | 6 | 8 | 7 | 9 |
| Left Turn | 6 | 6 | 3 | 13 | 9 |
| Slowing/Stopping | 5 | 7 | 8 | 6 | 4 |
| Stopped in Lane | 3 | 5 | 9 | 5 | 4 |
| Starting in Lane | 0 | 5 | 2 | 3 | 4 |
| Backing Up | 5 | 3 | 4 | 3 | 2 |
| Enter Parking | 0 | 0 | 0 | 0 | 1 |
| U-Turn | 0 | 0 | 0 | 0 | 1 |
| Changing Lanes | 1 | 2 | 2 | 0 | 1 |
| RTOR Permitted | 3 | 0 | 1 | 1 | 0 |
| RTOR Not Known | 1 | 0 | 1 | 1 | 0 |
| Other | 1 | 0 | 0 | 1 | 0 |
| Unknown | 0 | 0 | 1 | 0 | 0 |
| Passing | 1 | 6 | 0 | 0 | 0 |
| Leave Parking | 0 | 0 | 0 | 1 | 0 |
| | 178 | 165 | 195 | 232 | 189 |

** Ranked Based on 1999 Data*

Figure 19 shows a roll over as being associated with fatal truck-involved crashes on the order of 12 to 15 percent of the time. Where a roll over took place in conjunction with a fatal crash, it most often occurred subsequent to the crash as opposed to being the first event or event which gave cause to the crash..

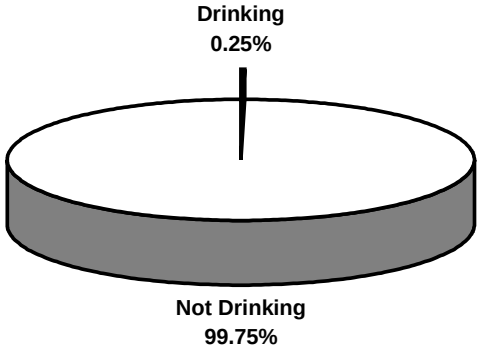
**Figure 19**
**Percent of Rollovers Reported as Either 'First' or 'Subsequent' Event in Fatal Truck Involved Crashes**
**Source: FARS 1995-1999**




**Driver-Related Factors (Alcohol, Age, etc.)**

Figure 20 shows that CMV drivers involved in crashes had been drinking in less than 1 percent of the cases.

**Figure 20**
**Truck Drivers Involved in Crashes 1995-1999**
**Drinking and Not Drinking**
**Source: FARS**



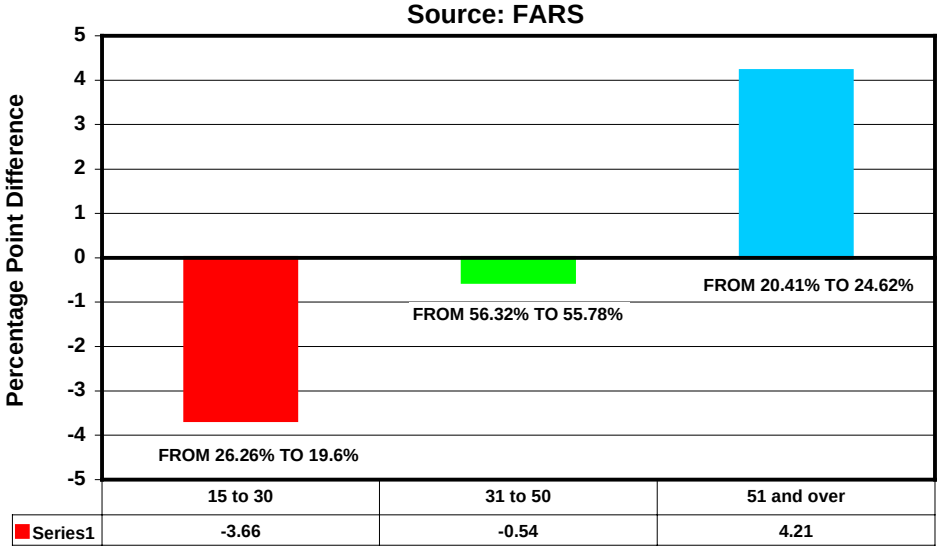
With respect to license status, Table 9 shows, by year, the status of the CMV driver's license. Conditions are reported as a percentage of all reported cases. The data show that the driver was driving with a valid license in approximately 95 percent of the time. These data suggest that there has been an increase in the involvement of drivers (in fatal crashes) operating on suspended licenses (from fewer than 1 percent of all fatal crashes in 1995 to over 3 percent in 1999).

**Table 9**
**License Status (as a Percent of Total Cases)**
**for Heavy Truck Operators Involved in Fatal Crashes in North Carolina**
**Source: FARS 1995-1999**

| | 1995 | 1996 | 1997 | 1998 | 1999 | 5yr Avg |
|---|---|---|---|---|---|---|
| **Not Licensed** | 0 | 0 | 0.52 | 0 | 0 | 0.10 |
| **Not Required** | 0 | 0 | 0 | 0 | 0.53 | 0.11 |
| **Suspended** | 0.56 | 1.2 | 2.6 | 0 | 3.17 | 1.51 |
| **Revoked** | 1.69 | 1.2 | 0.52 | 0.43 | 0 | 0.77 |
| **Not Valid** | | 4.22 | 3.65 | 2.16 | 3.7 | 3.43 |
| **Valid** | 94.35 | 95.78 | 94.27 | 96.98 | 94.71 | 95.22 |
| **Unknown** | 1.69 | 0 | 1.56 | 0.86 | 1.06 | 1.03 |

With respect to the age of the CMV driver involved in fatal crashes, refer to the data in Figure 21. The data show a 6-7 percentage point decrease (from 26.26 to 19.6 percent) in the number of drivers, age 15-30, involved in fatal truck crashes. There is no evidence for a change in the likelihood of involvement for drivers in the 31 to 50 year old age range. The data, however, show a greater than 4 percentage point increase (from 20.41 to 24.62 percent) increase in the involvement of older drivers (age 51 and older).

**Figure 21**
**Change from 1995 to 1999 in the Percentage of Heavy Truck Drivers in Each Age Group Involved in Crashes**
**Source: FARS**



## The Application of Geographic Information Systems (GIS) Capabilities

In attempting to convey the spatial attributes of truck-involved crashes in North Carolina to both the general public and to commercial vehicle enforcement personnel, the utility of a GIS or map-like interface to these kinds of data became readily obvious. Use of terms like the 'crescent' to describe the geographic location and extent of truck-involved crashes statewide implies a certain visual 'image' for the area under discussion. Defining the extent of the problem in visible, geographic (map-like) terms also proved helpful from the standpoint of allowing enforcement personnel operating within a defined geographic area of responsibility (districts) to more clearly orient to the spatial characteristics of the problem in ways that tabular data did not. And to the extent that enforcement personnel constitute a limited resource, the use of a GIS-type interface, seems to allow those responsible for the management of such resources a useful means to spot major discrepancies between the location of the problem and the spatial allocation/distribution of resources to address the problem.

Working with the North Carolina Center for Geographic Information and Analysis (CGIA), HSRC and GHSP sought to build on previous FHWA efforts at using GIS to characterize the locus of ped/bike crashes and truck crash 'corridors.' By building upon this prior work, HSRC and GHSP were able to also explore the utility of the analysis tools developed by CGIA in the context of those earlier efforts.

The GIS products described here represent very preliminary results in efforts to develop a spatially referenced crash data system for application to commercial motor vehicle crashes. These efforts are preliminary more in the sense of the scope of the data associated with the applications . . . in this case, a focus only on fatal truck-involved crashes over the period 1998 to 1999. Nevertheless, the effort provided the opportunity to experiment with the NCDOT's emerging linear referencing system and its ability to derive 'coordinates' from 'on-at-and-from' type road description used to indicate crash locations.

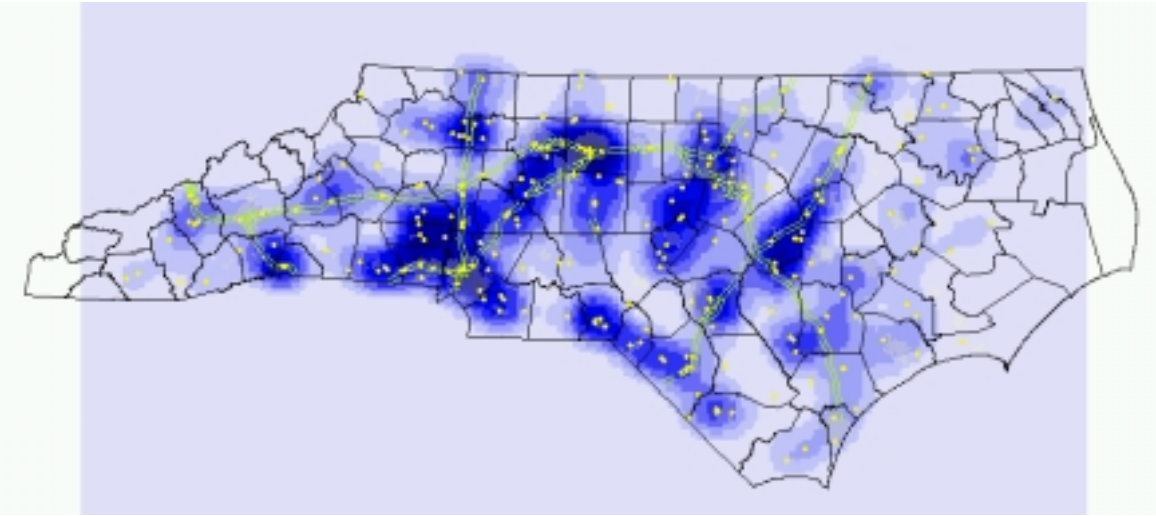
The effort also allowed HSRC the opportunity to explore further the results of other analyses (e.g., the relationship of crash frequency to population) as well as to address new issues such as the proximity of fatal truck-involved crashes to major trauma centers across the state.

Perhaps the greatest value of the current GIS efforts has been the insight its has prompted on the part of DMV Enforcement that perhaps GIS can help in establishing the connection between the spatial density of crashes and the spatial density of CMV enforcement activities. It is hoped that the use of GIS can help conceptually in arriving at a more useful notion of the capacity of the enforcement system to exercise not only broad area coverage (visibility) but also broad area effectiveness. How 'dense' must enforcement activity be (e.g., in terms of enforcement actions per square mile) to be 'effective'? And from a temporal standpoint, how long must this density be in place to be effective? Are concentrated wolf pack efforts, for example, more effective than a consistent broad-based 'presence' over a large geographic area? These questions are important from the standpoint of understanding resource needs in terms of the relationship between capacity and effectiveness.

**GIS "Products" Generated in FY2000**

***The Crash Density Plot***. Figure 22 is an example of the use of existing GIS analysis tools to define the relative density of crashes across the state. The data are all fatal truck-involved crashes over the two-year period between 1998 and 1999. Major aspects of the state road network are shown. Points are locations of actual crashes. The density plot is more informative than previous statewide plots which simply color-coded counties in terms of crash frequency. The density plot focuses on the relative magnitude of the problem independently of county boundaries. In this particular plot, one notices an area of crash density along SR74 near the North Carolina/South Carolina border. In the density plot, this area shows up even though a traditional county level orientation might not show these counties as being high in crashes. The same can be seen for Bertie County in the eastern portion of the state. Crash density can be high in a particular area even though the frequency of crashes in the county may not be sufficient to bring attention to the area otherwise.

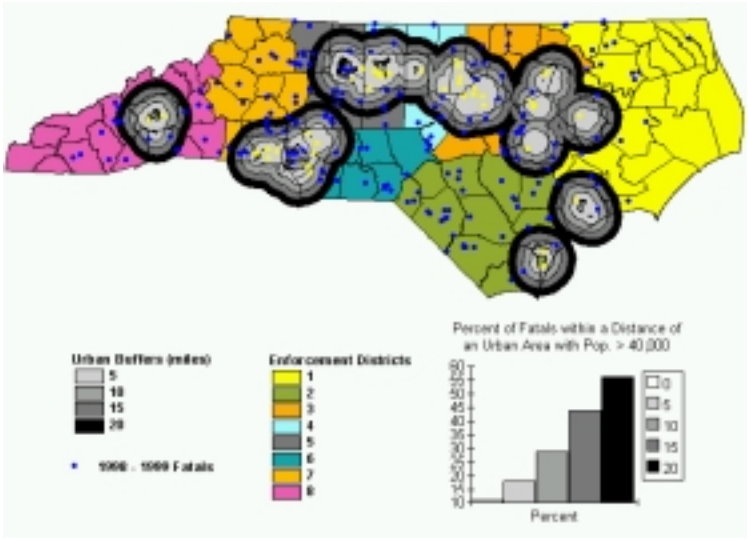
**Figure 22**
**Relative Densities of Fatal Truck-Involved Crashes in North Carolina**
**Source: NCDMV Crash Files, 1998 and 1999**

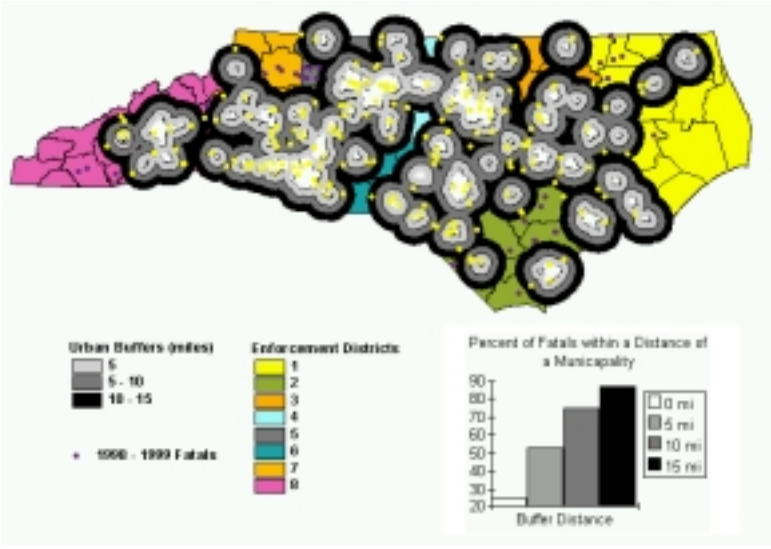


***The Use of 'Clustering' Tools/Displays.*** Figure 23 demonstrates the use of GIS analysis capabilities to define 'clusters' of fatal truck-involved crashes based upon their proximity to either (a) distance from urban areas with populations greater than 40,000 or (b) distance from a 'municipality.' The figure shows how the clustering tool within GIS can be used to evaluate 'buffers' of various sizes (e.g., 5, 10, 15, or 20 mile radius). The bar chart shows for each radius the percent of fatal crashes falling within that area. The top portion of the chart shows that approximately half of all fatal truck-involved crashes in North Carolina during the period 1998-1999 occurred within 20 miles of a major (greater

than 40,000) population area. The plots clearly show the 'crescent,' the greater Charlotte metropolitan area, the Asheville area, and the coastal areas around Wilmington. The bottom portion of the chart shows that almost 80 percent of all fatal truck-involved crashes occurred within 10-15 miles of a 'municipality.' While effective in capturing a higher percentage of fatal crashes than clusters defined on major population areas, the plot is not particularly informative in terms of targeting specific geographic areas.

**Figure 23**
**USE OF GIS CRASH REFERENCING SYSTEM TO**
**'CLUSTER' 1998 amd 1999 FATAL TRUCK CRASH LOCATIONS**
***DATA ARE FOR FATAL, HEAVY TRUCK-INVOLVED CRASHES***
***IN NORTH CAROLINA, SOURCE : NCDMV CRASH DATA 1998-1999***



***Further Information on Relationship Between Crashes, Population, and Population Growth.*** Preliminary analyses (see Figure 24) had shown that the frequency of crashes (for calendar year 1998) at the county level could, on the average, be reasonably well predicted on the basis of the population of the country. Fatal crashes were not as well predicted solely on the basis of population, but rather reflected the fact that most fatals occurred in rural areas on NC and US-numbered highways.

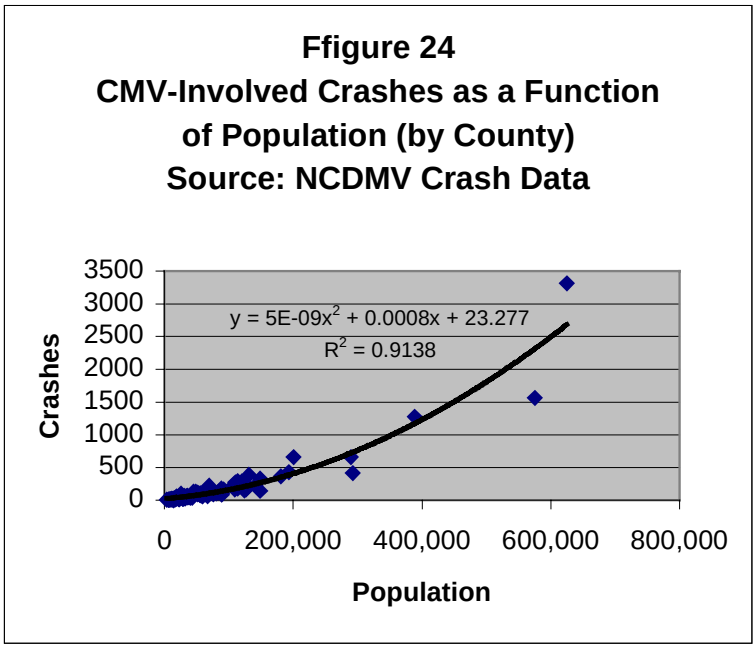
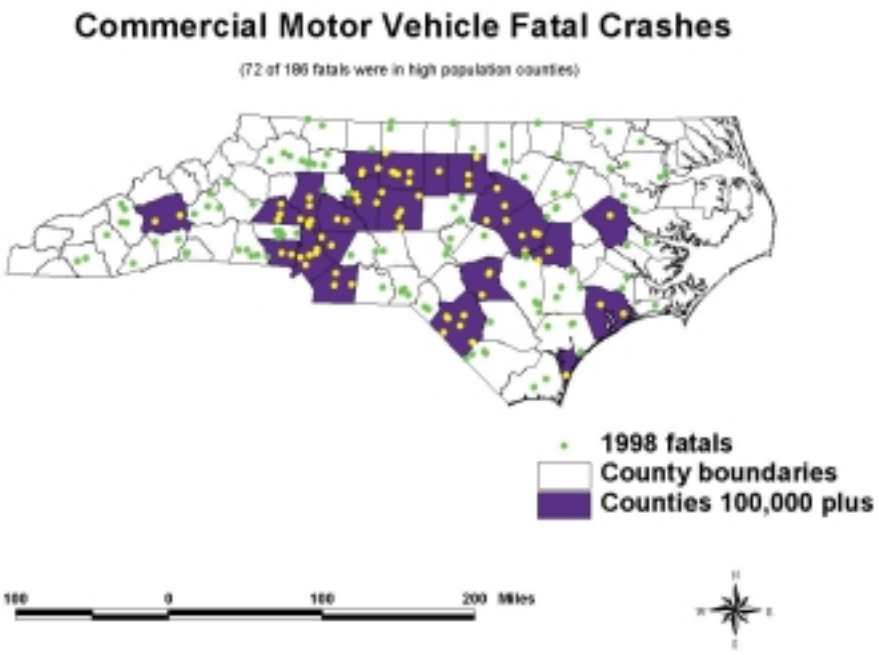
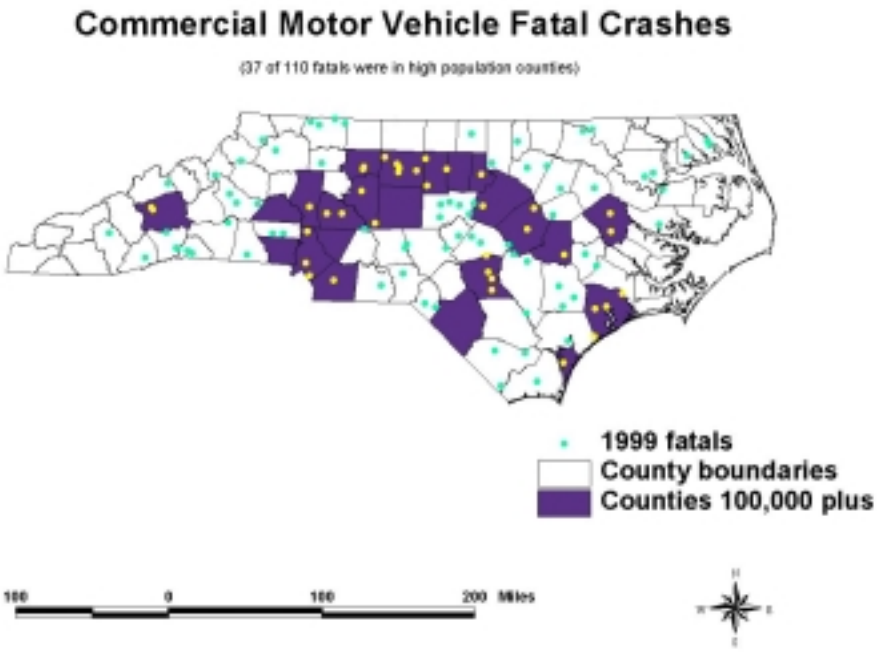



Figure 25 takes a closer look at the relationship over between fatal truck-involved crashes and population size. . . in this case, counties with population of 100,000 or greater. The comparison is between 1998 and 1999. The data show that for 1998, approximately 39 percent (72 of 186) fatal crashes occurred in counties with populations of 100,000 or greater. By contrast, in 1999, 34 percent of all fatal truck-involved crashes took place in counties with populations of 100,000 or greater . . . i.e., an approximate 5 percent reduction in the percentage of truck-involved fatals occurring in the most highly populated counties . . .perhaps reflecting an increasing 'migration' of the crash problem into the less populated counties.

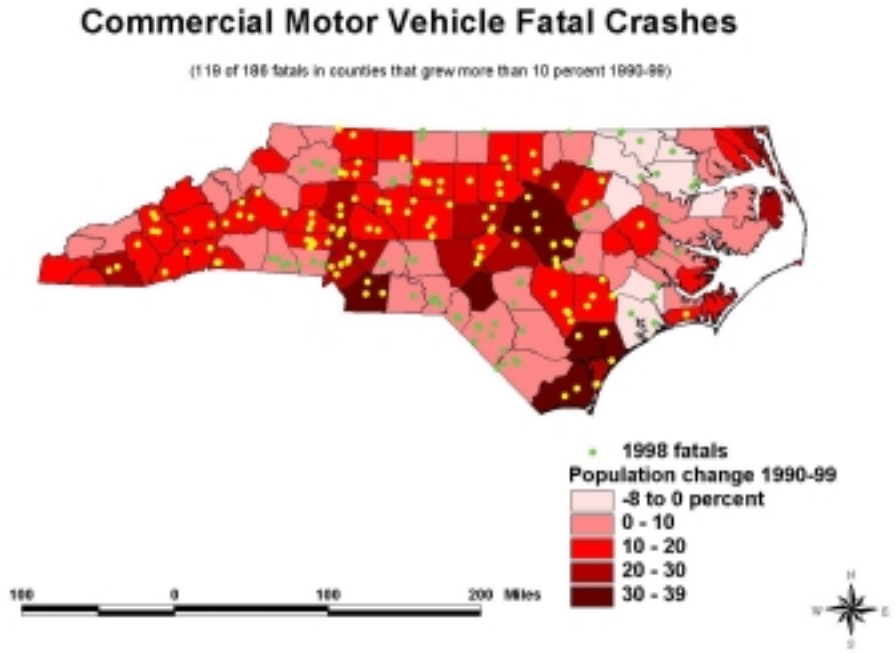
Figures 26 and 27 take a more dynamic view of population; in this case looking at counties which experienced either 10 percent growth in population from 1990-1999 or 20 percent growth. The data across both years shows that counties which grew more than 10 percent over the 10 year period accounted (in 1998 and 1999) for approximately 64 percent of all fatal truck-involved crashes. By contrast, those counties which grew by more than 20 percent accounted for approximately 21 percent of all fatal truck-involved crashes. Since the two sets of counties are not mutually exclusive, it is not possible to use these data to relate population 'growth' rates to crashes.

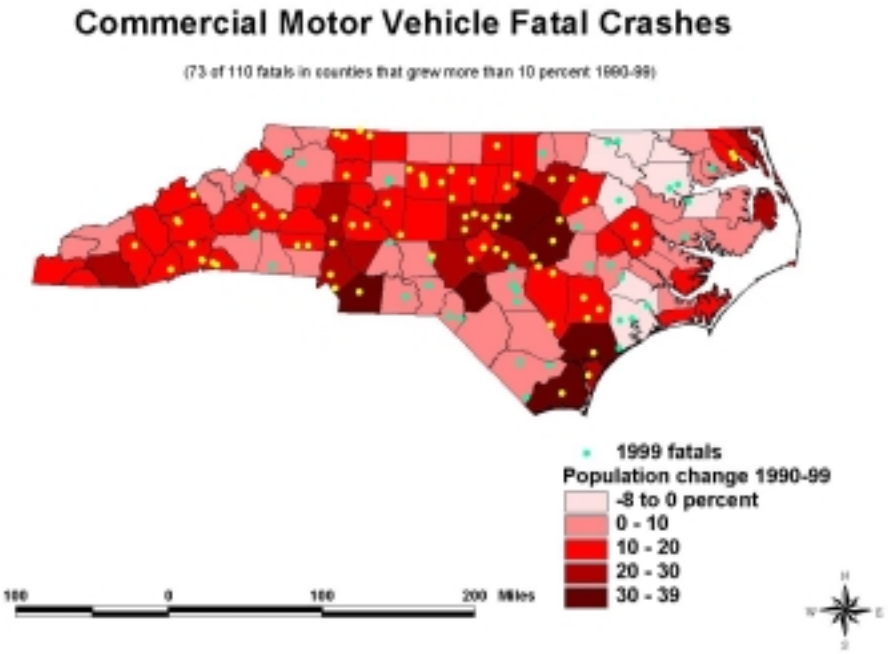
# Figure 25
# Fatal Truck Involved Crashes in Counties With Populations of 100,000 or Greater Comparison
**Source: NCDMV Crash Data**



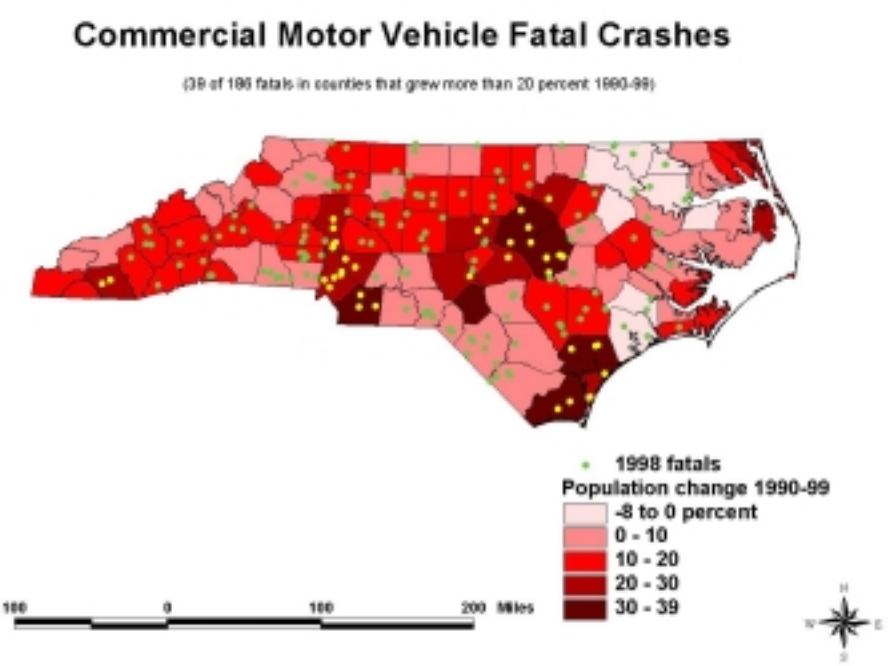



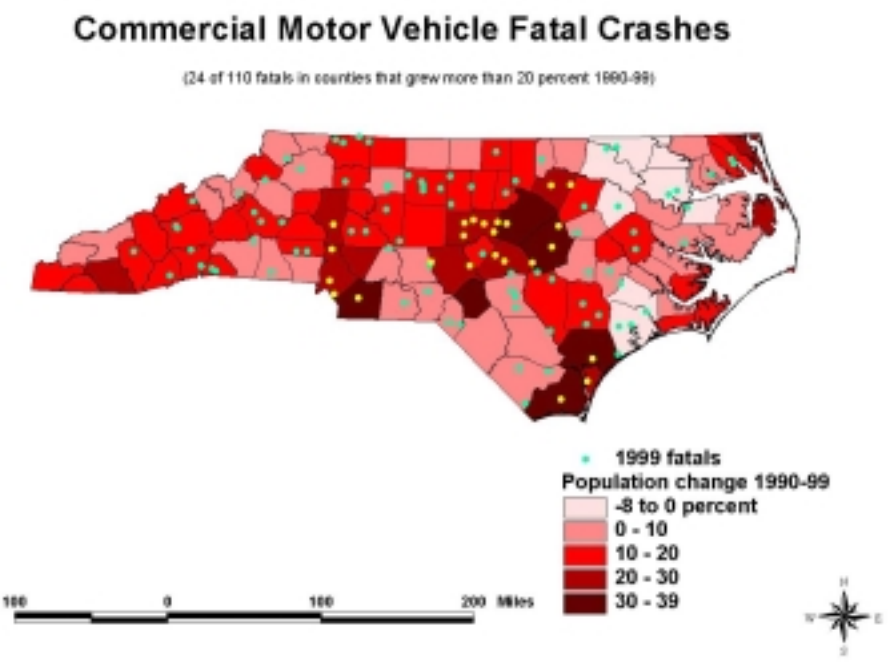
# Figure 26
# Fatal Truck-Involved Crashes in Counties Which Grew by More than 10 Percent over the Period 1990-1999
**Source: NCDMV Crash Data**



# Figure 27
# Fatal Truck-Involved Crashes in Counties Which Grew by More than 20 Percent over the Period 1990-1999
**Source: NCDMV Crash Data**



**GIS Plots of Fatal Truck-Involved Crashes in 30-County Enforcement Area.** Appendix A contains GIS displays of 1998 and 1999 fatal truck-involved crash locations for each of the 30 high crash counties targeted for increased CMV enforcement activity in FY2001. Appendix B displays these same crash locations in the context of individual DMV Enforcement 'district' plots. Figure 28 provides an example of the type of aerial imagery that is available through the web site maintained by NCCGIA at http://www.ncmapnet.com/. The display of aerial photographs for all fatal truck crash locations during this period is beyond the scope of this report. The imagery is available free of charge over the Internet. The ability to go directly from the location reported in the DMV Form 349 crash report to the precise location in the on-line aerial data, while desirable and technically feasible, is not a current capability of the system.

# Figure 28
## Representative Aerial Imagery of Crash Locations

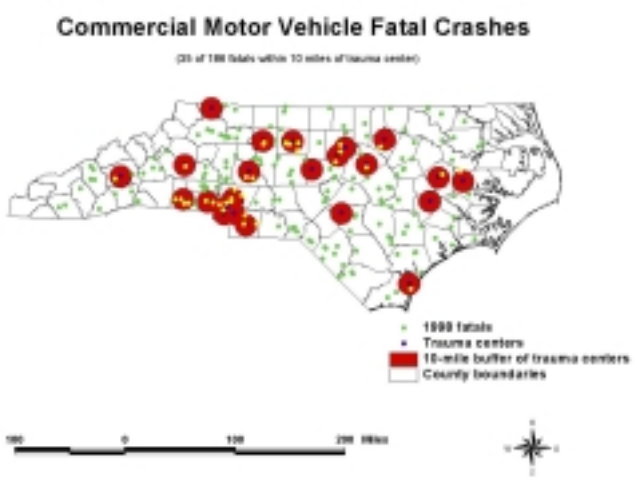

It is the intent of the GIS work funded by GHSP in FY2001 to work toward the creation of a more effective and better integrated user interface for the coordinated GIS-based display of crash location information, crash report parameters, aerial imagery, and citation/adjudication data. It is also the intent of the FY2001 work to explore the feasibility of linking crash data to other external (Internet-based) sources of carrier data (e.g. that available through the FMCSA "A&I On-line" site.

**Fatal Truck Crash Locations With Respect to Major North Carolina 'Corridors'.** Appendix C provides GIS plots of fatal crash locations along each of the major transportation 'corridors' in the state (i.e., I-40/I-85; I-95; I-40 (The Gorge); and I-77). Fatal crash locations are again those for 1998 and 1999. Figure 29 provides important

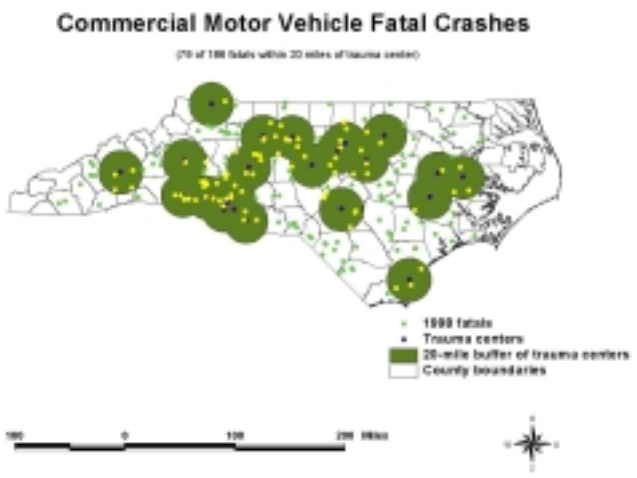
information on the I-95 corridor in terms of truck crashes, their severity compared to other corridors in the state. For example, in 1998, 21 percent of all fatalities resulting from truck-involved crashes occurred in the nine counties immediately surrounding I-95. In that same year, Robeson County led the state in the number of trucks involved in fatal crashes per vehicle mile traveled. . . 2.5 times the rate in Guilford Co. which had the same number of crashes. In 1998, the average number of fatal truck-involved crashes per mile traveled through the I-95 corridor was 1.5 times the average number for all North Carolina counties. The number of fatalities per mile traveled along the I-95 corridor was 1.39 times that for the state overall.

**Fatal Truck Crash Locations With Respect to Location of Trauma Centers.** To the extent that not all victims of truck-involved crashes are pronounced dead on the scene, the prompt availability of emergency and trauma room facilities may be critical in improving the survival rate for those involved in a truck-related crash. Figures 35 and 36 show the proximity of fatal truck-involved crash locations to major trauma centers. By creating 'buffer' zones around each trauma center location of either a 10, 20, or 50-mile radius, the GIS system can determine what percentage of crashes fall within that distance from the center. The data show that for the two year period 1998-1999 only 19-20 percent of all fatal truck crashes occurred within 10 miles of a trauma center; 42-48 percent within 20 miles; and 95-97 percent within 50 miles. A further GIS analysis could be done using the system's knowledge of the road network combined with assumed vehicle speeds to calculate a mean transport time for each crash location. The system could also compute flight times from crash locations to trauma facilities.

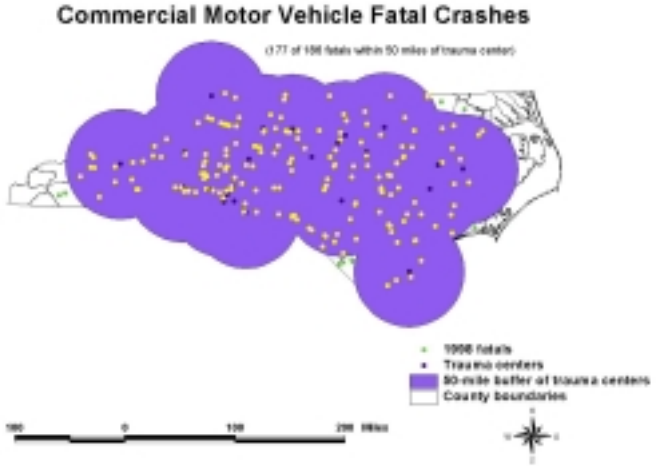
# Figure 29
# Fatal Truck Involved Crashes and Proximity to Major Trauma Centers in NC (1998)




**10 Mile**

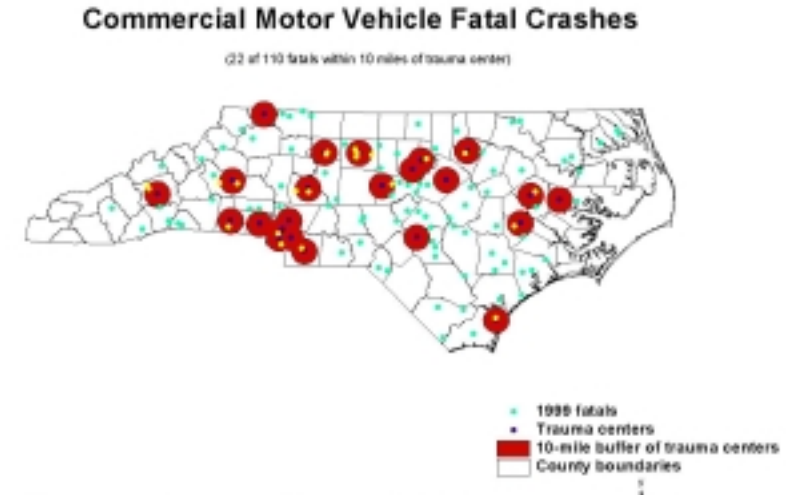



**20 Mile**

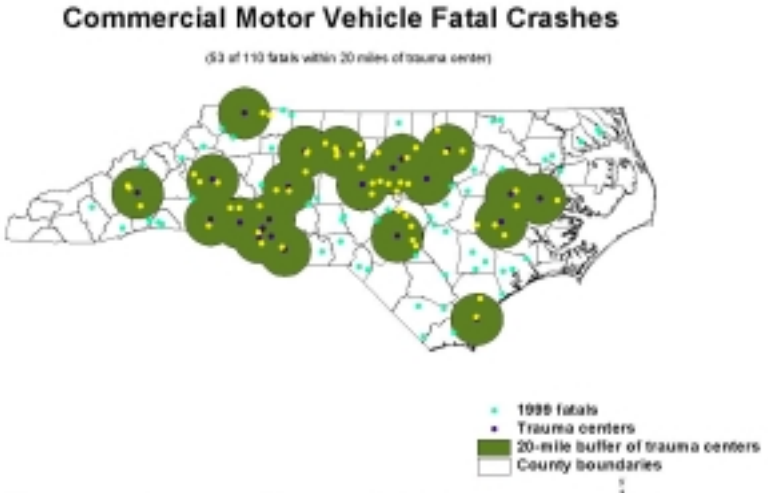



**50 Mile**

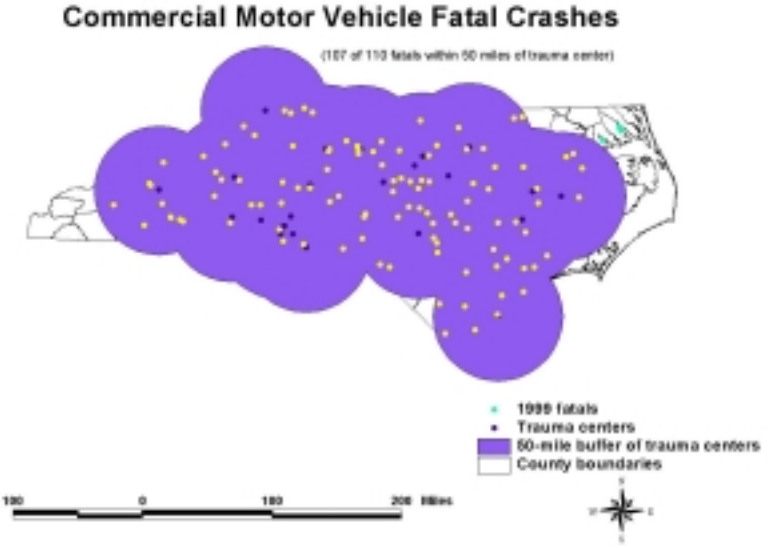
# Figures 30
# Fatal Truck Involved Crashes and Proximity to Major Trauma Centers in NC (1999)




**10 Mile Radius**




**20 Mile Radius**




**50 Mile Radius**

# So, What Do the Data Suggest We Should be Doing?

# Discussion

Given a continuation of the present system which permits large, heavily loaded commercial vehicles and smaller passenger vehicles to unconditionally share the same roadway, the frequency of truck-involved collisions will continue, and will be, to a great extent, a direct function of population size and resulting travel demand factors and their joint, negative impact on different vehicle types being able to operate safely in a limited space. (ala Physics 101)

Where traffic density increases, the frequency of truck-involved, as well as all other types of crashes, will increase . . . at least until such time that an ITS type of automated highway system (AHS) provides the means for system (versus driver) control over lane selection, vehicle speeds, and following distance. Collisions between elements in a largely driver controlled (versus managed), high speed operating system are inevitable.

While one does not want to say that drivers under such conditions can do nothing to avoid crashes, the present data suggest that for non-fatal truck-involved crashes, the commercial and non-commercial driver are equally likely to have contributed in some way to the crash. It remains interesting to note that in the case of *fatal* truck-involved crashes, it is more often (60-70 percent of the time) the driver of the passenger vehicle who is cited as contributing to the crash.

Some would argue that the dead (non-CMV) driver cannot defend himself or herself. Driver 'errors' (misperceptions, etc.), when they occur under congested, slower speed conditions, are somewhat protected from fatal or serious injury outcomes. Where similar errors take place in rural areas, characterized more often by narrower lane conditions, greater variation in horizontal and vertical curvature, lack of signalized means of traffic control, and unlimited/uncontrolled roadway access, those same errors will have an increased likelihood of being fatal. Under circumstances where roadway design and traffic control do not prohibit or lessen the likelihood of fatal driver errors, an increase in the likelihood of fatal truck-involved crashes will continue to be high.

So long as these system dynamics continue to operate, the most prudent course of action that one could take to reduce the personal injury associated with such collisions would be (a) to seek vehicle improvements (passenger protection devices and mechanisms) that would make such collisions more 'survivable' and (b) to pursue traffic control and traffic management strategies capable of offsetting the effects of lower road design standards and lack of effective traffic control characteristic of more 'rural' areas..

The decrease in fatal truck-involved crashes in 'rural' areas of our state is due to a number of factors: (a) increased enforcement focus in high crash counties, (b) aggressive efforts on the part of the NCDOT to 'upgrade' roadway design and roadway operational characteristics in those areas where 'rural' types of development are rapidly giving way to urbanization, and last but not least, (c) more widespread availability of airbag equipped vehicles and more widespread passenger use of restraint systems (e.g, seatbelts).

The increasing frequency of fatal crashes on urban classes of roadways cautions against adopting any simple dichotomy which says that crash frequency is an 'urban' (congestion-related) phenomenon and fatal crashes are a 'rural' phenomenon. The data show a slow, but consistent increase in fatal truck-involved crashes on almost all classes of urban roads except those classified as urban freeways and expressways. When looking at the frequency of fatal crashes on rural versus urban interstates, taking into account the high ratio of rural to urban interstate miles, the data suggest a higher risk of fatal crashes (i.e., the probability of any single crash being fatal) in the urban interstate environment.

While commercial motor vehicle (CMV) enforcement activities (e.g., driver and vehicle roadside inspections and the like) have been shown over the past year to result in a significant reduction in fatal crashes, the data suggest that it is not due to their 'enforcement' value alone since driver and vehicle out-of-service rates appear to have little or no correlation with carrier crash risk. It is more likely that their impact has been by way of fostering, directly or indirectly, better behavior on the part of the commercial vehicle driver (e.g., through better adherence to the hours-of-service requirements and a lessening of the impact of fatigue, to better adherence to traffic laws, etc.).

Enforcement cannot do it all. Neither is it realistic or feasible to expect the NCDOT to over night improve the design and traffic control of all roadways statewide. So what are the suggestions for improving truck safety in the near term?

# Recommendations

- Consider system-level options for reducing the volume of heavy commercial vehicles carrying goods on roadways that must be shared with smaller, non-commercial vehicles.

    - Off-load some portion of the shipping demand from large commercial vehicles operating on shared rights of way to other forms of transportation (e.g., rail) operating on separate rights of way. The evidence from Europe suggests that such an approach can have a measurable impact on reducing truck-involved crashes.

- Where the level of commercial vehicle usage of public roadways cannot be reduced or diverted to other modalities (such as rail), manage shipping patterns to minimize conflicts with non-commercial users of the roadway.

- For example, increase night-time movement of goods to avoid peak morning, mid day, and afternoon capacity demands. (Refer to Atlanta's success during the 1996 Olympic Games)

- Provide information to non-commercial users of the system that would allow at least some small percentage of those users to alter travel schedules and routes to avoid potential conflicts with large commercial vehicles, especially on those roadways less suited to shared use.

- Provide information (either in-vehicle or outside the vehicle through signing, strategically placed kiosks, etc.) of locations/areas known to have a high frequency of truck-involved crashes . . . especially those locations having a high frequency of fatal truck-involved crashes.

- Expand the FMCSA 'no zone' program to emphasize the risk associated with 'angle' crashes and the extent to which such crashes are influenced by inadequate traffic control methods, recognized 'errors' on the part of passenger car drivers to underestimate the speed of large approaching vehicles, and their tendency to ignore the significant differences in vehicle operating capabilities (especially the increased stopping distances associated with the braking system of large vehicles).

- Consider reducing posted speeds in areas where the data show there is a high probability of truck-involved crashes resulting in fatalities.

- Continue programs that promote adequate availability, and trucker awareness, of truck rest areas (both publicly and privately maintained).

- While fatal truck-involved crashes are obviously the result of collisions between commercial and non-commercial vehicles, the development of effective countermeasures needs to recognize the different dynamics of fatal and non-fatal crashes.

- To the extent that the data show that vehicle and driver out-of-service actions bear little correlation with carrier crash risk, encourage agencies responsible for CMV 'enforcement' to adopt practices that focus more on observable commercial vehicle driver behavior (e.g.., the Level III inspection activity) and on *cooperative efforts* with carriers (especially smaller carriers) to increase compliance. Enforcement should not be seen as a tool for 'developing' appropriate behavior on the part of commercial vehicle drivers and the carriers for whom they work, but rather as a means for reducing the undesirable 'extremes' which occur with any acquired/learned behavior. (Note: When you've punished all the 'bad' behavior, what you're left with is not necessarily the behavior(s) you're ultimately trying to achieve).

- Experiment with 'enforcement' methods that are not as inherently 'labor-intensive' as those which characterize current uniformed field operations (e.g., automated surveillance methods, the use of E-citations, etc.). The goal should be to achieve effective, area-wide surveillance and system compliance without significant increases in current manpower levels.

- Carefully consider the tradeoffs between the advantages of larger, longer, and heavier commercial vehicles with an increase in the overall number of commercial vehicles. Considerations should focus carefully on the predicted safety impacts and not solely on their effect upon the infrastructure (i.e., size and weight impacts).

- Even though tractor trailers presently constitute the vast majority of heavy vehicles involved in fatal crashes, careful attention should be given to monitoring the involvement of single unit trucks (SUTs), especially with regard to their greater predicted involvement in E-commerce delivery activity.

- Seek to identify desired operational changes (e.g., shifting some of load to rail; scheduling for off-peak driving times; etc.) and how positive incentives might be used to encourage compliance with desired ways of doing things. Work closely with carriers to identify incentives that are likely to reinforce desired behaviors. Efforts should focus on rewarding desired changes, not on punishing reluctance to change.

- Develop and use statistical modeling techniques to determine 'how much' change is required to meet FMCSA crash reduction goals given realistic assumptions about continued travel demand and crash risk. For example, can the actual number of fatal, truck-involved crashes in North Carolina be reduced by limiting 'exposure' even if the risk of a crash per mile driven remains the same?

- Consider multi-modal analysis efforts that would address (a) lives lost per pound and per mile traveled, regardless of the modality, (b) dollar loss per pound and/or per pound traveled, again regardless of modality. Analyses should factor in the cost of delay that may be associated with some modalities. Analyses should also address impacts of safety-driven, multi-modal countermeasures on just-in-time manufacturing and delivery strategies.

- Work closely with ITS and CVO committees within the NCDOT to formulate and evaluate innovative 'operational' (traffic engineering) changes considered to have potential for reducing truck-involved crashes (e.g., lane restrictions, etc.).

- Given that the data for North Carolina show an exponentially higher crash risk for the small carrier, DMV Enforcement and FMCSA (Raleigh) should work together to identify strategies aimed at helping smaller carriers to be compliant. . . rather than to simply punish their limited ability to comply.

- Vigorously pursue those components of the proposed North Carolina CVISN implementation effort which focus on 'safety.'

- Continue to work through crash data coordinating groups in the state to improve the timeliness and accuracy of CMV crash data reporting.

- Improve CMV awareness training for state and local law enforcement personnel oriented toward the collection of accurate carrier data on the 349 crash reporting form.

- Work together to ensure a prompt transition from the old NCDOT crash data base system to the new Oracle-based system.

- Work together to encourage prompt implementation of new NCDOT linear referencing system.

- Accelerate development of Geographic Information System (GIS) analysis tools.

- Continue GHSP advocacy and funding support for truck safety programs in North Carolina.

- Work to establish high-level (Governor's Office) support for a more integrated, multi-agency approach to commercial vehicle safety in North Carolina.

- Ensure that 'multi-agency' involvement includes legislative, enforcement, AND judicial participation.

- Give serious consideration to the judication portion of the overall system and to the 'evenness' with which commercial motor vehicle laws are applied across the different counties and regious in the state.

- Work with judicial personnel to identify approaches to enforcement and adjudication which are not manpower and personnel prohibitive.