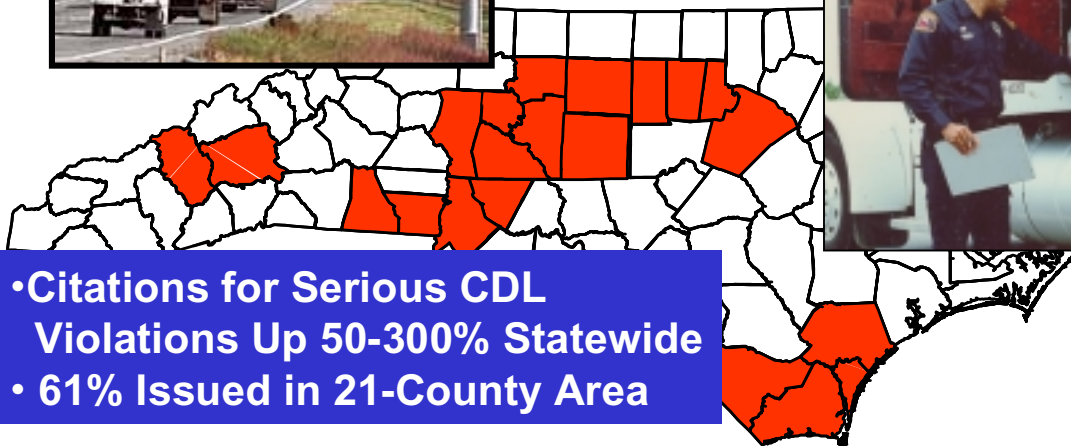


Truck Safety in North Carolina: Effectiveness of NCDMV Enforcement Efforts in FY99

•Fatal Crashes Down 17.7%
in 21 High Crash Counties

•Inspections Up 129% in High
Crash Counties



•Citations for Serious CDL
Violations Up 50-300% Statewide
• 61% Issued in 21-County Area



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Truck Safety in North Carolina and the Effectiveness of NCDMV Crash Reduction Efforts

EXECUTIVE SUMMARY

In 1998, North Carolina ranked fourth in the nation in terms of the number of truck-involved fatal crashes. As part of an effort to reduce fatal truck-involved crashes, the NCDMV, working with other law enforcement agencies in the State, increased commercial motor vehicle (CMV) enforcement activity in 21 North Carolina counties identified by the NCDOT as having the most truck-involved crashes. ***Increased CMV enforcement*** consisted of

- a major increase in the number of roadside inspections
- an increase in the number of vehicles and drivers placed out of service as a result of those inspections
- an increase in the number of citations written for serious CDL violations (e.g., traveling in excess of 15mph over the posted limit, reckless driving, erratic lane changes, following too closely, etc.)
- an increase in the number of public education efforts (e.g., ‘No-Zone’)
- development of adjudication tracking and judicial outreach program.

In addition, the DMV Enforcement section, in conjunction with the NC Governor’s Highway Safety Program (GHSP), enlisted the analytic and program evaluation support of the UNC Highway Safety Research Center.

The product of these combined and coordinated efforts was 17.7 percent *reduction* in the number of fatal truck-involved crashes from FY98 to FY99 in the 21 county area of increased enforcement attention. Fatal truck-involved crashes in the non-targeted area increased by 7.6 percent during this same period, and were correlated with decreases in roadside inspections and vehicle/driver out-of-service actions.

Statewide, there was a 48 percent increase in the number of roadside inspections conducted in FY99 (***129 percent increase in the 21 county area***). In the 21 county area, increased inspection activity resulted in a 20 percent increase in the number of vehicles placed out of service and an 89 percent increase in the number of drivers placed out of service. In the non-targeted counties, the number of vehicles placed out of service decreased by 36 percent; the number of drivers placed out of service decreased by 14 percent. In FY99, there were increases in citations statewide for serious CDL traffic offenses ranging from a 50 percent increase in erratic lane change citations to a nearly 300 percent increase in citations for reckless driving. Citations for truck speeds in excess of 15 mph over the posted limit increased by approximately 150 percent. CDL traffic violations/citations are currently being analyzed to determine the level of increase in the 21 county area, per se. Efforts to track the judicial outcomes of citations issued for these offenses, while showing an increase in ‘as-charged’ convictions, showed significant room for improvement.

While DMV enforcement efforts in FY99 were successful in reducing the number of fatal truck-involved crashes in the areas of targeted enforcement, North Carolina was among the poorest in Region 4 in terms of its efficiency in entering inspection and accident data into SAFETYNET. A significant backlog of reports in FY99, along with manpower and personnel constraints and SAFETY availability problems, contributed to North Carolina's performance.

In FY2000, results of the new truck safety legislation passed under H.B. 303 will be evaluated as well as NCDOT operational efforts such as selected lane restrictions for trucks. DMV efforts at increased 'partnering' with other law enforcement agencies in the state will continue as will efforts toward increased judicial outreach and public awareness/education. The introduction of a new consolidated crash data form, the installation of laptop computers and ASPEN software into MCSAP patrol vehicles are expected to significantly improve the timeliness of data entry and upload problem in the coming fiscal year.

Looking beyond FY2000, the main goal of DMV Enforcement will be to formulate a 'model' for effective CMV enforcement and crash reduction that can be feasibly applied on a statewide basis. Before attempting to extend this 'increased enforcement' approach to the rest of the state, or at a minimum, to those additional counties with 'emerging' CMV safety problems, a more careful evaluation of DMV resource allocation alternatives (to include increased partnering and shared CMV responsibilities) is required.

Recognizing that current enforcement methods are to a great extent resource constrained by available personnel and equipment, it is highly recommended that serious attention be given to the innovative use of available technology, especially that which can be used to more effectively automate the process of vehicle speed control. Likewise, efforts must continue to work with the traffic engineering and commercial vehicle safety components of the NCDOT to identify more effective means of avoiding the high frequency of fatal truck-involved angle crashes noted in the 1993-97 GHSP analysis as occurring at rural intersections and other unsignalized access points. And lastly, there must continue to be a strong emphasis on *safety* in North Carolina's efforts to implement key components of the CVISN program and other commercial vehicle programs within the area of Intelligent Transportation Systems (ITS)

Truck Safety in North Carolina and the Effectiveness of NCDMV Enforcement Efforts

Following a continued decline in the number of fatal truck-involved crashes in North Carolina from 1993 to 1996, the number of fatal truck-involved crashes showed a xx-percent *increase* in 1997. This shift toward an increase in the number of fatal crashes continued through calendar 1998 where the number of fatal truck-involved crashes increased approximately 17 percent from the previous calendar year (1997). This increase in fatal crashes was *not*, however, accompanied by an increase in the overall number of truck-involved crashes. In fact, the number of truck-involved *crashes* in 1998 (all levels of severity, including fatal) was approximately four percent *fewer* than the number observed in 1997. Traffic deaths (all vehicle types) were up 7.6 percent for calendar year 1998. Crashes (all vehicle types) for calendar year 1998 increased less than one percent.

The general crash trend in North Carolina for calendar year 1998 was a decrease in CMV-involved crashes and a less-than-one percent increase in vehicle crashes of all types. While crashes either remained unchanged or decreased in CY98, traffic deaths from all types of crashes were up 7.6 percent overall and 17.7 percent for truck-involved crashes. The overall crash trend was thus for an increase in the probability of a crash being fatal, with that probability being higher for truck-involved crashes.

The higher probability of a crash involving a fatality could be due to any number of factors; such as: (a) a possible increase in the number of vehicles involved in a crash, (b) a possible increase in the number of occupants in the vehicle, (c) a possible increase in the age of the occupants, or (d) a significant increase in average vehicle speeds at impact. These issues are being addressed in a parallel GHSP-supported analysis effort by the UNC Highway Safety Research Center (HSRC).

21 County CMV Enforcement Focus

In 1998, the Enforcement Section of the NC Division of Motor Vehicles instituted an increased level of CMV enforcement in 21 North Carolina counties identified by the NCDOT as high (truck) crash counties. The counties identified are highlighted in the figure below. This general area, often referred to as the 'crescent,' is associated with high population centers, high travel demand (miles traveled), as well as high levels of commerce served by trucking.

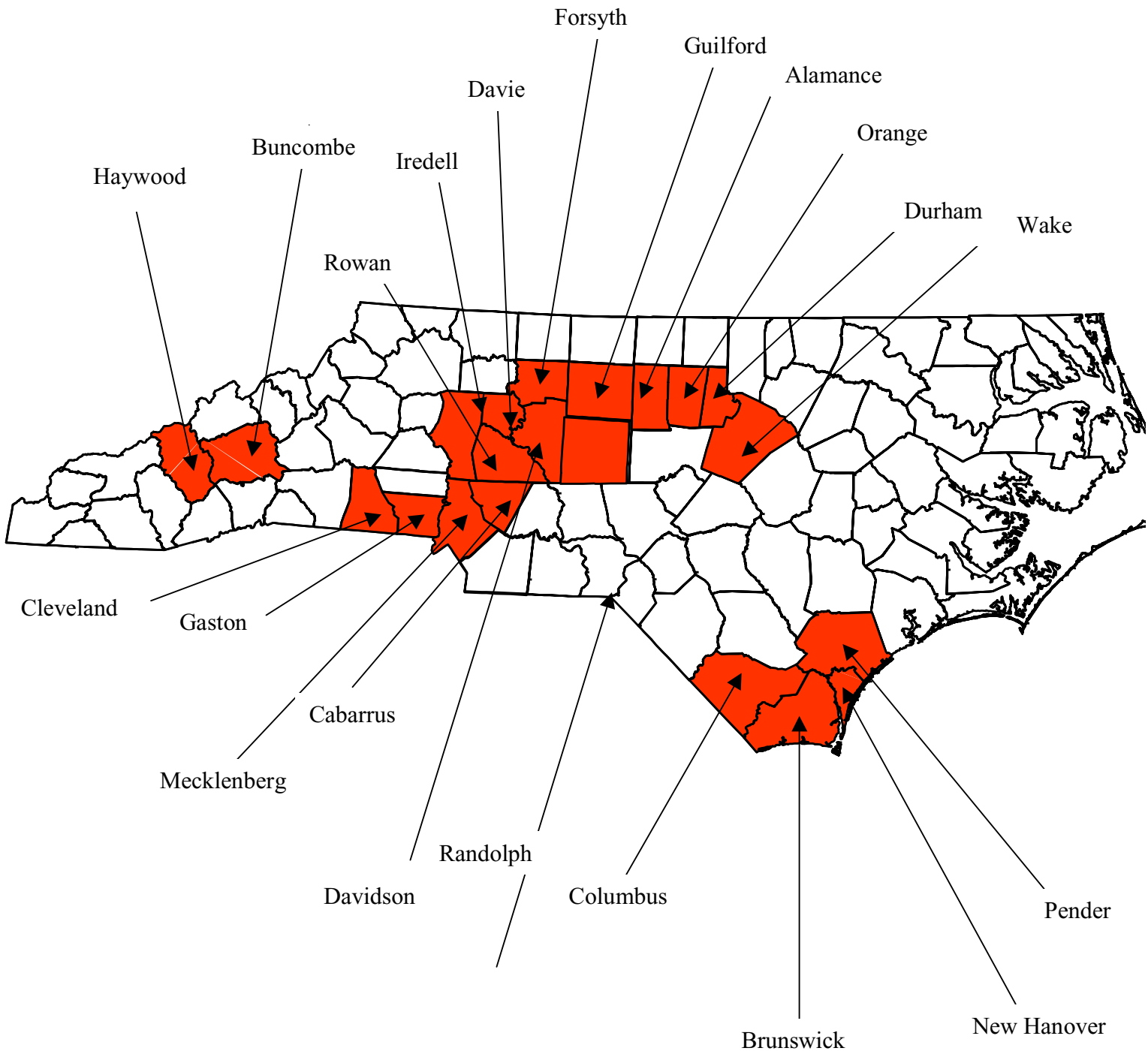


Figure 1
21 County Enforcement Area Based on
1995-1998 Crash Data (Source: NCDOT)

Increased CMV enforcement goals in these 21 counties were defined in terms of

- an increase in the number of driver and vehicle inspections
- an increase in the number of traffic enforcement citations issued for serious CDL traffic violations
- efforts at partnering with other law enforcement agencies
- joint special operations (Wolfpacks)
- a continuation of public education initiatives (e.g., “No-Zone”), and
- a judicial outreach program to increase the awareness of prosecutors and judges as to the seriousness of CMV traffic violations and to raise the ‘as charged’ conviction rate for serious commercial vehicle violations.

Increased enforcement in the 21 county ‘target’ area was to be accomplished *with no overall increase in DMV Enforcement resources*. It thus stands to reason that truck-involved crashes might be expected to rise in those counties not targeted for increased enforcement. Should it be possible, however, to demonstrate a clear reduction in CMV-involved fatal crashes in the 21 county area, these methods might be used as a ‘model’ for achieving a similar reduction in CMV crashes statewide.

Related Efforts

In mid-1999, the DMV Enforcement Section enlisted the aid of the University of North Carolina Highway Safety Research Center for the purpose of augmenting the DMV’s own internal analysis capability. Under MCSAP funding, the primary HSRC objective was to work with the DMV in obtaining a better understanding of the relationship between DMV enforcement actions and crash reduction objectives outlined in the Commercial Vehicle Safety Plan (CVSP). The overall problem definition component of the HSRC effort is being supported by the NC Governor’s Highway Safety Program (GHSP) as a continuation of an ongoing effort to remove North Carolina from NHTSA’s “Top Ten” list. In calendar year 1998, North Carolina ranked fourth in the US in terms of the number of truck-involved fatal crashes.

For the GHSP problem definition effort, data on all 1998 fatal truck-involved are being entered into a GIS Crash Referencing System developed earlier by the NCDOT in conjunction with the North Carolina Center for Geographic Information and Analysis (CGIA). Use of the GIS system will enable the DMV to more effectively monitor the geo-specific nature of fatal truck-involved crashes in the state. In addition to plotting crash locations, the GIS system will also permit the user to display essential information on individual crashes (from DMV crash data files) as well as to view crashes against a background of county and district level DMV enforcement actions. The GIS component of the analysis is currently ongoing. Preliminary products of that work are expected in the spring of calendar year 1999. A separate, but related, HSRC effort, funded through MCSAP with FHWA funds, will also use the GIS data base to identify the spatial attributes of SafetyNet data “quality” and MCMIS under-reporting.

PROGRAM RESULTS

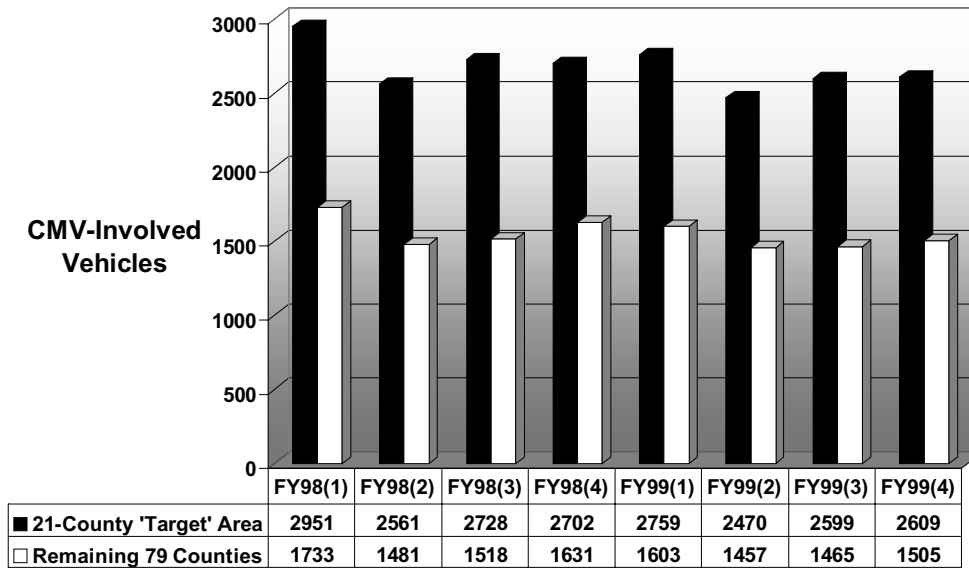
DMV Enforcement efforts during FY99 are discussed in terms of their contribution to overall CMV crash reduction goals defined in the CVSP. Contributing to the accomplishment of crash reduction goals are DMV Enforcement efforts in roadside inspections and traffic enforcement (for serious CDL violations). Results are also discussed from a supplementary analysis of carrier data available in the A&I On-line system (<http://ai.volpe.dot.gov/mcspa.asp>); in particular, the relationship between carrier size (number of power units) and crash risk (crashes per power unit). Additional data from the A&I On-line system address the relationship between driver and vehicle out-of-service rates, driver moving violations, and crash risk.

- **Crash Reduction Statewide (FY98 and FY99)**

Figure 2 compares crashes, by quarter, for Fiscal Year 98 and Fiscal Year 99. The quarter-by-quarter data for FY99 show reductions in CMV crashes over the first three quarters of the fiscal year (Oct 99 thru Jun 99) followed by an increase in the fourth quarter (Jul 99 thru Sep 99). The data in Figure are for all vehicles indicated in the crash data as a commercial motor vehicle (CMV), not simply 'heavy' trucks (typically 3 or more axles). Figure 3 shows that similar trends were observed for 'heavy' trucks (3 or more axle single unit trucks and tractor trailers).



**Commercial Motor Vehicles Involved in Crashes
(All Levels of Severity) in North Carolina FY98 and
FY99, By Quarter**



**Commercial Motor Vehicles Involved in Fatal
Crashes in North Carolina for FY98 and FY99, By
Quarter**

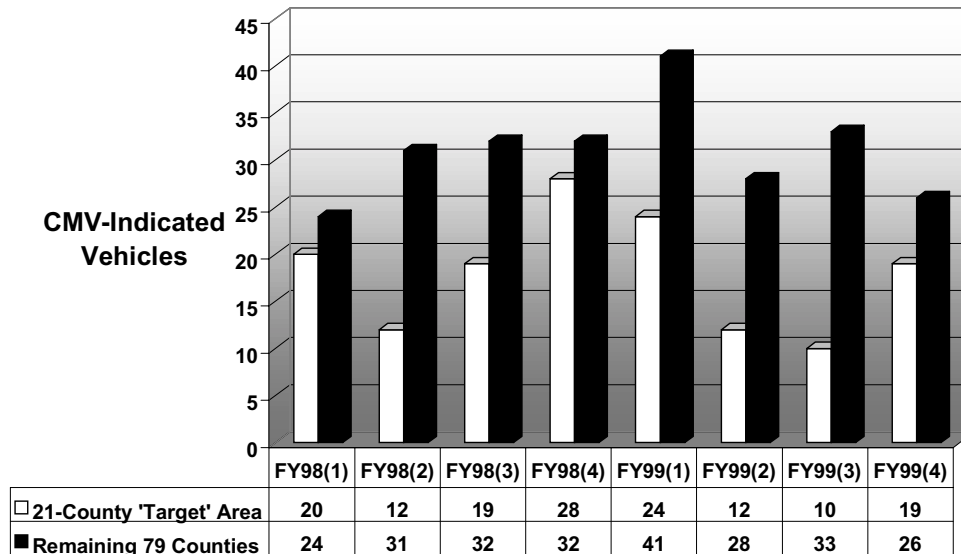
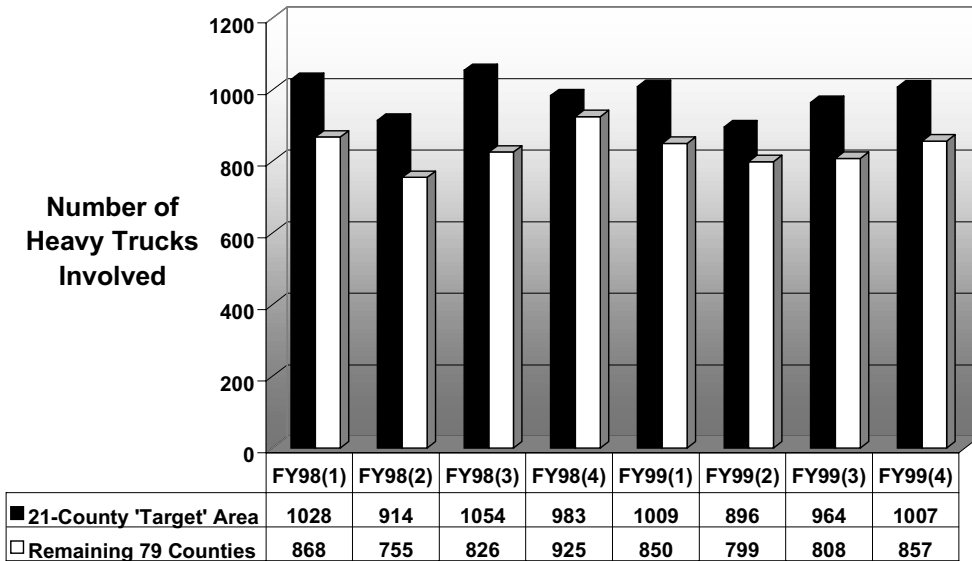


Figure 2. Commercial Motor Vehicles (CMV) Involved in Crashes (All Levels of Severity) and Those Involving One or More Fatalities, by Quarter, for FY98 and FY99

'Heavy' Trucks Involved in Crashes (All Levels of Severity) in North Carolina FY98 and FY99, By Quarter



'Heavy' Trucks Involved in Fatal Crashes in North Carolina, FY98 and FY99, By Quarter

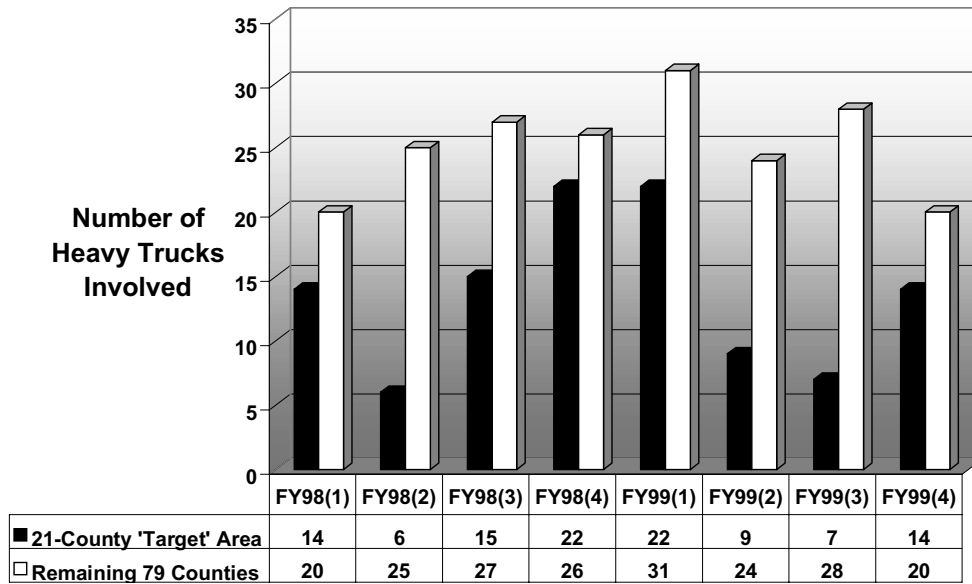


Figure 2. Heavy Trucks Involved in Crashes (All Levels of Severity) and Those Involving One or More Fatalities, by Quarter, for FY98 and FY99

- **Performance in High Crash Counties**

Based upon CMV-involved crashes between January 1, 1995 and August 31, 1998, the NCDOT identified 21 high crash counties. DMV Enforcement personnel used this list to 'target' increased enforcement activities (roadside inspections, traffic enforcement, and special operations) in these areas. This increased enforcement effort went into effect as part of the FY99 CVSP.

Figures 4 and 5 show the extent to which CMV crashes *overall* and CMV-involved *fatal* crashes were affected in the 21 county area. Figure 4 shows that CMV-involved crashes (all levels of severity, including fatal) decreased by 4-5 percent statewide, irrespective of the additional enforcement thrust in the 21-county area. With respect to *fatal crashes*, Figure 5 shows a 17.7 percent *reduction* in the 21 county area. In the 79 counties not targeted for increased CMV enforcement actions, the number of CMVs involved in fatal crashes *increased* by 7.6 percent.

Figure 4
An Average 5% Reduction from FY98 to FY99 in
the Number of Commercial Motor Vehicles
Involved in Crashes

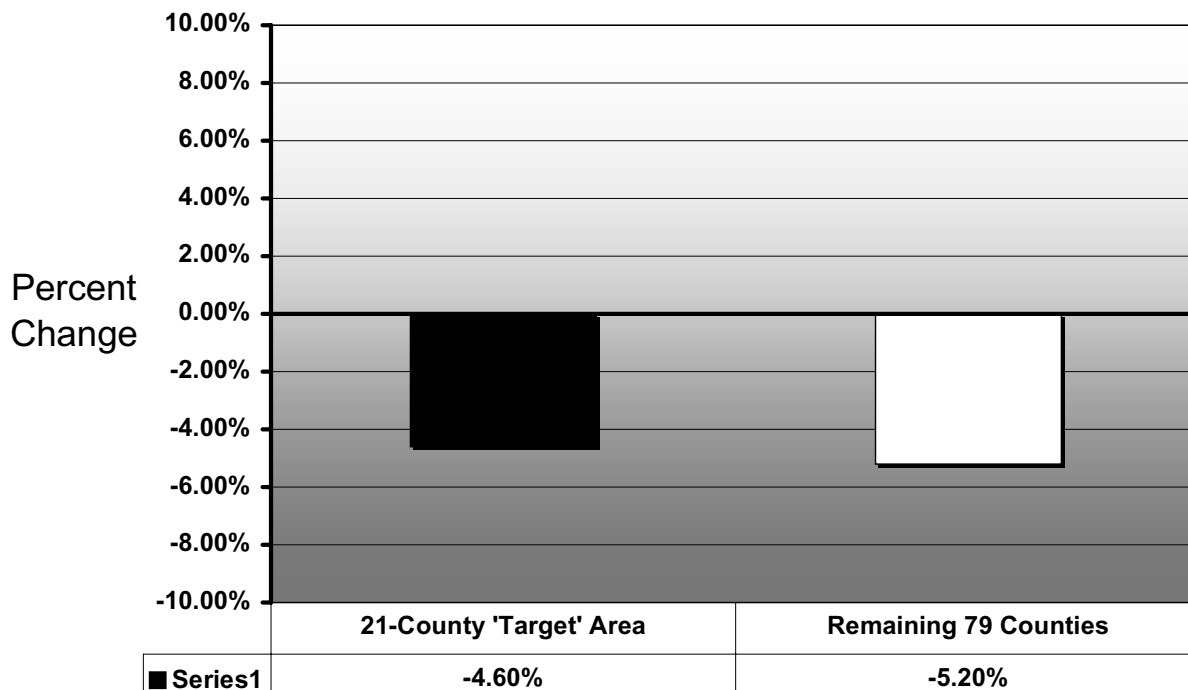


Figure 5

Number of Commercial Motor Vehicles Involved in Fatal Crashes 'Down' 17.7% from FY98 to FY99 in 'Target' Area; Up 7.6% Elsewhere in the State

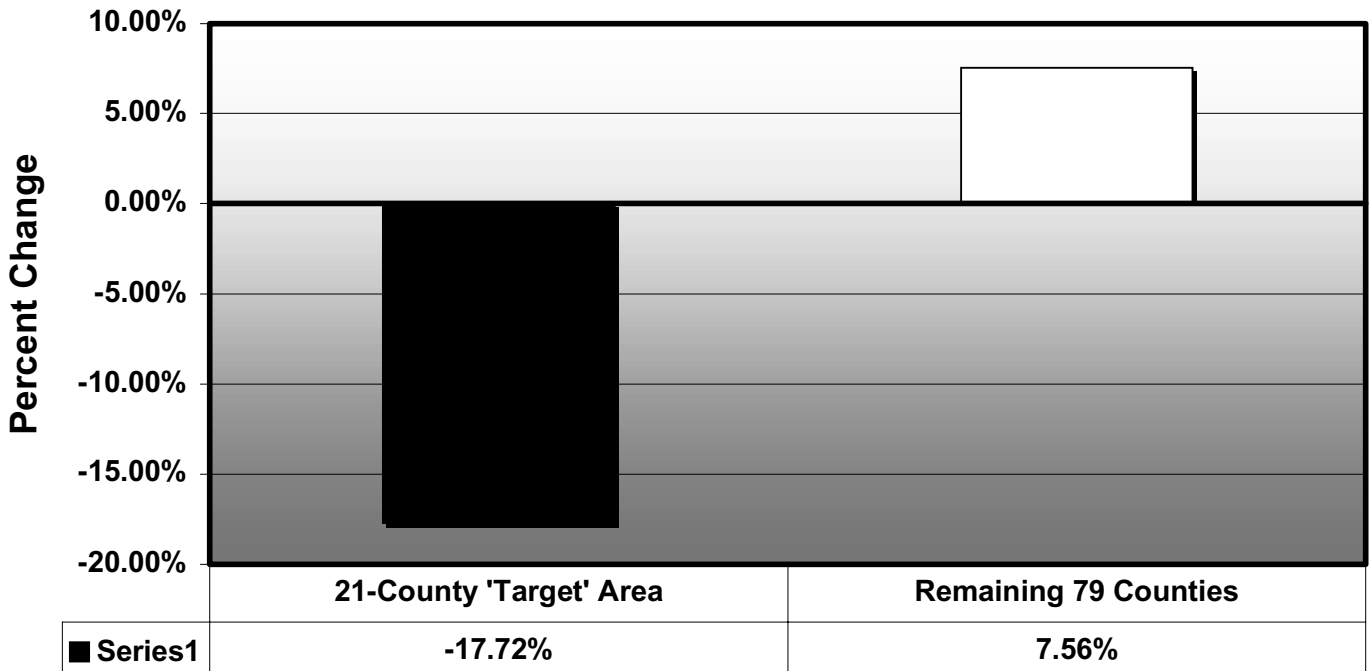


Table 1 lists the top 21 counties in the state during FY98 and FY99 in terms of fatal truck-involved crashes. The left two columns contrast FY98 and FY99 in terms of all CMV-involved crashes, irrespective of outcome. Counties in the original list of 21 are highlighted. The right two columns contrast FY98 and FY99 in terms of fatal, truck-involved crashes.

While Wake, Durham, and Mecklenburg counties continued to be represented among the top five counties in the state in terms of CMV-involved crashes, the data show that some of the original 21 counties have dropped off the list, while others not on the original list now appear among the top 21. For example, major shifts occur when ranked on the basis of the number of *fatal* crashes (e.g., increase in Guilford from 4 to 9 fatalities per year; decrease in Durham from 8 to 3 fatalities per year). Ten counties not on FY98 fatal list appear on the FY99 list.

Concurrence with the original list of 21 is greatest where rank is based on total number of CMV-involved crashes. Significant shifts occur when ranked on the basis of the number of fatal crashes. It is important to remember that the NHTSA 'Top Ten' list is based upon *fatal* truck involved crashes and not total crashes. While crash reduction is a major CVSP goal, the higher priority goal is a reduction in fatal crashes. The present data point out it is quite possible to obtain a reduction in crashes while the number of fatal crashes increases.

Table 1
TOP 21 NORTH CAROLINA COUNTIES IN TERMS OF
NUMBER OF
OVERALL CMV-INVOLVED CRASHES
AND NUMBER OF CMV-INVOLVED FATAL CRASHES
FOR FY98 AND FY99

All CMV-Involved Crashes				Fatal CMV-Involved Crashes			
County	FY98	County	FY99	County	FY98	County	FY99
Mecklenberg	3345	Mecklenberg	3249	Mecklenberg	10	Guilford	9
Wake	1591	Wake	1538	Durham	8	Wake	8
Guilford	1324	Guilford	1244	Wake	7	Mecklenberg	7
Forsyth	696	Forsyth	610	Robeson	7	Cumberland	7
Durham	652	Durham	610	Rowan	6	Columbus	6
Buncombe	454	Cumberland	401	Johnston	6	Chatham	6
Catawba	399	Buncombe	379	Randolph	6	Johnston	5
Cumberland	384	Gaston	347	Cleveland	6	Forsyth	5
Gaston	366	Catawba	346	Forsyth	5	Duplin	5
New Hanover	356	Iredell	299	Catawba	5	Surry	5
Iredell	287	New Hanover	290	Duplin	5	Bertie	5
Cabarrus	281	Union	256	Guilford	4	Union	4
Union	264	Cabarrus	252	Gaston	4	Iredell	4
Rowan	258	Rowan	242	Union	4	Davidson	4
Alamance	246	Johnston	230	Surry	4	Burke	4
Johnston	245	Robeson	227	Wilson	4	Onslow	4
Davidson	240	Davidson	224	Lee	4	Henderson	4
Wilson	232	Alamance	218	McDowell	4	Pender	4
Robeson	230	Orange	200	Sampson	4	Durham	3
Pitt	190	Wayne	191	Yadkin	4	Robeson	3
Nash	181	Surry	172	Iredell	3	Rowan	3

The list of all 100 North Carolina counties, in terms of fatal truck-involved crashes in FY98, is provided in Table 2.

- **The ‘Dynamic’ Nature of the 21-County Target**

The extent to which the CMV fatal crash-involvement problem is ‘migrating’ over time is shown in the Figure 6. Counties on the original list of 21 are represented by the darker shading; those on the current FY list but not on the original list of 21 are represented by the lighter shading. Where targeted enforcement efforts were put into effect, we see over time a reduction in fatal crashes (indicated by the county coming off the top 21 list). However new counties, not on the original NCDOT list of 21, are beginning to appear. In the western part of the state, Henderson and McDowell counties take the place of Buncombe and Haywood previously on the original list of 21. Northwest of Winston-Salem (Forsyth Co), Yadkin and Surry counties appear on the list. Union county, adjacent to Mecklenburg Co, now appears consistently on the list of 21. Perhaps most noticeable is a continuation or further development of an area defined by counties in/near the I-95 corridor. Figure 7 indicates current and ‘new’ areas for consideration in terms of increased CMV enforcement.

TABLE 2
Total CMV Crashes and Total CMV Crashes Involving
a Fatality for FY98 and FY99 by Individual North Carolina County
(Counties in original 21 county 'target' area are highlighted)

All CMV-Involved Vehicles			All CMV Vehicles Involved in Fatal Crashes	
County	FY98	FY99	FY98	FY99
Alamance	246	218	2	3
Alexander	35	25		
Alleghany	13	11	1	0
Anson	68	64	1	1
Ashe	21	28	1	1
Avery	21	15	0	1
Beaufort	73	66	1	2
Bertie	39	39	0	5
Bladen	60	59	1	1
Brunswick	77	71	2	2
Buncombe	454	379	2	3
Burke	145	146	3	4
Cabarrus	281	252	1	0
Caldwell	110	97	1	1
Camden	7	7		
Carteret	62	53	2	0
Caswell	22	20	2	0
Catawba	399	346	5	0
Chatham	99	93	2	6
Cherokee	20	17		
Chowan	16	21		
Clay	11	13		
Cleveland	154	155	6	1
Columbus	89	119	3	6
Craven	99	92	3	1
Cumberland	384	401	2	7
Currituck	20	13		
Dare	38	35		
Davidson	240	224	3	4
Davie	54	53	2	0
Duplin	132	112	5	5
Durham	652	610	8	3
Edgecombe	91	71	1	2
Forsyth	696	610	5	5
Franklin	86	50	0	3
Gaston	366	347	4	0
Gates	19	15	1	0
Graham	9	4		
Granville	89	99	3	2
Greene	46	19		
Guilford	1324	1244	4	9
Halifax	121	91	2	1
Harnett	137	96	0	3
Haywood	105	135	2	2
Henderson	110	114	2	4
Hertford	25	26	3	0
Hoke	22	25	1	0
Hyde	4	7		
Iredell	287	299	3	4
Jackson	50	39	2	0
Johnston	245	230	6	5
Jones	15	14	1	

Lee	116	136		4	2
Lenior	95	95		1	3
Lincoln	68	74		3	3
Macon	36	38		2	1
Madison	24	22		0	1
Martin	61	57		0	1
McDowell	104	115		4	1
Mecklenberg	3345	3249		10	7
Mitchell	9	8			
Montgomery	43	46		1	2
Moore	117	119		1	3
Nash	181	156		2	3
New Hanover	356	290		1	0
Northhampton	41	36		3	2
Onslow	126	150		2	4
Orange	161	200			
Pamlico	13	7			
Pasquotank	63	56		0	2
Pender	49	43		2	4
Perquimans	17	17		0	1
Person	51	43		1	1
Pitt	190	159		0	2
Polk	33	23		2	2
Randolph	162	167		6	1
Richmond	123	108		1	3
Robeson	230	227		7	3
Rockingham	118	137		3	1
Rowan	258	242		6	3
Rutherford	80	64		1	3
Sampson	102	112		4	3
Scotland	44	54		2	3
Stanly	89	85		0	2
Stokes	34	43		0	2
Surry	125	172		4	5
Swain	8	20			
Transylvania	29	32		0	1
Tyrrell	5	6			
Union	264	256		4	4
Vance	92	69		1	1
Wake	1591	1538		7	8
Warren	25	21			
Washington	25	20		0	1
Watauga	68	75			
Wayne	165	191		3	2
Wilkes	84	86		3	1
Wilson	232	170		4	2
Yadkin	64	50		4	2
Yancey	11	12			

Figure 6
Original 21 Counties (based on 1-95 thru 8-98); FY98 High Crash
Counties (middle); FY99 High Crash Counties (bottom)

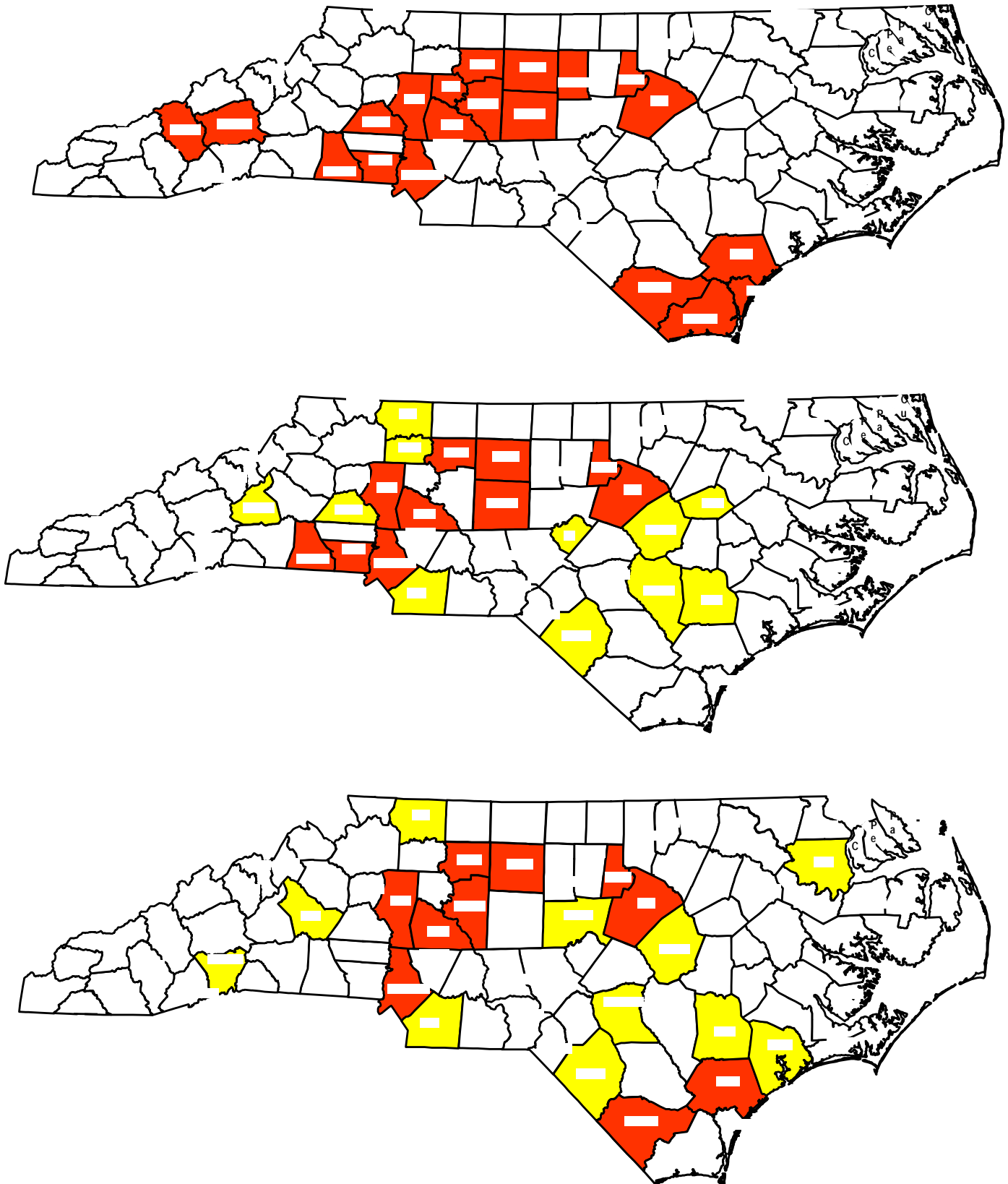
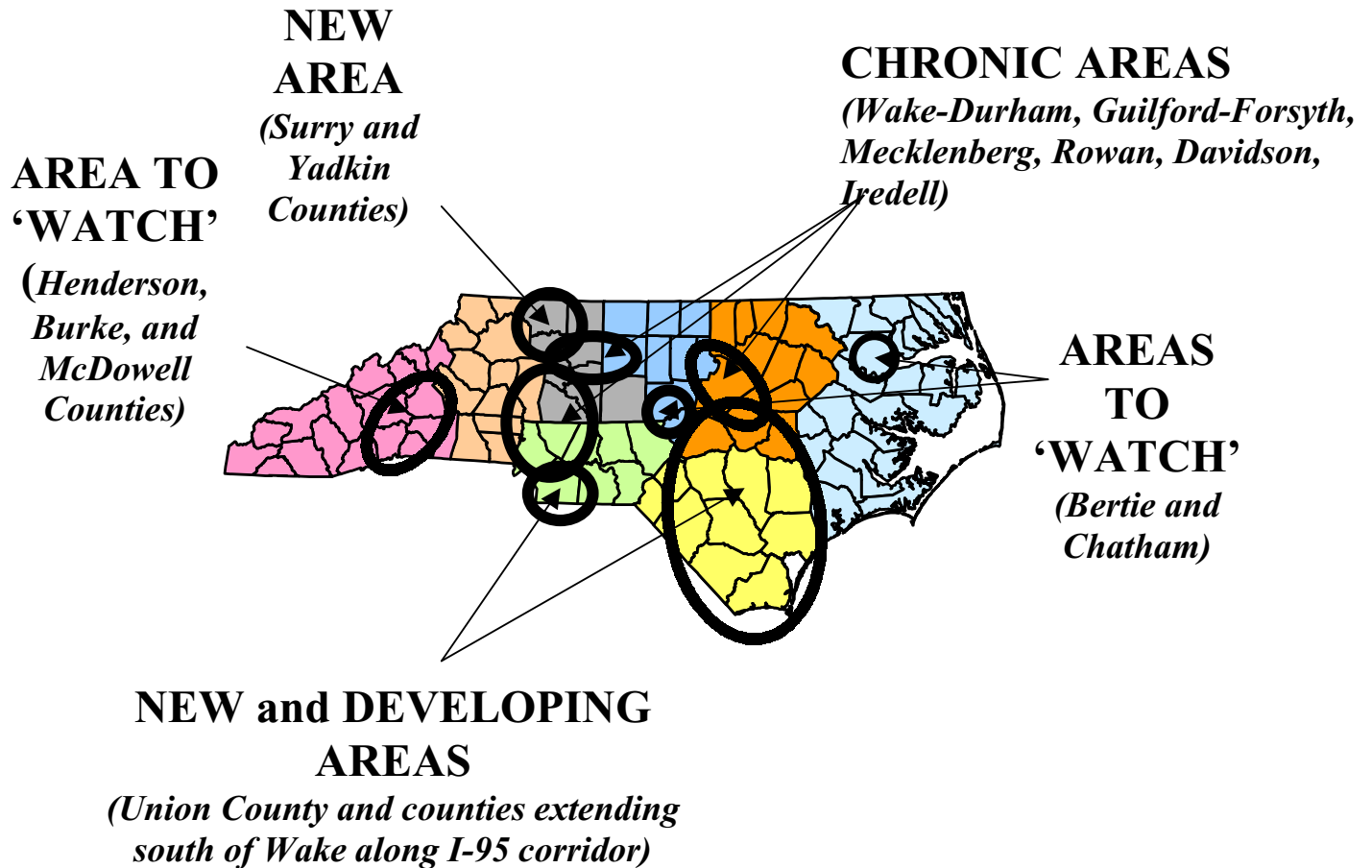


Figure 7
CANDIDATES FOR TARGETED CMV ENFORCEMENT



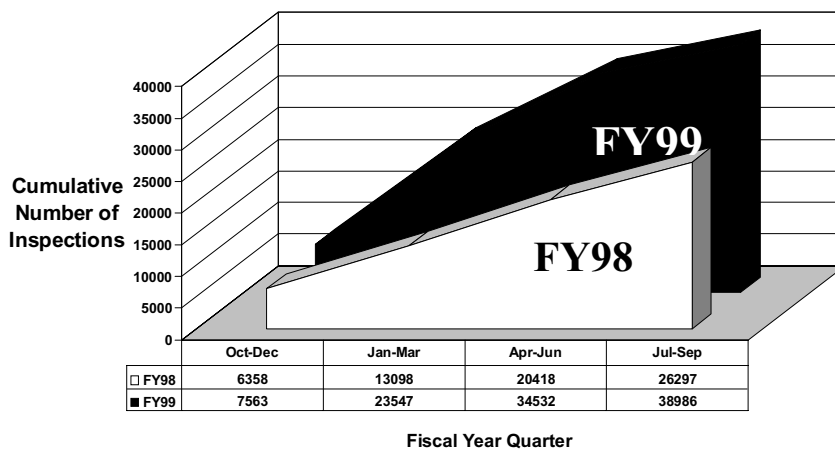
- Evidence for Increased CMV Enforcement

Driver and Vehicle Inspections (Statewide)

Driver and vehicle roadside inspections are an important part of DMV Enforcement responsibilities. Figure 8 presents data (as of the FY99 4thQTR MCSAP report) on the number of inspection actions conducted by the DMV in FY98 and FY99. The data do not reflect the DMV data entry backlog. DMV estimates that at the end of September 1999 (i.e., end of 4thQTR, FY99), there were approximately 14,000 inspections that had yet to be entered into SAFETYNET and are thus not included in these totals.

Figure 8

**Cumulative Number of CMV Inspections Conducted
by Year
(FY98 and FY99)**



**48% increase in overall
number of
CMV roadside inspections**

NOTE: Data do not reflect the backlog of approximately 14,000 inspection reports not entered into the system as of 09-99.

Figure 9 shows the cumulative number of CMV inspections conducted, by quarter, during FY98 and FY99, overall and by specific level. The cumulative total (not counting the backlog) of all inspection types combined was 48% higher in FY99 than in FY98.

Figure 9, which is based on 4th QTR FY99 MCSAP data shows that overall (when taking into account the backlog), the MCSAP program approached the goal of 60,000 inspections in FY99. HazMat and Bus inspections, according to data available as of the end of Qtr4 FY99, were both well below projected levels. It appears that roadside inspection goals were achieved (when the backlog is considered) for Level II and Level III inspections, but not for Level I. These data reflect the increased DMV emphasis on driver-related inspections in the FY99 CVSP.

Figure 9
Level I, II, and III Inspections, Actual Versus Predicted for FY99

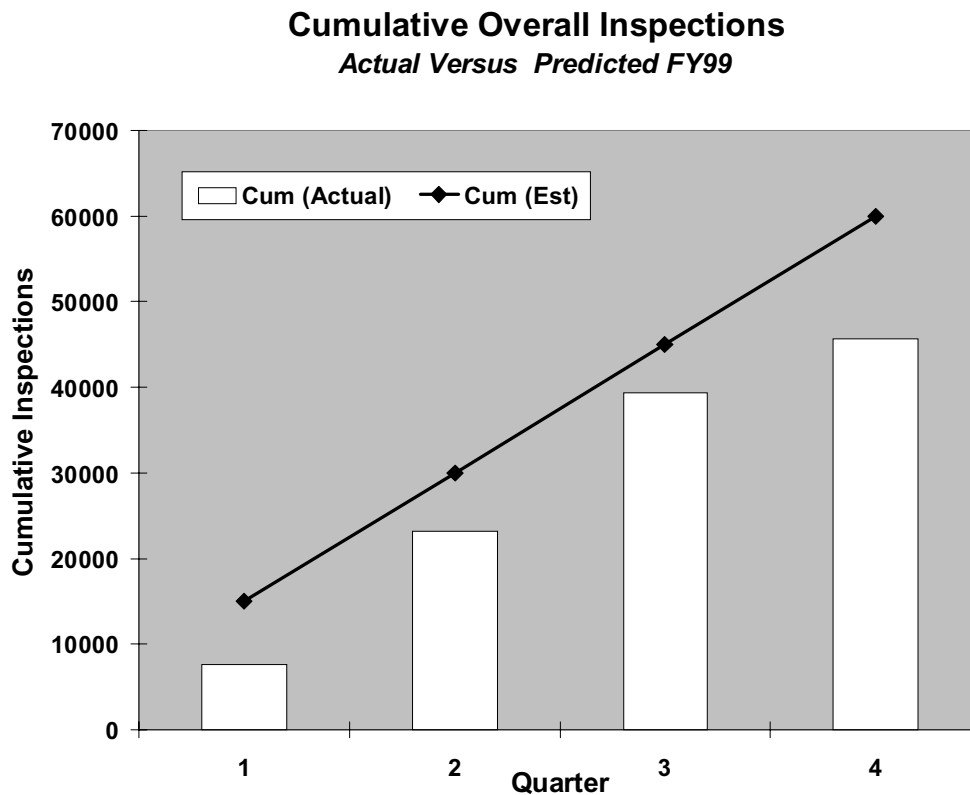
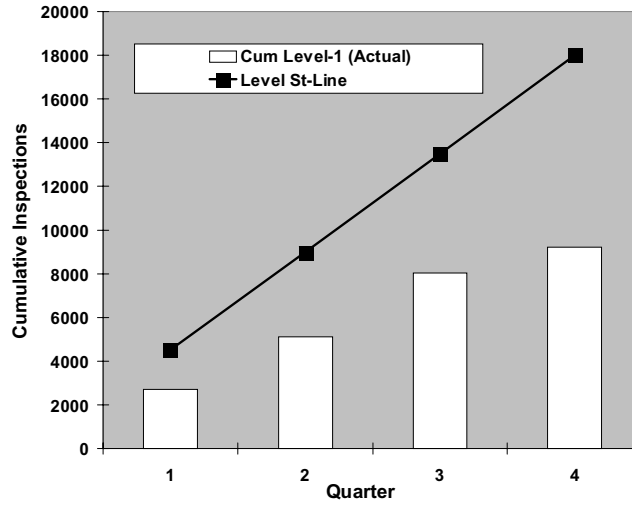
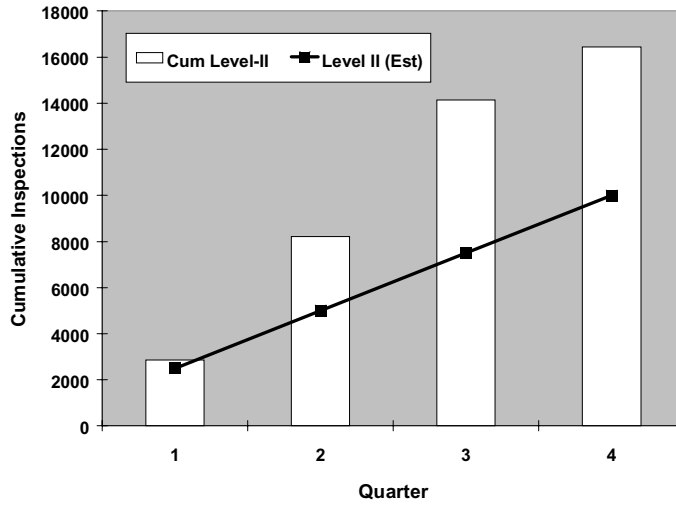


Figure 9, Continued

Cumulative Level I Inspections
Actual Versus Predicted, FY99



Cumulative Level II Inspections
Actual Versus Predicted, FY99



Cumulative Level III Inspections
Actual Versus Predicted, FY99

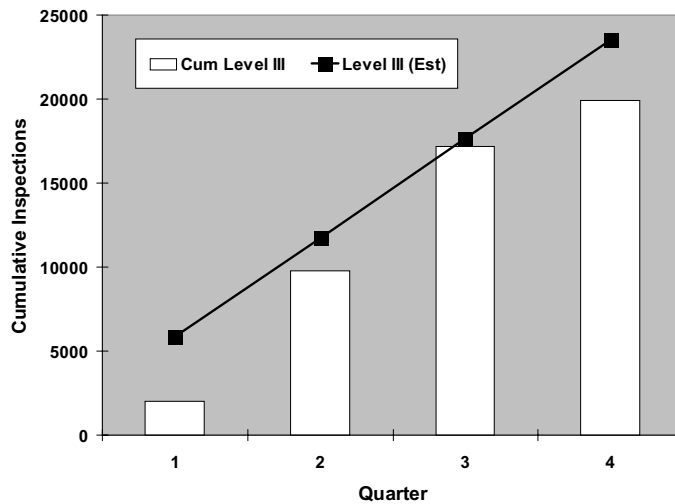
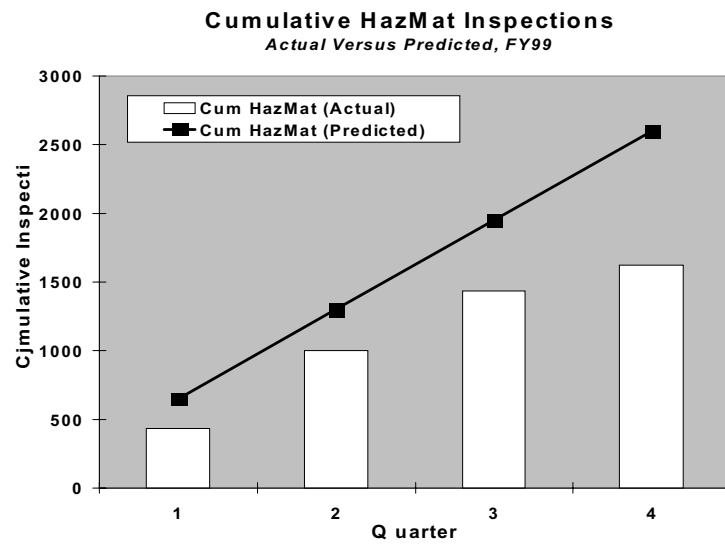
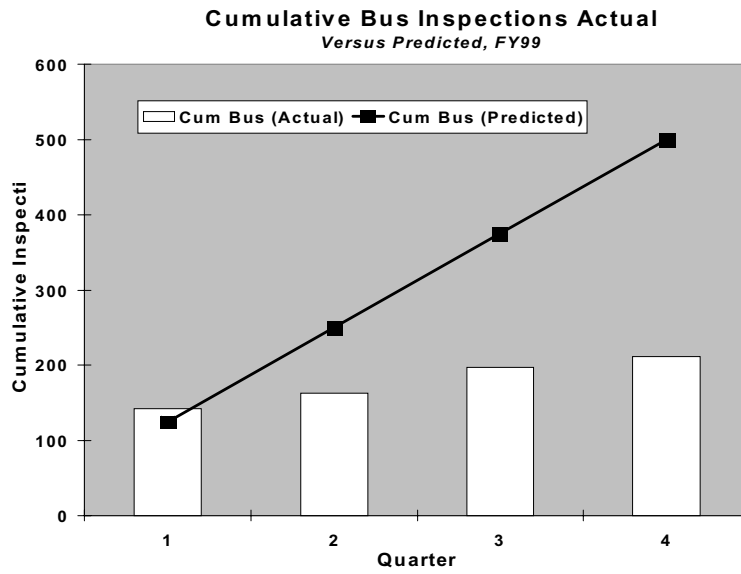


Figure 9, Continued

Vehicle/Driver Inspections in 21-County Area

Table 3 documents the number of inspections (all levels) conducted during FY98 and FY99, both statewide as well as within the targeted (21-county) and non-targeted areas. The 48 percent increase in inspections statewide is clearly due to the large (129%) increase in inspections in the 21-county target area. Inspections in the 79-county non-targeted area decreased by 17 percent. It is not clear whether this decrease in inspections alone is sufficient to account for the increase in fatal truck-involved crashes in those counties during FY99

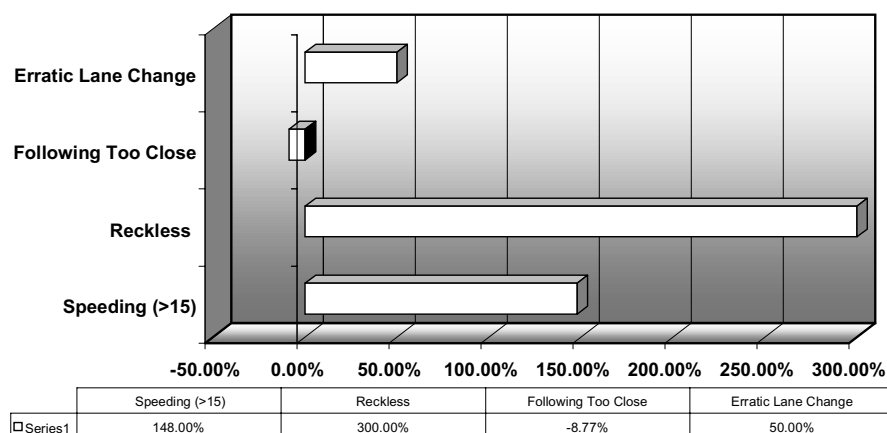
TABLE 3			
Number of Inspections (All Levels)			
	21 Counties	Other Counties	Totals
FY98	11781 (561)	14516 (184)	26297 (263)
FY99	26975 (1284)	12011 (152)	38986 (390)
%Change	129%	-17%	48%

Note: Numbers in parentheses are averages, per county

Serious CDL Traffic Violations (4thQtr FY99 –vs- 4th Qtr FY98)

Figure 10 compares serious CDL traffic violations (citations written) between 4th Qtr FY99 and 4th Qtr FY98. The data shown in Figure 10 are *statewide*. An analysis is currently being conducted that will enable comparisons to be made between the 21 county enforcement area and the remainder (non-targeted) areas of the state. Comparisons are expressed as a ‘percent difference.’ Positive differences indicate an increase in the number of citations written in FY99. A negative result indicates a decrease from FY98 to FY99. The data indicate that the number of serious CDL citations issues in FY99 increased from approximately 50 percent (erratic lane changes) to approximately 300 percent for reckless driving. Serious CDL speeding citations (for speeds in excess of 14 mph over the posted limit) increased by roughly 150 percent. The only area showing a decrease in FY99 was ‘following too close.’

Figure 10
Percent Difference Between the Number of Serious CDL Citations Issued 4th Quarter FY98 and 4th Quarter FY99



Out of Service Citations

It is a major goal of the roadside inspection program to identify driver and vehicle deficiencies, and, where warranted, to place either the driver or vehicle, or both, out-of-service. Figures 11 and 12 show the cumulative number of vehicles and drivers placed out-of-service in FY98 and FY99. Figure 13 documents the percent change in the number of drivers and vehicles placed out of service from FY98 to FY99. The data are expressed as an average per county measure. Inasmuch as FY99 saw an increased focus on driver-oriented inspections, it is not surprising to find that there was a 24% increase in the number of drivers placed out-of-service in FY99 compared to FY98. Even though the overall number of inspections for FY99 exceeded the number of FY98, the number of vehicles placed out-of-service in FY99 was only 2% greater than that in FY98. . . perhaps, in part, due to an apparent decrease in Level I inspections in FY99

Out-of-service rates (number of OOS actions divided by total inspections) remained approximately the same for *drivers* (approximately 6-7 per 100 inspections). A similar approach to computing an estimate of vehicle OOS rates results in an under estimate of the true vehicle OOS rate since (1) a vehicle would be placed OOS only as the result of a Level I or II inspection and (2) given the increase in Level II and Level III inspections in FY99, using *all* FY99 inspections to estimate the vehicle OOS rate would result in a further under estimate of the true vehicle OOS rate.

Evidence of Public (CMV) Education Efforts

From January through December 1998, DMV Enforcement personnel conducted 13 “Share the Road” programs in public school systems throughout the state. These 13 programs reached 712 individuals in driver education programs at the junior and senior high level. From January through December 1999, DMV personnel conducted 48 programs, reaching 1,930 in attendance. This represented a three to four-fold increase in the number of presentations delivered and a two to three-fold increase in the number of young drivers exposed to ‘share the road’ concepts.

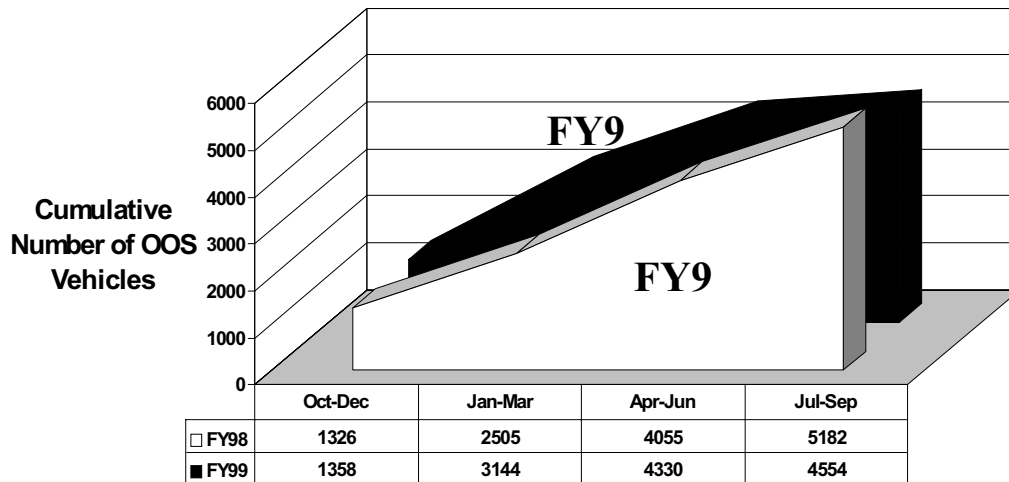
Evidence of Judicial Outreach Efforts and Adjudication Tracking

Work was begun on creating a video presentation which could be used to raise the awareness of those working on the adjudication side of the CMV enforcement issue (i.e., judges, prosecutors, etc.).

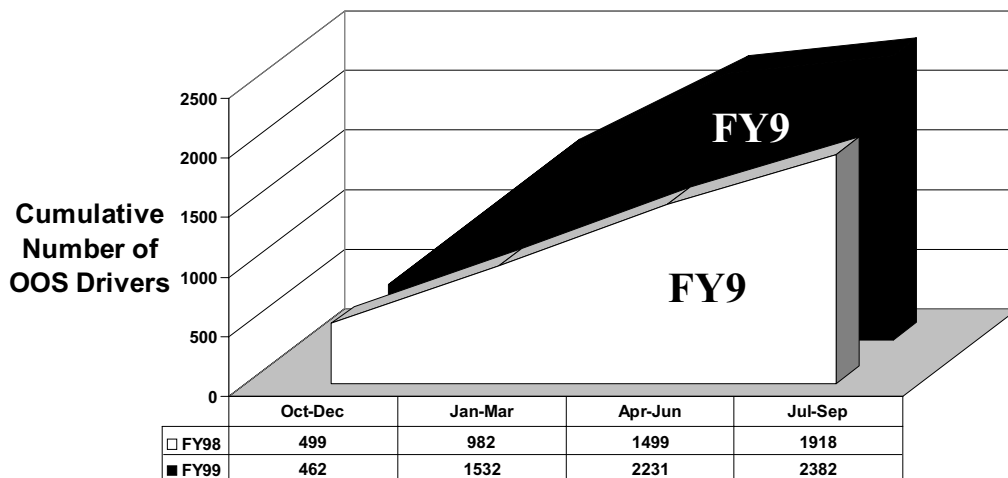
Adjudication tracking efforts continued in FY99. Because of the prolonged process involved, the piecemeal nature of the available data make it difficult to assess the extent to which there has been a significant increase in the convicted-as-charged rate for serious CDL violations. The tracking effort is continuing. The ability to monitor this process, however prolonged and piecemeal it may seem, is essential to DMV being able to objectively assess the effectiveness of its overall judicial outreach program(s). Timely and effective adjudication of serious CDL offenses is not just an administrative issue. Without appropriate adjudication, the effectiveness of legislation and enforcement are seriously degraded.

Figures 11 and 12

Cumulative Number of Vehicles Placed Out-of-Service Statewide (FY98 and FY99)



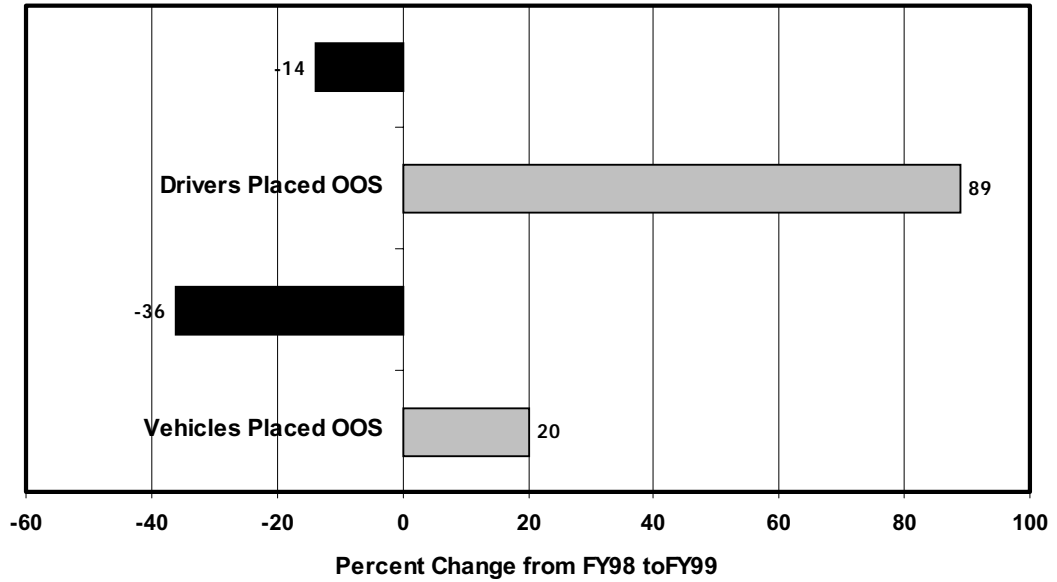
Cumulative Number of Drivers Placed Out-of-Service Statewide (FY98 and FY99)



24% increase in drivers placed OOS

NOTE: Data do not reflect the backlog of approximately 14,000 inspection reports as of the end of 4thQTR FY99.

Figure 13
Percent Change from FY98 to FY99 in the Number of Vehicles
and Drivers Placed Out-of-Service
(Average Per County) by Area of Enforcement



21 County Area
 Non-Targeted Area

Average Number of Drivers Placed OOS Per County

	<i>21 County</i>	<i>Other Counties</i>
FY98	37	14
FY99	70	12
	<i>89% increase</i>	<i>14% decrease</i>

Average Number of Vehicles Placed OOS Per County

	<i>21 County</i>	<i>Other Counties</i>
FY98	101	39
FY99	121	25
	<i>20% increase</i>	<i>36% decrease</i>

Timeliness and Non-Match Issues

The data reported in this section provide feedback on the efficiency whereby inspection and accident data are entered into the SAFETYNET system. While timely data are important to the management of any process, to include the MCSAP program, it is also important to keep in mind that the effectiveness of the enforcement activities reported through SAFETYNET must be evaluated independently of the timeliness associated with their entry and system upload.

The timely entry and upload of data to SAFETYNET do not guarantee commercial vehicle safety. Granted, the more timely data that are available for use by system managers, the more effectively that limited equipment and personnel resources can be ‘targeted’ to specific areas of need. The evidence reported elsewhere in this evaluation argue clearly for the measured effectiveness of DMV enforcement actions during FY99 and for the effective use of data in specifically ‘targeting’ limited resources toward specific geographical areas in the state. Operational effectiveness notwithstanding, there is clear room for improvement in NCDMV’s ability to quickly and accurately enter and upload data into SAFETYNET. The following results address those areas of continued need.

- **Time from Inspection to Entry**

The data in Figure 14 show the time (in days) from inspection to entry (not upload). The data are reported for each of the eight (8) states in Region 4 for FY99 and for FY98. Comparison data are also presented for the region as a whole and for the US overall. It is clear from looking at these data that North Carolina was the only state in Region 4 not to show a reduction in the ‘inspection-to-entry’ time from FY98 to FY99. During this period, inspection-to-entry times in North Carolina increased from an average of 17 days to an average of 41 days. This is, obviously in part due to the significant data entry backlog and to personnel limitations on addressing the problem.

- **Time from Entry to Upload**

Figure 15 shows in a similar manner state, region, and US performance in terms of the time from data entry to system upload. The average entry-to-upload times for Region 4 and for the US overall were both 10 days for FY99. For FY98 this represented a slight decrease in performance for Region 4; a light increase in performance for the US overall. During this period, North Carolina exhibited the worst performance in the Region, with entry-to-upload times increasing from an average of 12 days in FY98 to an average of 20 days in FY99. Personnel shortages and SAFETYNET system availability problems were, in some part, contributing factors.

- **Overall Time from Inspection to Upload**

Figure 16 looks overall performance from time of inspection to time of system upload. In FY99, the time from inspection-to-upload in North Carolina was 60 days. . . an increase of 29 days, on the average, from the level of performance demonstrated in FY98. Region 4 overall closely approximated the mean level of performance nationwide (33 days for

Region 4 compared to 29 days for the US overall). The combined effects of a significant increase in the overall number of inspections conducted, manpower and personnel shortages in the data entry area, and SAFETYNET system availability problems result in an inspection-to-upload timeline for North Carolina that is almost double that of the rest of Region 4 and the US overall.

- **Time from Accident to Data Entry**

Data here refer to the information provided on the Form 349-C (the ‘supplemental’ form, as it is referred to in North Carolina). In FY98 and FY99, the Form 349-C was a separate form that the reporting officer had to fill out. It is recognized that this additional form was not always filled out by the individual submitting the normal crash report form. It is the 349-C, however, and not the primary crash form itself that provides the basis for documenting CMV-involved crashes through the SAFETYNET system. Beginning after the first of calendar year 2000, a single revised crash report form is being adopted by North Carolina, and is expected to, in large part, eliminate many of the CMV reporting problems experience in the past. The data for FY98 and FY99 thus reflect many of the problems associated with the older system. Also in FY2000, laptop computers are being installed in all MCSAP patrol vehicles and will permit MCSAP officers to directly upload inspection data to SAFETYNET. Any delays in uploading accident data to SAFETYNET after adoption of the new reporting form will be synonymous with overall DMV crash reporting practices and no longer unique to those of the DMV Enforcement branch.

Figure 17 shows the average time (in days) from the accident to data entry for each state in Region 4 and for the US as a whole. In FY99, both Region 4 and the US as a whole reduced the time from accident-to-data entry, by 14 days and 32 days, respectively. During this same period, the state went from an average of 36 days in FY98 to an average of 49 days in FY99. As with the inspection data, these delays were in large part due to manpower/personnel problems; to delays in the submission of the 349-C; and to a continuation of SAFETYNET system availability problems.

- **Time from Entry to Upload**

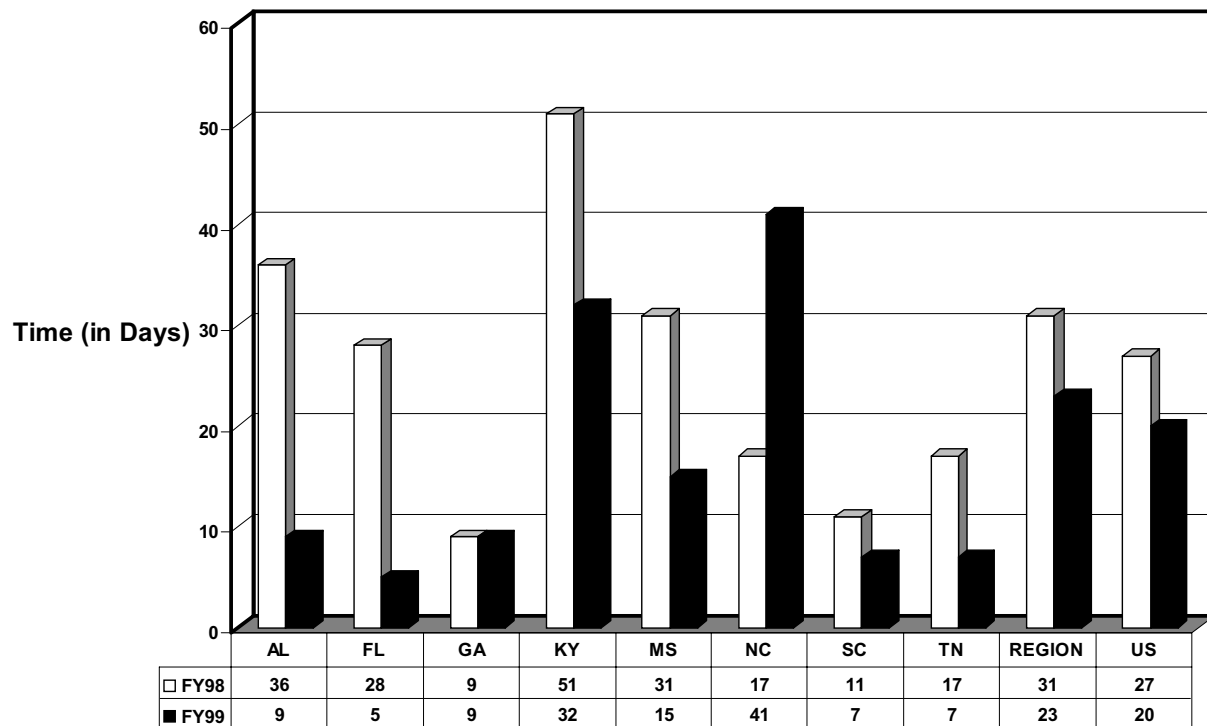
In FY99, the time between data entry and system upload (see Figure 18) decreased in Region 4 from an average of 14 days to an average of 8 days. In the US as a whole, the time decreased from an average of 15 days to an average of 10 days. In North Carolina during this period, entry-to-upload times increased from 9 days to 13 days.

- **Overall Time from Accident to Upload**

Overall accident-to-upload times decreased from FY98 to FY99 both for Region 4 and for the US as a whole (see Figure 19). Times in Region 4 decreased from 77 to 57 days. Times in the US overall decreased from 124 to 85 days. Time from accident to upload in North Carolina increased from 45 to 62 days on the average from FY98 to FY99.

Figure 14

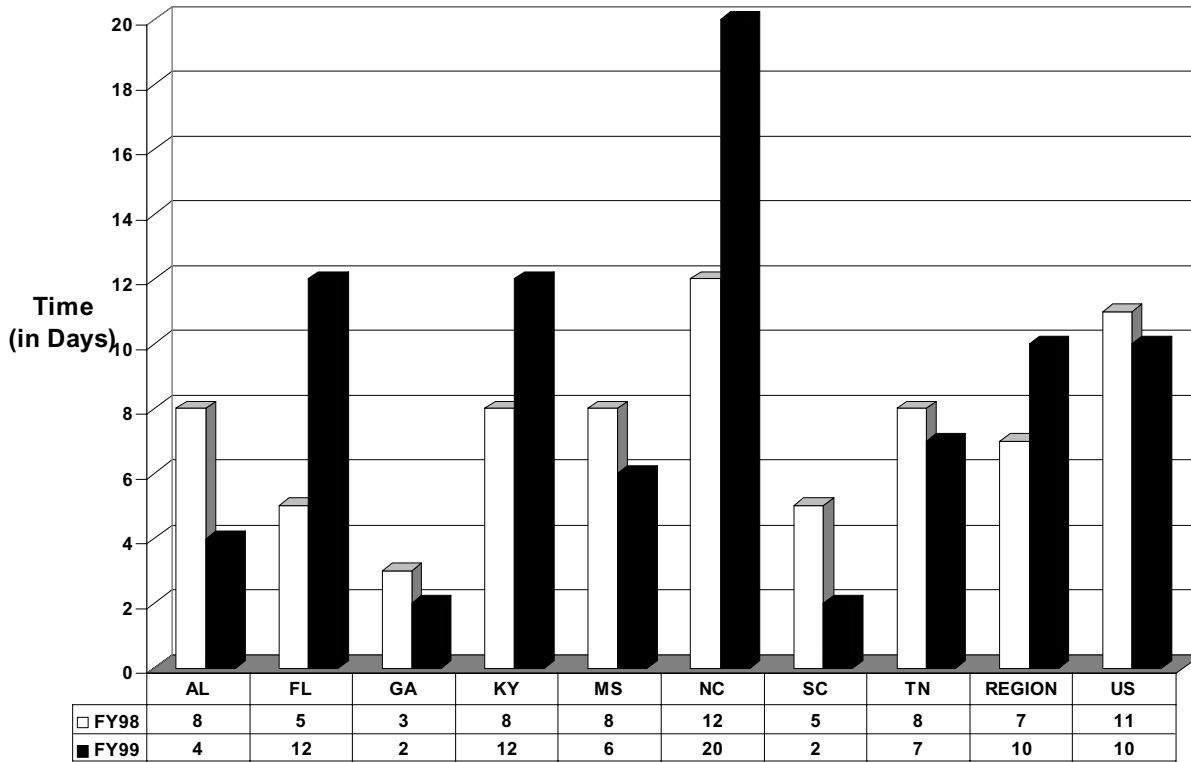
**Time (in Days) From Inspection to Entry
(FY99 Compared to FY98)**



NORTH CAROLINA WAS ONLY STATE IN REGION 4 NOT TO REDUCE TIME BETWEEN INSPECTION AND DATA ENTRY. IN FY99, TIME INCREASED FROM AN AVERAGE OF 17 DAYS TO AN AVERAGE OF 41 DAYS

Figure 15

Time (in Days) Between Data Entry and Upload (FY98 and FY99)

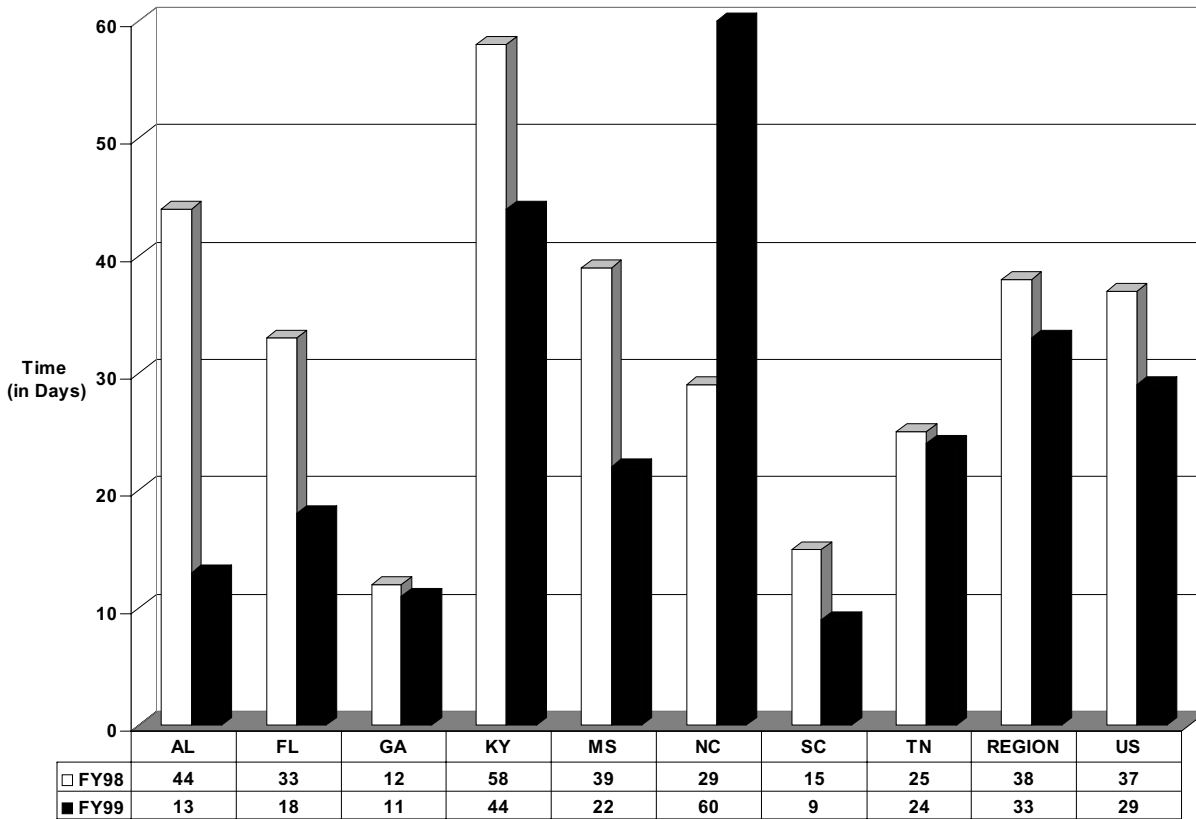


IN FY99, NORTH CAROLINA HAD WORST PERFORMANCE IN REGION 4 IN TERMS OF TIME FROM ENTRY TO UPLOAD (INCREASED FROM AN AVERAGE OF 12 DAYS TO AN AVERAGE OF 20 DAYS).

REGION 4 AVERAGE IN FY99 WAS 10 DAYS. NATIONWIDE AVERAGE WAS ALSO 10 DAYS.

Figure 16

Time (in Days) Between Inspection and Upload

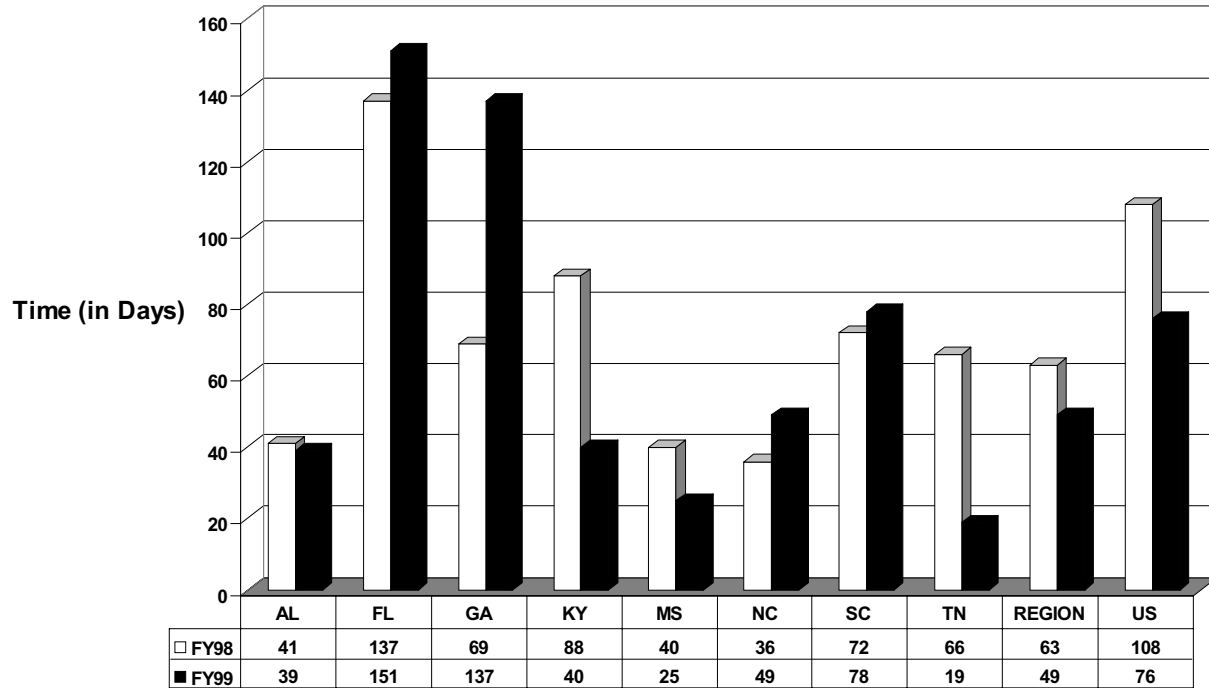


IN FY99, THE TIME REQUIRED FOR NORTH CAROLINA TO GO FROM INSPECTION TO UPLOAD WAS 60 DAYS. THIS WAS AN INCREASE OF 31 DAYS FROM THE PREVIOUS YEAR (FY98)

REGION 4 AVERAGE IN FY99 WAS 33 DAYS, WHICH WAS 4 DAYS MORE THAN THE NATIONAL AVERAGE. OF 29.

Figure 17

Time (in Days) from Accident to Entry (FY98 and FY99)

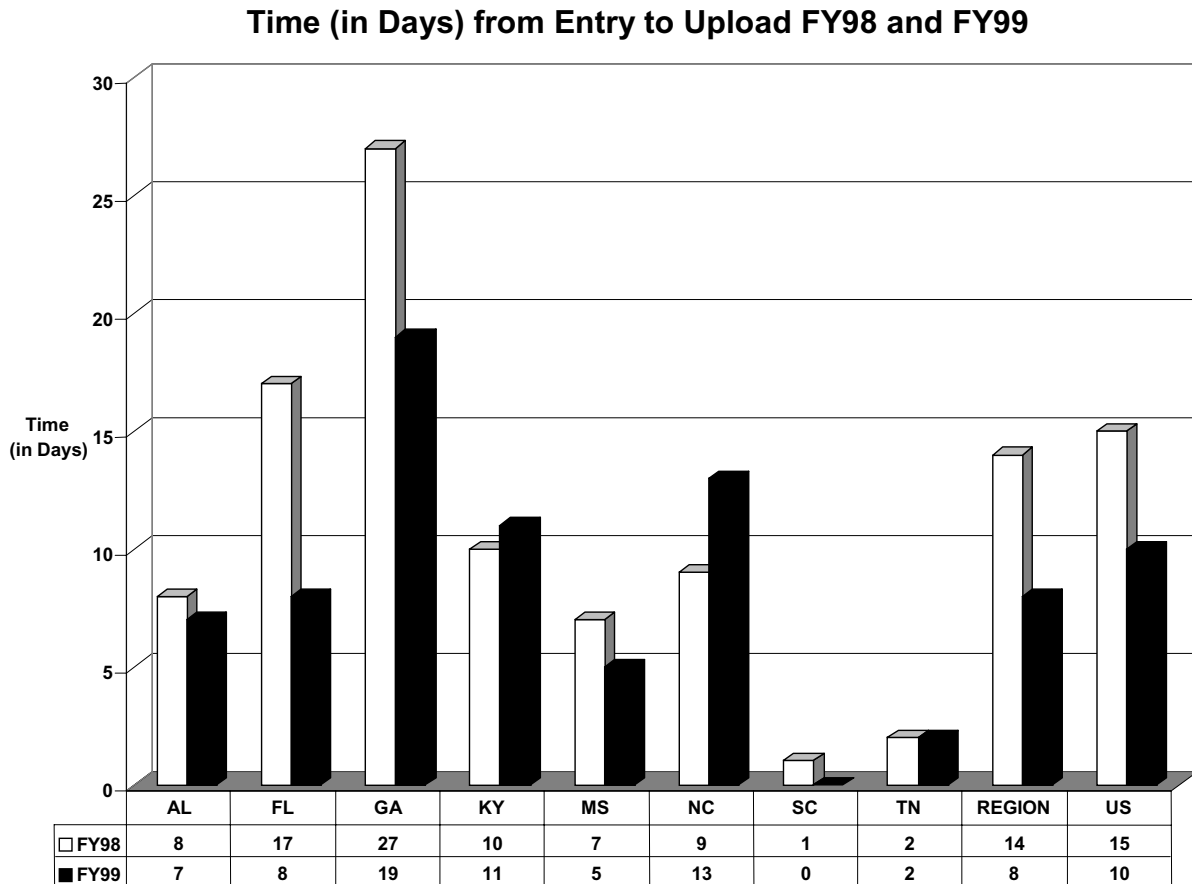


IN FY99, REGION 4 REDUCED THE NUMBER OF DAYS BETWEEN ACCIDENT AND ENTRY FROM 63 DAYS TO 49 DAYS.

IN THE NATION OVERALL, THE TIME WAS REDUCED FROM AN AVERAGE OF 108 DAYS TO AN AVERAGE OF 76 DAYS.

IN NORTH CAROLINA, THE TIME INCREASED FROM AN AVERAGE OF 36 DAYS IN FY98 TO AN AVERAGE OF 49 DAYS IN FY99.

Figure 18



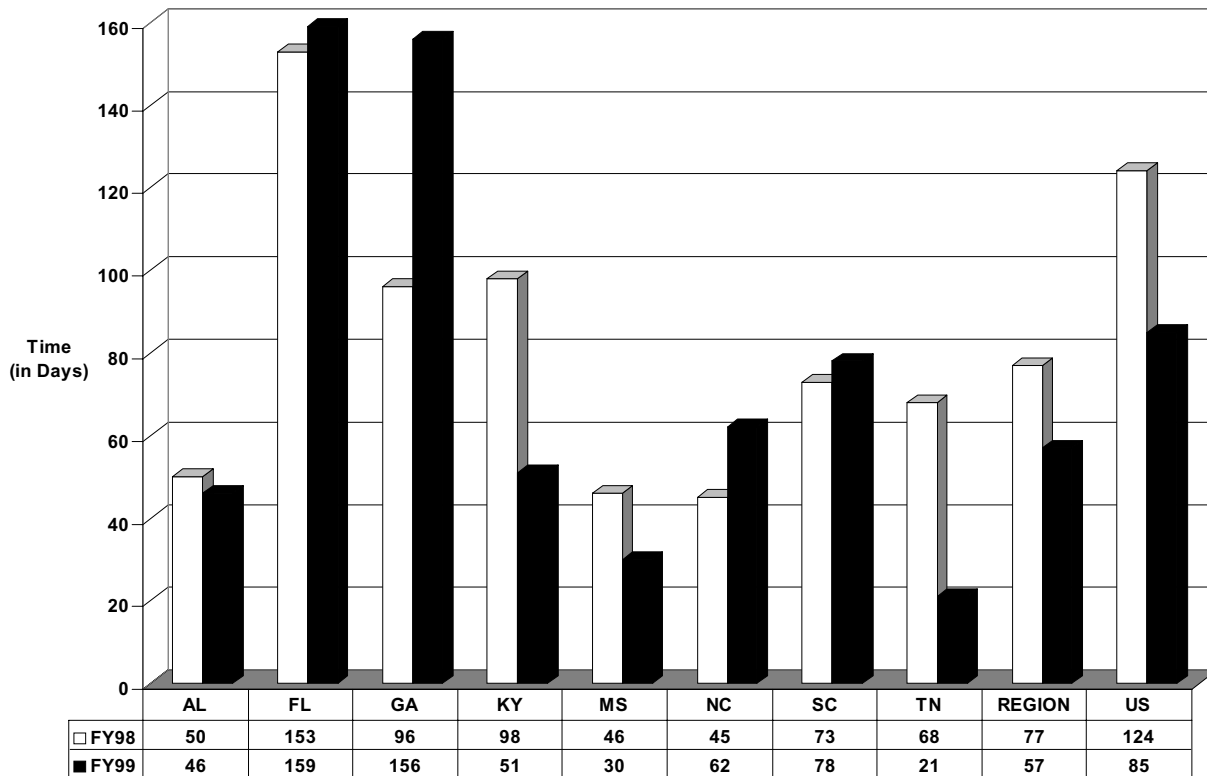
IN FY99, THE TIME BETWEEN ENTRY AND UPLOAD DECREASED IN REGION 4 FROM AN AVERAGE OF 14 DAYS TO AN AVERAGE OF 8 DAYS.

IN THE US AS A WHOLE, THE TIME DECREASED ON THE AVERAGE FROM 15 DAYS TO 10 DAYS.

THE TIME IN NORTH CAROLINA INCREASED FROM 9 DAYS IN FY98 TO 13 DAYS IN FY99.

Figure 19

**Overall Time (in Days) Between Accident and Upload
FY98 and FY99**



FROM 5798 TO FY99, THE TIME REQUIRED IN REGION 4 FROM ACCIDENT TO UPLOAD DECREASED FROM 77 TO 57 DAYS.

IN THE US OVERALL, THE TIME DECREASED FROM 124 TO 85 DAYS.

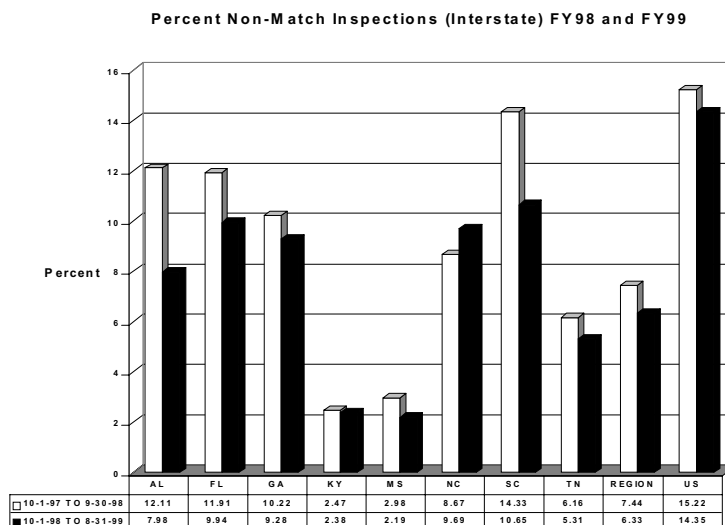
IN NORTH CAROLINA, THE TIME BETWEEN ACCIDENT AND UPLOAD INCREASED FROM AN AVERAGE OF 45 DAYS IN FY98 TO AN AVERAGE OF 62 DAYS IN FY99.

Non-Match Information

In addition to CVSP goals for improvements in the timeliness with which data are entered and uploaded into SAFETYNET, there are also goals for reducing the percentage of non-match data. Figure 19 shows comparisons of FY98 and FY99 data for each state in Region 4, for the Region as a whole, and for the US overall.

From FY98 to FY99, the percent of non-match (interstate) inspections nationwide decreased from 15.2 percent to 14.4 percent (see Figure 20). In Region 4, the percent of non-matches decreased from 7.4 to 6.3 percent. In North Carolina, the percent of non-match inspections increased from 8.7 percent in FY98 to 9.7 percent in FY99. The data are too limited to determine whether these differences represent meaningful changes or simply year-to-year fluctuations. The important point is that North Carolina continues to have a poorer record than either Region 4 as a whole or the US as whole. Non-match problems (at least those associated with MCSAP officers, per se) should be eliminated through use of the ASPEN software and its self-checking software routines. However that data which continues to be recorded and entered manually will continue to be subject to mis-match errors.

Figure 20



Note: Data are available for only 8 months of FY99 (i.e., thru 8-31-99)

FROM FY98 TO FY99, THE PERCENT OF NON-MATCH (INTERSTATE) INSPECTIONS NATIONWIDE DECREASED FROM 15.2 PERCENT TO 14.4 PERCENT. IN REGION 4, THE PERCENT OF NON-MATCHES DECREASED FROM 7.4 TO 6.3 PERCENT.

IN NORTH CAROLINA, THE PERCENT OF NON-MATCH INSPECTIONS INCREASED FROM 8.7 PERCENT IN FY98 TO 9.7 PERCENT IN FY99.

ASIDE FROM WHETHER THESE FLUCTUATIONS ARE STATISTICALLY SIGNIFICANT, NORTH CAROLINA REMAINS TO HAVE A POORER RECORD THAN BOTH THE REGION AND THE US OVERALL

Other Considerations

As was pointed out in the introduction to this section, data on the 'efficiency' by which inspection and accident data are entered and uploaded into SAFETYNET are, in part, a reflection of variables which are, for the most part, independent of the effectiveness of the actions they represent. NCDMV Enforcement has recognized manpower/personnel problems that affect the efficiency of the data entry/upload process. Significant SAFETYNET system availability problems (quantified in the FY98 CVSP evaluation) continued to hamper progress throughout FY99. To a lesser extent, reporting problems associated with the use of the 'supplemental' Form 349-C, also affect these data. With adoption of laptop computers and the ASPEN software in all MCSAP patrol vehicles, a direct SAFETYNET data entry/upload capability in FY2000 is expected to correct some but not all of these problems (i.e, not all CVSA certified officers will have the ASPEN laptop capabilities).

To the extent that DMV Enforcement goals lead to an increase in the absolute number of inspections conducted and to the extent that data entry and system upload task remain labor intensive (both in terms of *manpower* (the number of data entry personnel available) and *personnel* (the permissible grade level) and subject to data entry errors, North Carolina will lag behind other states in the Region and the US as a whole. The use of technology (laptops, special data entry software, and direct electronic uploads), along with the adoption of the revised crash reporting form are all expected to impact these problems in a positive manner. The speed with which these problems can be eliminated will in large part be a function of the speed with which these improvements can be implemented.

- **Supplemental Analyses: Carrier Size, Crash Risk, and their Relationship to OOS Violations and Driver Traffic Enforcement Violations.**

As a part of the FY99 CVSP analysis effort, an effort was made to explore the utility of carrier, vehicle, and driver performance data available publicly on the Internet at <http://ai.volpe.dot.gov/mcspa.asp>. To the extent that these data provide information on in-state crashes (both fatal and non-fatal) and carrier size (number of power units), it is possible to develop a measure of crash risk (i.e., crashes per power unit) that can be used to compare the safety of carriers in a relative sense. Also, to the extent that these data also provide information on a carrier's vehicle and driver out-of-service rates and average moving violations per driver, they also enable one to begin to link crash statistics to DMV enforcement roadside inspection and CDL traffic enforcement activities.

At the time of the analysis, data on the A&I Online site were only available for fiscal year 1998 (which would, by definition, include the first quarter. . . Sep 98-Dec 99. . . of FY99). The data thus cannot be linked directly to crash reduction and roadside inspection goals/activities for FY99. The data, however, provide some insight into the relationship between carrier crash risk and the carrier's performance with respect to OOS violations and driver moving violations.

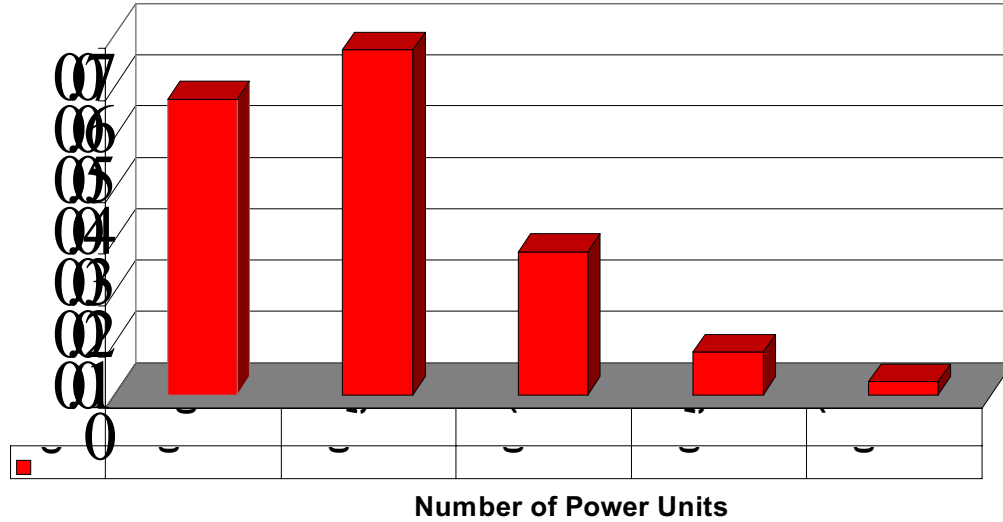
Carrier Size and Crash Risk

The analysis utilized data from the 100 carriers with the most crashes in North Carolina during 1998, irrespective of whether the carrier was domiciled in North Carolina or not. The number of power units applies to 'all' units operated by the carrier regardless of whether operated exclusively in North Carolina or not, whereas the number of crashes reported in the on-line A&I data for North Carolina relate only to those crashes experienced by the carrier in North Carolina. The present analysis therefore assumes that carrier crash risk is uniform across the different states in which the carrier operates. It should be noted too that actual carrier 'exposure' is only indirectly estimated by the number of power units under operation. Accurate measures of exposure (e.g., average miles traveled per power unit) is not available from the A&I Online data.

For analysis purposes, crash 'risk' was defined in terms of the number of crashes per power unit. Figure 21 shows that the smaller the carrier, the greater the risk, with crash risk increasing exponentially for carriers operating fewer than 50 power units (refer to bottom portion of the figure. Figure 22 shows a similar trend for *NC-based (interstate)* carriers. The data in the figure are restricted to those carriers operating fewer than 100 power units. A list of all North Carolina based intrastate carriers (regardless of size) contributing most to the overall number of truck-involved crashes is given in Appendix A.

Figure 21

Mean Number of Crashes Per Power Unit as a Function of the Number of Carrier-Operated Units
 (based on 1998 NC data downloaded from A&I Online)



Individual Safety Performances for Carriers Operating Fewer Than 100 Power Units
 (based on 1998 NC Crash data: source *A&I Online*)

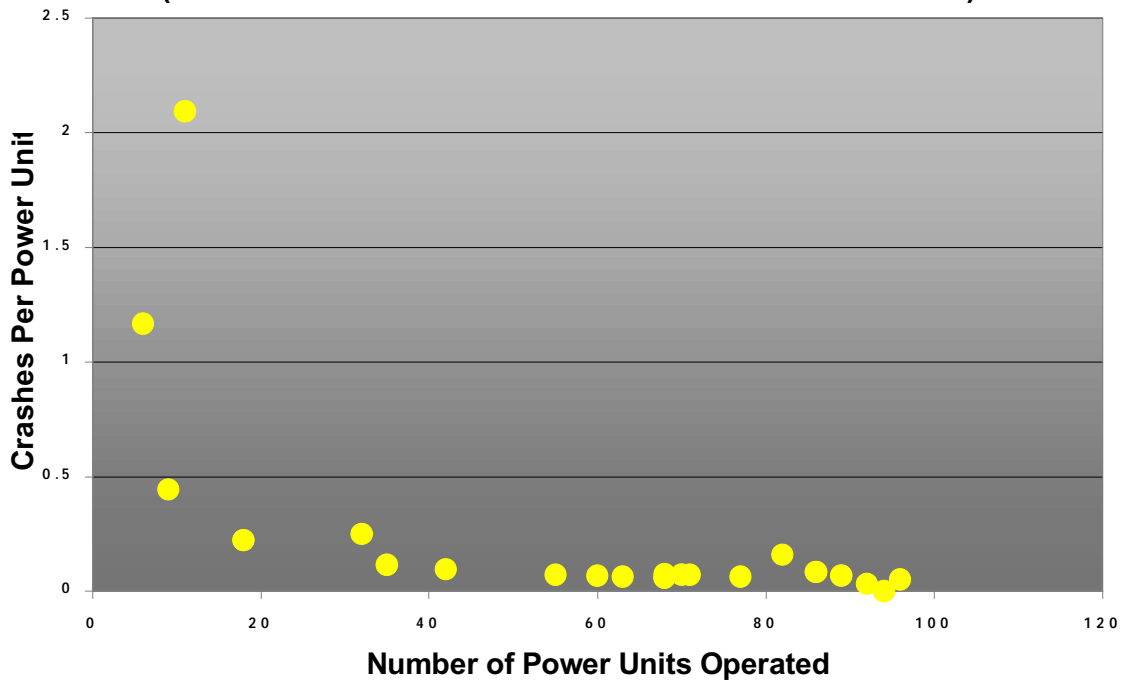
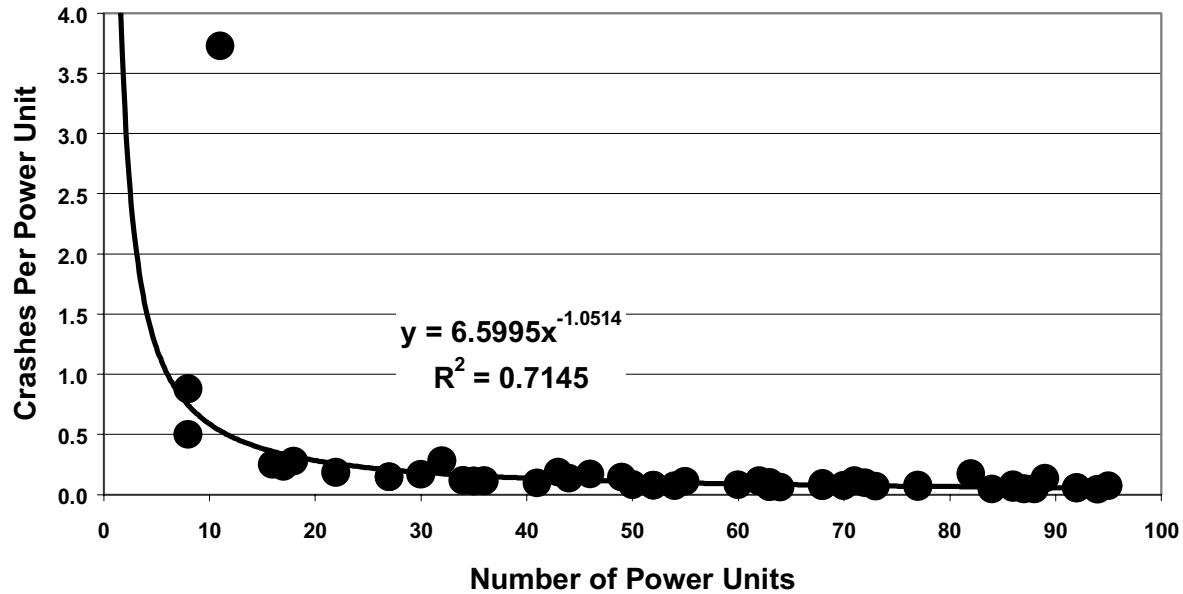


Figure 22
Crashes Per Power Unit as a Function of
the Number of Power Units
for NC-Based Carriers (<100 units) Having the Worst Crash
Records in FY98**



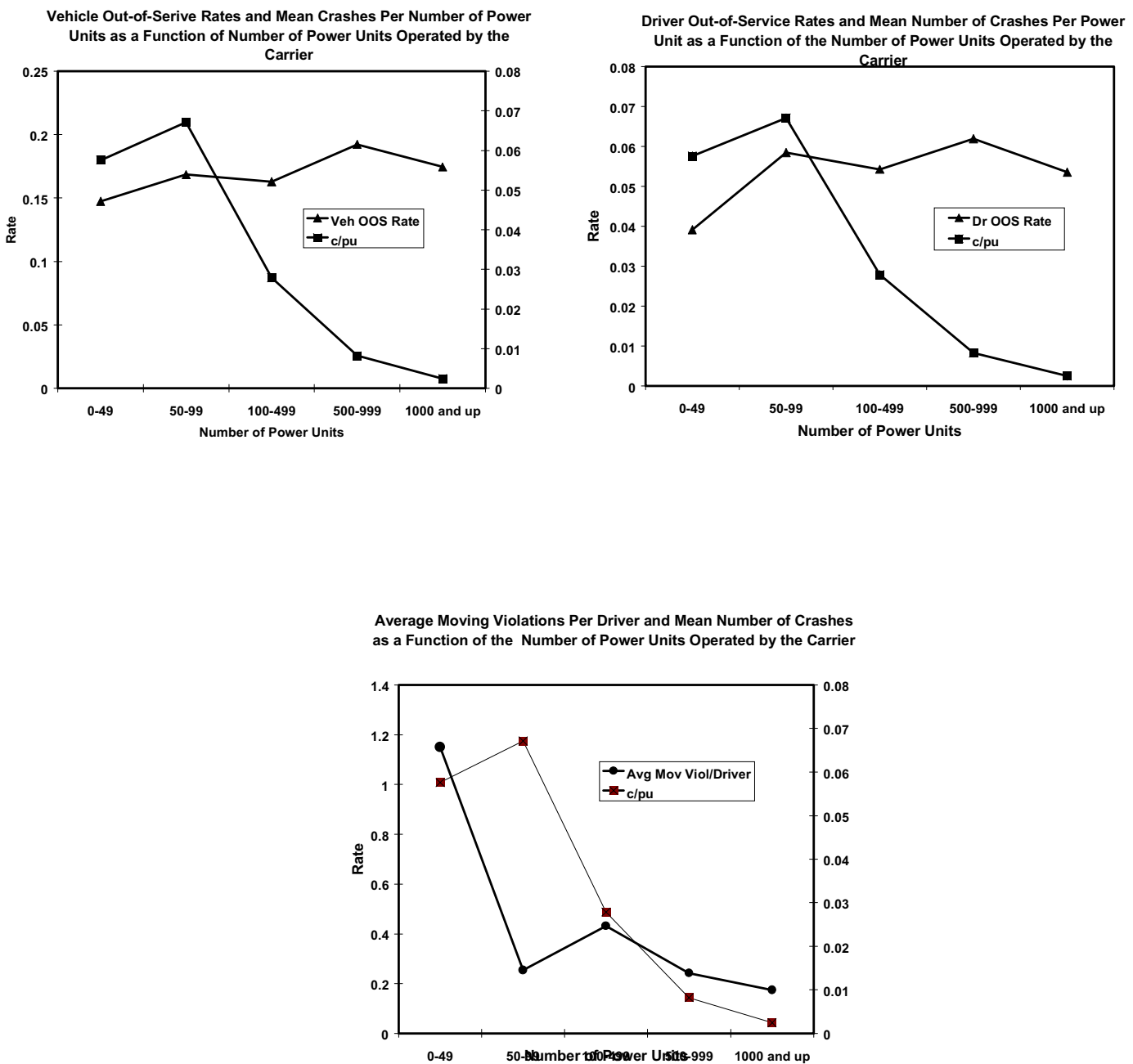
** Crashes per power unit can also be understood in terms of the probability of crash per power unit. For example, when the measure of crashes per power unit is 0.50, this means that statistically the expectation is for 1 crash for every 2 power units, which would translate into a probability of crash for any single unit of 0.50 (a 50/50 chance).

Note: These data do not represent the performance of ALL North Carolina-based carriers, only those listed as being among the top 100 NC-based carriers in terms of reported crashes for 1998.

Carrier Size, Crash Risk, OOS, and Driver Moving Violations

It might be presumed that those carriers with the highest driver and vehicle out-of-service rates would also be the carriers with the highest measures of crash risk. The data in Figure 22 show, surprisingly, no apparent relationship between driver or vehicle out-of-service rates and carrier size; and by implication, the absence of any relationship to the number of crashes per power unit.

Figure 22
Crash Risk, Carrier Size, OOS and Moving Violations



Not surprisingly, on the other hand, the data show a positive correlation between the average number of moving violations per driver and carrier size. The data suggest that driver behavior (as reflected by the number of moving violations) plays a direct role in crash risk. In the present analysis, moving violations per driver is obviously confounded with carrier size; that is to say, a direct relationship between driver moving violations has not been established independently of carrier size. . . although such a relationship could be identified, if present, from individual driver traffic and crash histories (independently of the size of the carrier for whom the driver worked).

SUMMARY

THE ENFORCEMENT 'PROCESS'

- 48 percent increase *statewide* in overall number of CMV roadside inspections from FY98 to FY99. Backlog of 14,000 at end of 4th Qtr FY99. Predict overall goals will be met. Goals for Level II and Level III exceeded.
- North Carolina continues to experience manpower and personnel problems which affect the efficiency of required SAFETYNET data entry and upload requirements.
- In the *21 county area* targeted for increased CMV enforcement activity, there was a *129 percent increase* in inspections from FY98 to FY99.
- 24 percent increase *statewide* in number of drivers placed out-of-service as a consequence of roadside inspections.
- In the *21 county area* targeted for increased CMV enforcement activity, there was a 89 percent *increase* in the average number of drivers placed out of service from FY98 to FY99. In the non-targeted counties during this same period, there was a 14 percent *decrease* in drivers placed out-of-service.
- In the 21 county area, the average number of vehicles placed out of service *increased* from FY98 to FY99 by 20 percent. A 36 percent *decrease* in vehicles placed out-of-service was recorded in the non-targeted counties.
- Percent increases ranging from 50 percent to almost 300 percent in citations written for serious CDL traffic violations (erratic lane change, reckless, and speeding in excess of 15mph). Only area to show decrease statewide was 'following too close.' Inadequate data thus far for FY99 to evaluate judicial outreach/adjudication tracking *impacts*.

THE ENFORCEMENT RESULTS

- 4 to 5 percent average reduction in truck-involved crashes *statewide*. This compares to a less-than-one percent decrease in non-CMV crashes statewide during the same period.
- *17.7 percent reduction* in fatal truck-involved crashes in *21 'high crash' county area* identified on the basis of 1995-1998 CMV crash data. Comparisons are between FY99 and FY98 (not calendar years).

THE 'DYNAMIC' NATURE OF THE 'TARGET'

- Evidence of a need to re-evaluate counties included in 'target' area. Data point to a migration of fatal truck crash problem to other adjacent counties (e.g., I-95 corridor

between Wake Co and border; Union county east of Mecklenberg; Surry and Yadkin counties northwest of Winston-Salem/Forsyth Co).

CARRIER VARIABLES

- Supplemental analyses point to relationship between carrier crash risk (crashes per power unit) and carrier size (number of power units).
- A&I Online data show that crash risk for the top 100 carriers in terms of NC crashes increased exponentially for carriers operating fewer than 50 power units.
- *No evidence* that driver or vehicle OOS rates were correlated with carrier crash risk.
- Data suggest strong correlation between carrier crash risk and a measure of the average number of moving violations for drivers employed by the carrier.

BOTTOM LINE

- **Increased CMV enforcement was demonstrated to be successful in reducing fatal truck-involved crashes in a 21 county area identified on the basis of CMV crashes (1995-1998).**
- **Increased CMV enforcement was evidenced by:**
 - **Significant increases in the number of roadside inspections**
 - **Increases in the number of vehicles and drivers placed out-of-service, and**
 - **Increases in the number of serious CDL citations**
- **Supplemental analyses indicated a high correlation between carrier size (number of power units) and crash risk (crashes per power unit).**
- **Data suggest carrier crash risk is related to average number of moving violations per driver, but not to vehicle and driver out-of-service rates.**
- **Need to document in more detail the essential elements of an increased CMV enforcement “model” for application statewide.**
- **At a minimum, consider extending the size of the ‘target’ area to 30 counties. . . i.e., the original 21 plus those in the ‘emerging’ problem areas.**
- **Evaluation efforts in FY2000 need to focus on incremental contributions of new truck safety legislation (HB 303) and NCDOT operational efforts (e.g., lane restrictions, etc.).**
- **To the extent that speed is indicated as a likely contributing factor to higher crash fatality rates, additional enforcement and traffic engineering efforts are warranted.**
- **Accelerated technology improvements are necessary to offset manpower and personnel limitations in the area of SAFETYNET data entry/upload requirements as well as to extend the effectiveness of limited enforcement personnel.**

Appendix A
North Carolina-Based Carriers With the Most Crashes Inside/Outside North Carolina in 1998

US DOT#	ICC#	Carrier Name	Power Units	Carrier City	Carrier State	Number of Crashes	Number of Fatal Crashes	Crashes Per Power Unit
47467	0	A T WILLIAMS OIL COMPANY INC	0	WINSTON SALEM	NC	6	1	
639491	299098	CORPORATE EXPRESS DELIVERY SYSTEMS-SD	0	CHARLOTTE	NC	6	1	
242397	173109	WOODRUFF TRANSPORT CO INC	0	HIGH POINT	NC	4	0	
229354	162239	SALEM CARRIERS INC	11	WINSTON SALEM	NC	41	2	3.7273
449380	280931	BRITT & SON TRUCKING COMPANY INC	8	AHOSKIE	NC	7	0	0.8750
91541	0	INTERSTATE TIRE COMPANY INC	8	WILSON	NC	4	0	0.5000
334451	0	WASTE MANAGEMENT OF CAROLINAS INC	32	GASTONIA	NC	9	0	0.2813
483220	258980	LEMONS BACKHOE & LOADER SERVICE INC	18	TROY	NC	5	1	0.2778
433916	197274	J & D TRUCKING INC	16	GRANITE FALLS	NC	4	0	0.2500
272140	239653	HAROLD A PURYEAR TRUCKING CO	17	RALEIGH	NC	4	0	0.2353
252936	175568	STAR LEASING INC	43	FAYETTEVILLE	NC	8	0	0.1860
472357	250797	MID SOUTH TRUCK LINES INC	22	ROSEBORO	NC	4	0	0.1818
206635	230752	EDWARDS WOOD PRODUCTS INC TRUCKING	46	MARSHVILLE	NC	8	0	0.1739
108568	0	MURPHY FARMS INCORPORATED	82	ROSE HILL	NC	14	1	0.1707
97221	112288	YARBROUGH TRANSFER COMPANY	30	WINSTON SALEM	NC	5	0	0.1667
340665	174834	INMAN TRUCKING INC	27	LELAND	NC	4	0	0.1481
495182	255978	T PRESSLEY TRUCKING INC	27	ASHEVILLE	NC	4	0	0.1481
226831	165196	EAST COAST LEASING INC	49	GREENSBORO	NC	7	0	0.1429
208389	160767	LADD TRANSPORTATION INC	44	HIGH POINT	NC	6	1	0.1364
517375	222306	MABE TRUCKING CO INC	89	EDEN	NC	12	0	0.1348
97077	2473	BILLINGS FREIGHT SYSTEM INC	151	LEXINGTON	NC	18	1	0.1192
207519	160198	COX MOTOR EXPRESS INC	34	GREENSBORO	NC	4	0	0.1176
171171	121834	EZZELL TRUCKING INC	207	HARRELLS	NC	24	3	0.1159
48076	0	JESSE EDWARD GALLOWAY	35	MONROE	NC	4	0	0.1143
274842	0	METRO PRODUCTS AND CONSTRUCTION INC	35	FAYETTEVILLE	NC	4	0	0.1143
273416	179973	SHELBA D JOHNSON TRUCKING INC	62	THOMASVILLE	NC	7	0	0.1129
311711	199727	SOUTHLAND TRANSPORTATION COMPANY	71	BOONVILLE	NC	8	0	0.1127
294778	196226	WILLIAM DENNIS COOK INCORPORATED	36	VILAS	NC	4	1	0.1111
386446	0	PRESTAGE FARMS INC	55	CLINTON	NC	6	0	0.1091
402000	215666	ZENITH TRANSPORTATION INC	41	CONOVER	NC	4	0	0.0976
94671	144740	L G DEWITT TRUCKING COMPANY INC	72	ELLERBE	NC	7	0	0.0972
263935	172691	SOUTHEASTERN TRANSPORT INC	103	MARION	NC	10	0	0.0971
108536	170106	THE LUNDY PACKING COMPAMY	63	CLINTON	NC	6	1	0.0952
284383	184340	PETROLEUM TRANSPORT COMPANY INC	68	MOUNT AIRY	NC	6	0	0.0882
395508	232818	CARRIER HAULERS INC	60	STATESVILLE	NC	5	0	0.0833
172859	146665	GUY SHAVENDER TRUCKING INC	86	PANTEGO	NC	7	0	0.0814
165206	145912	TRUCK SERVICE INC	50	FOREST CITY	NC	4	0	0.0800
285231	0	CBP RESOURCES INC	128	GREENSBORO	NC	10	0	0.0781
174228	148313	PHIL CLINE TRUCKING INC	77	CONCORD	NC	6	0	0.0779
252346	0	CARROLL'S FOODS INC	104	WARSAW	NC	8	0	0.0769
226571	165807	CAROLINA TANK LINES INC	52	BURLINGTON	NC	4	0	0.0769
388174	230234	TCI LOGISTICS INC	52	KERNERSVILLE	NC	4	0	0.0769
97088	115793	CALDWELL FREIGHT LINES INC	188	LENOIR	NC	14	0	0.0745
297801	175731	NORTH BERGEN REX TRANSPORT INC	54	HENDERSON	NC	4	0	0.0741
90805	19105	FORBES TRANSFER CO INC	95	WILSON	NC	7	0	0.0737
97068	45656	ANDERSON TRUCK LINE INC	95	HUDSON	NC	7	0	0.0737
157596	14286	MCO TRANSPORT INC	68	WILMINGTON	NC	5	0	0.0735
229714	0	JENKINS GAS COMPANY INC	68	POLLOCKSVILLE	NC	5	0	0.0735
120195	44128	EPES TRANSPORT SYSTEM INC	275	GREENSBORO	NC	20	0	0.0727
232982	180218	JACK B WOOTEN COMPANY	70	STATESVILLE	NC	5	0	0.0714
185354	272735	MIDLAND DELIVERY SERVICES INC	184	GREENSBORO	NC	13	0	0.0707
90884	93980	VANCE TRUCKING COMPANY INC	142	HENDERSON	NC	10	0	0.0704
314765	194927	W WAYNE TRANSPORTATION INC	73	ARCHDALE	NC	5	0	0.0685
97170	2421	NEWTON TRANSPORTATION INC	105	HUDSON	NC	7	0	0.0667
90792	128539	EAGLE TRANSPORT CORPORATION	196	ROCKY MOUNT	NC	13	2	0.0663

Appendix A
North Carolina-Based Carriers With the Most Crashes Inside/Outside North Carolina in 1998

US DOT#	ICC#	Carrier Name	Power Units	Carrier City	Carrier State	Number of Crashes	Number of Fatal Crashes	Crashes Per Power Unit
192153	0	S T WOOTEN CONSTRUCTION COMPANY INC	77	WILSON	NC	5	0	0.0649
261635	178219	B C J TRUCKING INC	63	MOUNT AIRY	NC	4	1	0.0635
97086	107934	BYRD MOTOR LINE INC	63	LEXINGTON	NC	4	0	0.0635
90770	140460	COAST REFRIGERATED TRUCKING CO INC	128	HOLLY RIDGE	NC	8	0	0.0625
97123	120368	DIXIE TRUCKING CO INC	96	CHARLOTTE	NC	6	1	0.0625
199315	156944	ROSEWAY TRANSPORTATION INC	96	ASHEVILLE	NC	6	0	0.0625
312151	210798	L C TRANSPORTATION SERVICE INC	64	MOUNT AIRY	NC	4	0	0.0625
90831	124306	KENAN TRANSPORT COMPANY	433	CHAPEL HILL	NC	27	2	0.0624
155414	143498	ATW INC	225	GREENSBORO	NC	14	0	0.0622
90849	107478	OLD DOMINION FREIGHT LINE INC	1,307	HIGH POINT	NC	78	4	0.0597
90882	115831	TIDEWATER TRANSIT COMPANY INC	186	KINSTON	NC	11	0	0.0591
375593	227106	CONN TRUCKING COMPANY INC	86	HENDERSON	NC	5	0	0.0581
383914	196859	WILLIAM LEO ANDERSON	105	MOUNT AIRY	NC	6	0	0.0571
132257	144790	HOWARD LISK INC	92	WADESBORO	NC	5	1	0.0543
47483	0	WINN-DIXIE CHARLOTTE INC	92	CHARLOTTE	NC	5	0	0.0543
294507	163551	DANNY NICHOLSON INCORPORATED	173	LEXINGTON	NC	9	0	0.0520
97133	93649	GAINES MOTOR LINES INC	119	HICKORY	NC	6	0	0.0504
257302	182121	CHEETAH TRANSPORTATION COMPANY	246	MOORESVILLE	NC	12	1	0.0488
21887	114562	WENDELL TRANSPORT CORPORATION	84	CLAYTON	NC	4	1	0.0476
223397	158451	GUY M TURNER INC	87	GREENSBORO	NC	4	0	0.0460
223032	156751	GREEN ARROW MOTOR EXPRESS INC	88	ROCKY MOUNT	NC	4	1	0.0455
97214	123872	W & L MOTOR LINES INC	243	CONOVER	NC	11	0	0.0453
352692	0	INTEGRAL TRUCK LEASING INC	243	GREENSBORO	NC	11	0	0.0453
16205	216628	COLLINS & AIKMAN CORPORATION	94	ALBEMARLE	NC	4	0	0.0426
48104	162035	MERCHANTS TRANSPORT OF HICKORY INC	120	HICKORY	NC	5	0	0.0417
328463	207641	HILCO TRANSPORT INC	177	WILMINGTON	NC	7	0	0.0395
90768	118831	CENTRAL TRANSPORT INC	437	HIGH POINT	NC	16	1	0.0366
94770	291210	FOOD LION INC	322	SALISBURY	NC	11	3	0.0342
293665	195304	CALIBER DEDICATED TRANSPORTATION INC	384	CHAPEL HILL	NC	13	1	0.0339
165214	215388	FAMILY DOLLAR TRUCKING INC	120	MATTHEWS	NC	4	0	0.0333
108306	0	FAST FOOD MERCHANDISERS INC	123	ROCKY MOUNT	NC	4	0	0.0325
83855	154667	B I TRANSPORTATION INC	140	BURLINGTON	NC	4	0	0.0286
158006	0	CONCRETE SUPPLY COMPANY	256	CHARLOTTE	NC	7	0	0.0273
329656	217349	CALIBER LOGISTICS HEALTHCARE INC	150	CHAPEL HILL	NC	4	0	0.0267
97173	128117	SUNBELT FURNITURE XPRESS INC	189	HICKORY	NC	5	0	0.0265
191496	154105	CARDINAL FREIGHT CARRIERS INC	1,969	CONCORD	NC	51	3	0.0259
257768	161652	CARGO TRANSPORTERS INC	204	CLAREMONT	NC	5	0	0.0245
47495	37896	YOUNGBLOOD TRANSPORTATION SYSTEMS IN	331	FLETCHER	NC	8	0	0.0242
90893	99044	WEST BROTHERS TRANSFER & STORAGE HAU	257	RALEIGH	NC	6	0	0.0233
342515	0	CAROLINA BUILDERS CORPORATION	379	RALEIGH	NC	8	0	0.0211
198696	336320	WASTE INDUSTRIES INC	360	ELIZABETH CITY	NC	7	0	0.0194
190580	0	ANSKO & ASSOCIATES INC	274	GREENSBORO	NC	4	0	0.0146
165182	0	PIKE ELECTRIC INC	1,857	MT AIRY	NC	13	0	0.0070
97235	0	LOWES COMPANIES INC	2,001	NORTH WILKESBO	NC	14	1	0.0070
16208	0	COCA COLA BOTTLING COMPANY CONSOLIDAT	1,217	CHARLOTTE	NC	6	0	0.0049