Commercial Vehicle Safety in North Carolina: An Analysis of Crash Data for the Period 1995-1999

EXECUTIVE SUMMARY

This report describes analysis work conducted by the UNC Highway Safety Research Center (HSRC) and sponsored by the North Carolina Governor's Highway Safety Program (GHSP). The focus of these analyses is on fatal, truck-involved crashes in North Carolina over the period 1995-1999. The study analyzed crash data from two major sources: (a) the Fatal Analysis Reporting System (FARS) and (b) crash data files maintained by the North Carolina Division of Motor Vehicles. The focus was on 'heavy' trucks as opposed to all commercial motor vehicles. GHSP's support of the analysis and problem definition component of truck safety programs in North Carolina parallels enforcement-oriented analysis and program evaluation efforts being conducted by HSRC for the CMV Enforcement section of the NCDMV. Together, the goal of these efforts is to remove North Carolina from its prominent position (4^{th} in 1998) on NHTSA's list of the Top Ten states in terms of fatal truck-involved crashes in the US.

North Carolina Moves From 4^{th} to 8^{th}

The data show that following a sharp rise in fatal, truck-involved crashes in North Carolina from 1996 to 1998, the number of fatal crashes in 1999 *decreased* markedly. This is, in part, attributed to increased commercial vehicle enforcement efforts on the part of NCDMV enforcement personnel and a deliberate attempt to target 21 high crash counties in the state. The decrease improved North Carolina's 1999 standing from 4^{th} in the nation to 8^{th}.

Truck Crashes and Their Likelihood of Being Fatal in Each of the 100 Counties in North Carolina

The report provides county-level data for all 100 North Carolina counties for the period 1995-1999. These data include the number of heavy truck-involved crashes, the number of fatal heavy truck-involved crashes, and the percentage of truck-involved crashes that were fatal during this period. Data are also provided on high crash locations in the 30 counties under consideration for increased enforcement actions in FY2001. The location data will also be used to identify hazardous locations to be used in the Mack Truck/Intelligent Vehicle Initiative (IVI) in the coming year. The IVI effort will provide drivers in-vehicle 'alerts' as they approach known high crash locations or areas.

Crash Severity Summarized for the Each of the Eight DMV Enforcement Districts

The severity of injuries encountered in truck-involved crashes between 1995 and 1999 is summarized in table form for each of the eight NCDMV enforcement districts in the state. The data show that between 1998 and 1999 the number of fatal truck-involved

crashes decreased in Districts 2, 3, 5, and 7; remained relatively unchanged in Districts 4, 6, and 8; and increased in District 1 (Greenville).

General Pattern of Crashes Unchanged

While the number of fatal, truck-involved crashes decreased in 1999, the general characteristics of the truck crash problem remained relatively unchanged from prior years. For example, most fatal truck-involved crashes continued to occur in rural areas on US and NC-numbered highways. Fatal crashes most often occurred on 2 or 4-lane roads. Fatal truck-involved crashes were least likely to occur on divided highways with barrier type separation; next most likely on roads with conventional medians; and most likely on roads with no separation of opposing directions of travel.

Fatal crashes in North Carolina were relatively evenly spread across the different months of the year with some tendency for an increase during the September to November time frame. Fatal crashes tended to peak at about mid to just past mid-week. Fatal crashes involving large trucks were most likely to occur in the mid-afternoon period (around 3pm), next most likely at mid-day followed by early morning (6-8am).

'Rural' vs 'Urban' Attributes Showing Some Change

The frequency of fatal truck-involved crashes on rural interstates during this five-year period decreased, while the frequency of fatal truck-involved crashes on urban interstates increased. Considering the far greater number of rural interstate miles of roadway, these data suggest a higher 'risk' of a truck being involved in a fatal crash on urban interstate roadways (even though the absolute number of fatal truck-involved crashes will continue to be higher on rural roadways). Between 1998 and 1999, the frequency of fatal crashes decreased on almost all classes of rural roads (rural principle arterial, rural major collector, rural minor arterial, and rural interstate). The frequency of fatal truck-involved crashes on urban principal and minor arterials, urban local streets, and urban interstates continued the pattern of an increase in fatal crashes begun in 1997. The bottom line, with respect to the rural-urban dichotomy, is that while largest number of fatal truck-involved crashes occur in 'rural' areas, the data suggest a steadily worsening problem on urban roadways.

Tractor Trailers and Vehicles Over 26,000 lbs GVW Most Involved

Tractor trailers and vehicles with GVWs of 26,000 pounds or greater continued to account for the majority of all fatal truck-involved crashes. Angle crashes represented the crash type having the highest joint probability of occurrence and being fatal. Rollovers were involved in fatal crashes between 12 and 15 percent of the time, with the roll over most often times being a 'subsequent' event rather than the initiating even in the crash.

The Driver of the Large Truck

The drivers of large trucks involved in fatal crashes were killed less than l percent of the time. These drivers were most often in the 31-50 year age range (the age range of most commercial vehicle drivers). From 1995 to 1999 the data showed about a 4 percentage point increase in the involvement of drivers 51 and over in fatal crashes. During this same period, the data showed an approximate 7 percentage point decrease in the involvement of drivers in the 15-30 year range.

Commercial vehicle drivers were likely to have been wearing a seat belt at the time of the crash. Fewer than 1 percent of truck drivers involved in fatal crashes were reported to have been drinking. In approximately 6 to 7 out of 10 fatal truck-involved crashes, the driver of the truck was *not* cited as contributing in some way to the crash. Where the driver was cited as contributing to the crash, the driver was most often cited for erratic/reckless driving, for driving too fast, or for lane encroachment (driving on the wrong side of the road). In non-fatal, truck-involved crashes the driver of the truck and the driver of the other vehicle were about equally likely to be cited (at least in the case of 2-vehicle only truck-involved crashes).

In roughly 95 percent of fatal truck-involved crashes, the driver of the truck possessed a valid operator's license. The data showed some tendency from 1995 to 1999 for drivers involved in fatal truck-involved crashes to be operating on a suspended license (from less than 1 percent in 1995 to slightly over 3 percent in 1999).

The Geographic Distribution of Fatal Truck-Involved Crashes

Data showed that the pattern of heavy truck crashes (all levels of severity) could be predicted in large part by population level, but that the pattern of 'fatal' truck-involved crashes did not strictly follow population counts. High numbers of fatals in highly populated areas are likely a function of exposure/opportunity while the high number of fatals in less populated areas are more likely related to road class and higher vehicle speeds. The clearest geographic pattern of crashes was that defined by the 'crescent.' GIS crash density plots showed 'emerging' areas outside the original 21 county DMV enforcement area. The report provides GIS plots of fatal crash locations in 30 counties targeted by DMV Enforcement in its FY2001 Commercial Vehicle Safety Plan (CVSP). GIS plots are also provided for each of the eight DMV enforcement 'districts' in the state. Major 'corridor' plots are also provided (I-77; I-40/I-85; I-40 through the Gorge; and I-95). Specific analysis attention is given to truck crashes within the I-95 corridor.

Carrier-Related Variables

The report makes reference to truck safety analysis efforts being conducted concurrently by HSRC for the commercial vehicle enforcement section of the NC Division of Motor Vehicles as part of the state's Motor Carrier Safety Assistance Program (MCSAP). The results of that work are included in the GHSP report since they clearly show an increased crash risk for the smaller carrier. Those results also show the relative absence of any clear

relationship between driver and/or vehicle out-of-service rates and crash risk. But on the other hand, these analyses show a rather clear relationship between crash risk and the 'average number of moving violations per driver.' Thus, while the current and previous year's GHSP analysis efforts reconfirm the observation that the driver of the commercial vehicle involved in a (fatal) crash is most often 'not' the one cited as contributing to the crash, the MCSAP analysis points to the importance of the commercial driver's behavior in crashes. One needs to remember that the risk of being involved in a crash and being 'responsible' for the crash are not necessarily one-in-the-same.

Initial Applications of Geographic Information Systems (GIS) Technology

The graphic, map-based format of GIS proved to be an effective interface between operations oriented enforcement personnel and the spatial characteristics of the truck crash data. The capability of GIS for going beyond traditional boundary-defined, 'frequency count' type of analyses promises to be a valuable program planning and evaluation tool for CMV enforcement personnel . . .especially once CMV enforcement actions can be mile posted for direct entry into the GIS environment.

Fatal Truck Crashes and Proximity to Major Trauma Centers

GIS capabilities were also used to analyze the proximity of major North Carolina trauma centers to fatal crash locations. The analysis showed that 95-97 percent of all fatal truck-involved crashes in North Carolina during 1998 and 1999 were within 50 miles of a major trauma center; 19 to 20 percent were within 10 miles; 42 to 48 percent were within 20 miles. The logic for including the trauma center proximity data is that it may be possible through prompt medical treatment to increase the chances of survival for persons seriously injured, but not killed, in truck-involved crashes.

Crashes and Population

GIS analysis capabilities were also used to analyze the relationship between crashes and population size. In general, this line of analysis suggested that the frequency of truck-involved crashes (all severity levels) could be largely understood (or at least predicted) in terms of population and related travel demand. To the extent that 'congestion' increases the density of vehicles on the road, it stands to reason, at least given current operating conditions, that as density increases, crashes will also increase. It does not follow, however, that fatal crashes will increase, since congestion also has the effect of reducing average vehicle speeds. Fatal crashes continue to be high on rural roads where road conditions (number of lanes, directional separation of opposing traffic flows, lane widths, shoulder conditions, curvature, access control, signalization, etc.) are often not conducive to increased safety. Fatal crashes (or more precisely, the probability of a crash being fatal) are thus more likely in the less populated areas.

From the standpoint of system-level countermeasure development, it is clear there needs to be a stronger focus on the more operational components of (a) traffic density/congestion and safety and (b) the control of vehicle speeds under conditions where roadway design, vehicle speeds, and driver behavior factors interact. Speed management, lane management, and access control are, in the opinion of the authors, three of the most important components of truck safety countermeasure development.

So What Do the Data Suggest We Should Do?

From a conceptual standpoint, there is a need for those concerned with truck safety to distinguish between (a) truck crash-involvement problems that are 'frequency' and 'exposure' derived (such as those predicted directly from a knowledge of local area population and travel demand characteristics, and (b) those that are derived from a combination of high operating speeds, driver-related problems, and roadway design/operational traffic control problems. In a continued environment of unconditional shared use of the roads by large, heavy commercial vehicles and smaller, lighter non-commercial vehicles there will continue to be 'collisions.' These collisions need not always be fatal, even when occurring at higher speeds. There is only so much one can do given the current state of technology and engineering to improve the survivability of occupants in a truck-involved crash. . . especially one that occurs at high rates of speed. In the meantime, steps can and must be taken to deal with the operational problems associated with shared use. A number of recommendations are put forth as a basis for developing a safer concept for the joint movement of persons and goods.