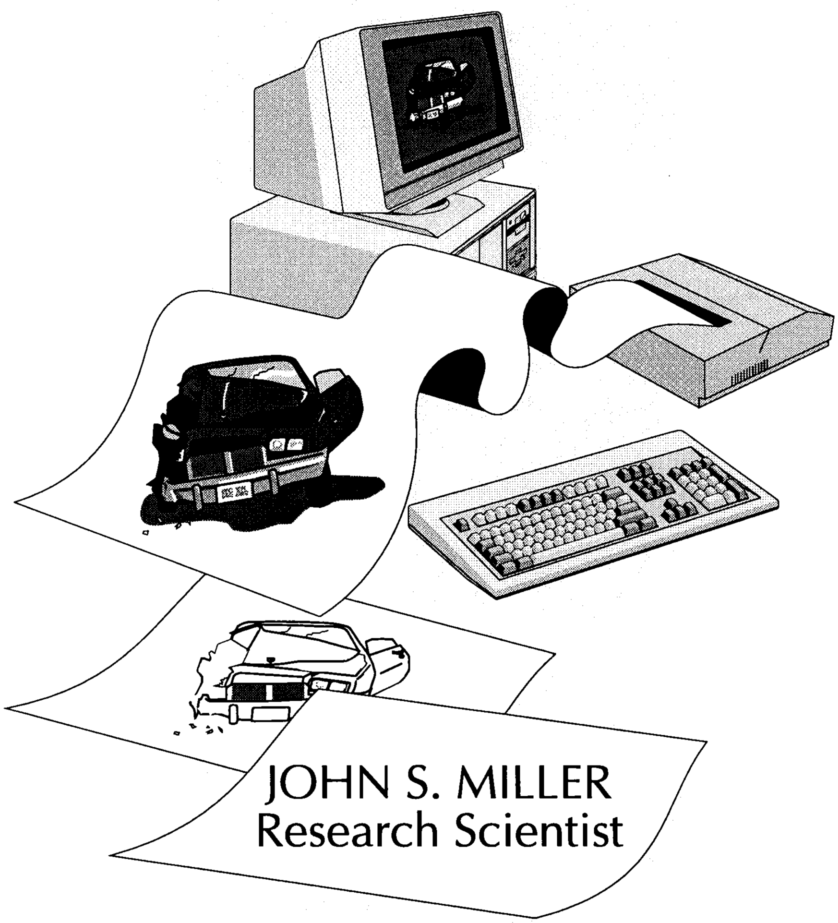
FINAL REPORT

AN OVERVIEW OF VIRGINIA'S COMPUTERIZED CRASH RECORDS SYSTEMS



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Supplementary Notes

Abstract

This report identifies the various components of Virginia's computerized crash records systems and explains how these components process crash data. Emphasis has been placed on recording information that was previously not documented. Most of the statewide systems were studied in late 1994, and most of the local systems were studied in early 1995.

The scope has been limited to systems that capture, store, and report data on traffic crashes. Statewide systems include those of the Department of Motor Vehicles (DMV), the Department of Transportation (VDOT), the Department of State Police (VSP), the Commission on the Virginia Alcohol Safety Action Program (VASAP), the Office of Emergency Medical Services (OEMS), the Department of Education (DOE), and the Department of Corrections (DOC). Local users such as planning district commissions, a traffic engineering department, and certain representative local law enforcement agencies were also included in the study.

Representatives from statewide and local agencies were interviewed concerning how their respective systems processed crash data. Computer printouts, data dictionaries, and other agency-generated information were used in conjunction with the interviews to synthesize descriptions of how data are processed.

Virginia's computerized crash records are analyzed from several perspectives. These include the diversity of crash data users and providers, the need for access to crash data, existing documentation of database capabilities, coordination among agencies, sources of duplication of effort, the methods used to collect data, and linkage opportunities. In light of this discussion, recommendations are made to improve crash data utility, accessibility, and accuracy.

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(A Cooperative Organization Sponsored Jointly by the Virginia Department of Transportation and the University)

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Table of Contents

GLOSSARY

ABC	Department of Alcoholic Beverage Control
BAC	Blood/Breath Alcohol Content
CAP	Centralized Accident Processing database
CMS	Congestion Management System
CODES	Crash Outcome Data Evaluation System
DCJS	Department of Criminal Justice Services
DIT	Department of Information Technology
DMV	Department of Motor Vehicles
DOC	Department of Corrections
DOE	Department of Education
DOH	Department of Health
DRPT	Department of Rail and Public Transportation
EMS	Emergency Medical Services (denotes an independent provider)
FARS	Fatal Accident Reporting System
FR-300P	Virginia's crash report form completed by state and local law enforcement
GIS	Geographic Information System
GPS	Global Positioning System
HTRIS	Highway Traffic Records Information System (crash records subsystem only)
MPO	Metropolitan Planning Organization
MTRS	Micro Traffic Records Information System
NHTSA	National Highway Traffic Safety Administration
OEMS	Office of Emergency Medical Services (denotes a statewide agency)
PC	Portable Computer
PDC	Planning District Commission
PPCR	Pre-Hospital Patient Care Report
PTS	Pupil Transportation Service (within the Department of Education)
SMS	Safety Management System
TRASER	PC-based database software developed by the Texas Transportation Institute
VASAP	Commission on the Virginia Alcohol Safety Action Program
VDOT	Virginia Department of Transportation
VSP	Virginia Department of State Police
VTRC	Virginia Transportation Research Council

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Each of the primary interviewees provided information, answered questions, and reviewed documentation. R. Brietenbach, W. Kelsh, and B. Pritchard provided valuable insights about the development of MTRS, while W. Lawson and R. Roberts demonstrated MTRS applications. W. Heffron, G. Krause, and M. Uram explained the operation of Fairfax County's system, while F. Starzynski outlined Arlington County's use of laptop computers for crash reporting. D. Fleet, V. Hupp, D. Mosley, R. Rasmussen, and G. Venable spent a considerable amount of time explaining how crash data are processed at the statewide level, while A. Austin, B. Dunnavant, and D. Slater noted the relevance of certain roadway features to a statewide database. J. Anderson, H. Bridges, W. Cox, V. Davis, and D. Peacock described VSP's use of statewide crash data, and D. Kurowski noted DIT's role in database management. W. Alsop-Corbin and W. McCollum explained how VASAP processes crash data, and S. McHenry and D. Edwards did the same for OEMS. R. Cere, V. Crozier, and B. Goodman showed DOE's applications of crash data. J. McDonough and J. Terlep explained the many databases maintained by DOC and DCJS. B. Binkowski, J. Grimm, and S. Taylor explained the processing of fatal crash data for NHTSA's FARS database.

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Without such participation, this project could not have been accomplished.

PREFACE

In 1994, the Virginia Department of Motor Vehicles (DMV) requested that the Virginia Transportation Research Council (VTRC) conduct an assessment of Virginia's computerized crash records systems. DMV requested that VTRC begin by collecting information from users and providers of crash data to prepare a briefing document for an independent consulting firm that would be conducting a traffic records audit in the future.

The initial plan was for the consultant's traffic records audit to be performed before VTRC's crash records assessment. Logistical difficulties, however, prevented the consultant from beginning the audit until late 1995. Meanwhile, VTRC developed the attached crash records assessment independently of the consultant. VTRC provided this report, minus the conclusions and recommendations, to the consultant as a briefing document for the traffic records audit. The consultant's audit, therefore, is not part of this study except for the following: As this report went to press, the consultants began their first round of interviews on October 30, 1995. Information from the interviews that clarifies this document has been placed in footnotes on pages 13, 19, and 82.

ABSTRACT

This report identifies the various components of Virginia's computerized crash records systems and explains how these components process crash data. Emphasis has been placed on recording information that was previously not documented. Most of the statewide systems were studied in late 1994, and most of the local systems were studied in early 1995.

The scope has been limited to systems that capture, store, and report data on traffic crashes. Statewide systems include those of the Department of Motor Vehicles (DMV), the Department of Transportation (VDOT), the Department of State Police (VSP), the Commission on the Virginia Alcohol Safety Action Program (VASAP), the Office of Emergency Medical Services (OEMS), the Department of Education (DOE), and the Department of Corrections (DOC). Local users such as planning district commissions, a traffic engineering department, and certain representative local law enforcement agencies were also included in the study.

Representatives from statewide and local agencies were interviewed concerning how their respective systems processed crash data. Computer printouts, data dictionaries, and other agency-generated information were used in conjunction with the interviews to synthesize descriptions of how data are processed.

Virginia's computerized crash records are analyzed from several perspectives. These include the diversity of crash data users and providers, the need for access to crash data, existing documentation of database capabilities, coordination among agencies, sources of duplication of effort, the methods used to collect data, and linkage opportunities. In light of this discussion, recommendations are made to improve crash data utility, accessibility, and accuracy.

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INTRODUCTION

Virginia has studied its crash data management systems several times in the past two decades, performing needs assessment studies, forming committees to represent all potential users of crash data, and employing in-house groups and consulting firms to revise systems and procedures. Studies in 1973, 1979, and 1984 led to the Centralized Accident Processing (CAP) system in 1984.[1,2,3] Since then, local jurisdictions have taken advantage of computer technologies to meet new needs for data. The implementation of CAP and related software also affected the processing of crash data at the statewide level. Since 1984, the methods for processing crash data both at state and local levels have changed greatly. For example, many local law enforcement agencies now enter crash data into their own databases before the crash data enter the statewide databases. Fifteen years ago, not many of these local computerized databases existed.

PURPOSE AND SCOPE

This report identifies the various components of Virginia's computerized crash records system and explains how these components process crash data. The emphasis is on obtaining descriptive information about these systems, since much of this information has not been formally documented. Because CAP is central to Virginia's crash reporting system, much of this work is an analysis of CAP and CAP's ties to other systems.

The project was limited to systems that capture, store, and report data on traffic crashes. Users were originally limited to the Department of Motor Vehicles (DMV), the Department of Transportation (VDOT), the Department of State Police (VSP), the Commission on the Virginia Alcohol Safety Action Program (VASAP), the Office of Emergency Medical Services (OEMS), the Department of Education (DOE), the Department of Corrections (DOC), and certain representative local law enforcement agencies (Fairfax County Police, the City of Charlottesville Police, and the Powhatan County Sheriff's Department). As it became apparent that other state and local users needed crash records data, they were interviewed to determine their perspective of Virginia's computerized crash records systems.

The study period lasted from June 1994 through July 1995. Most interviews with primary users were completed by the end of 1994, while interviews with secondary users were conducted in early 1995.

This report serves two purposes. First, a consultant will be conducting an independent audit of Virginia's traffic records systems, and much information about the development of Virginia's computerized crash records systems since 1984 has not been documented. This report has been written in response to DMV's request to furnish the consultant with background information describing Virginia's computerized crash records systems.

Second, there is growing interest in developing a Safety Management System in Virginia. A necessary step in this process is to inventory, assess, and recommend improvements to Virginia's computerized crash records systems to those who will play a role in Virginia's SMS effort, such as the SMS Steering Committee. VDOT, DMV, VSP, VASAP, DOC, DOE, OEMS, local law enforcement agencies, and the Transportation Safety Training Center all have decision-making powers to address issues raised in this work.

METHODS

When this project began, much of the information about Virginia's crash records system was stored in the minds of individuals, undocumented. Face-to-face interviews and telephone conversations with the various users and providers of crash data gathered this information. The ideal strategy would have been to visit every entity involved with crash data, but this was beyond our resources. Instead, users and providers were categorized into two groups: primary users (who affect or potentially affect the flow of crash data) and secondary users (who use crash data but do not necessarily affect the integrity of the data). Primary users, unlike secondary users, had the opportunity to review and make changes to the descriptions of their crash records systems. Thus, the terms "primary" and "secondary" denote only whether the descriptions were verified, not the relative importance of these agencies.

Primary Users

Most primary users were visited at the site where they processed crash data, although four users were interviewed by telephone only. In most cases, the site visit was essential to understanding the magnitude of the agency's use of crash data. Representatives from all users except the Arlington County Police Department were questioned on the following topics:

- *How the system processes data.* "System" in this case included the procedures followed by the persons who enter the data and how the data are stored.

- *A summary of the data used by the system.* Representatives described the types of data contained within their system as well as specific data elements.

- *What the data are used for.* Reporting requirements, analytical needs, and data requests from the public or other branches of government were explored.

- *The agency's computer system.* Where appropriate, representatives gave the number of records contained by their computer system and its operating environment (mainframe, personal computer, etc.)

- *Explanatory notes.* Representatives commented about expected improvements to their systems or process, data integrity, or additional data needs.

The Arlington County Police Department was interviewed because it is evolving toward having officers complete crash reports with laptop computers, a relatively new technological application for crash records. That interview was restricted to that particular topic.

The interviews were kept informal for several reasons. Although the interviewees were often experts in their particular crash records system, it was not always their role to be a spokesperson about how their system operated. Consequently some prompting was needed to elucidate information. For example, one interviewee said that the system captured every single element shown on the FR-300P, although further questioning revealed that some data elements were not recorded. In addition, interviewees brought up new issues, such as the large number of nonreportable crashes. A flexible interview structure brought out information that a strict set of survey questions would have missed.

Where available, data dictionaries were examined to understand the data processed by the system. Not every data dictionary was accurate, due to progressive modifications to the computer systems, but the data dictionaries helped with some of the more cryptic field names shown by the computer-generated printouts. Finally, agency-generated literature such as annual reports based on crash data, instruction manuals, or computer specifications, supplemented information obtained during the interviews.

Following the interviews, a description of each agency's crash records system was created. These descriptions generally included a summary of the agency's computer system, the process through which crash data were collected and disseminated, the purpose for which the data were used, the crash data elements used by the agency, and any explanatory notes. These descriptions were then mailed to each agency for verification. If the agency then made a significant number of corrections, they were provided with a revised description for re-verification. Sometimes several iterations were required before the interviewer and interviewee agreed that the description was accurate. Table 1 shows the agencies approached by this method.

Table 1. Agencies Who Verified their Interview Findings

Agency (and Computer System)	*Site Visit?*	*Computer Printouts Used*	*Data Dictionaries and Other Agency-Provided Literature*
Charlottesville Police Dept (MTRS)	Yes	1A. Accident Location Summary	None
Powhatan Sheriff's Office (MTRS)	Yes	2A. Accident Location Summary 2B. General Traffic Accident Summary 2C. General Traffic Summons Summary 2D. Traffic Offenses by Badge Number	2E. Summary of MTRS Usage
Fairfax County Police Dept (Case File History Subsystem)	Yes	3A. Data entry screen	3B. Central Records Section Paper Flow Process Review (1992) 3C. Fairfax County Information Technology Introduction 3D. Fairfax County Pedestrian Crash Overview (1993) 3E. Annual Report CY 93 3F. Top 10 Crash Locations
Transportation Safety Training Center (MTRS)	No	4A. MTRS Sample Outputs	4B. MTRS Version 5.0 Accident Type Definitions 4C. MTRS Instructions for Coding Accident Locations 4D. MTRS Overview and Summary (1991)
Arlington County Police Department (laptop computers)	Yes	Visual inspection of computer screen	5A. Front of FR-300P Virginia Accident Report 5B. Template of FR-300P Virginia Accident Report 5C. "Pen-Based Computing for Electronic Field Reporting" Available in Oct. 1993 ed. of *Law Enforcement Technology*

Agency (and Computer System)	*Site Visit?*	*Computer Printouts Used*	*Data Dictionaries and Other Agency-Provided Literature*
DMV (CSS and CAP) (verified initial findings; clarifying information later added)	Yes	6A. General Accident Inquiry 6B. General Update 6C. Vehicle Update 6D. Pedestrian Update 6E. Medical Update 6I. Additional runs from VDOT and DMV for the CAP Tape	6F. Police Officer's Instruction Manual 6G. CAP Record Layout Sheet (2/8/91) 6H. CAP Data Dictionary (6/28/94)
VDOT (CAP and HTRIS) (verified initial findings; clarifying information later added)	Yes	7A. Operator Data Entry Screen 7B. Accident Record Inquiry 7C. Vehicle Record Inquiry 7D. Pedestrian Record Inquiry 1992-1993 CAP data tape (Not shown)	7E. HTRIS Crash Record Subsystem Data Dictionary (5/1/92) 7F. User Manual for the Accident Subsystem of HTRIS 7G. HTRIS Notes 7H. "Zone of Impact" Coding Sheet
VSP (CAP)	Yes (field office only)	8A. Accident Summaries by time of day, day of the week, causative factor, and alcohol involvement	8B. Directed Patrol Locations for 1992-1993, 8C. Table of Contents from Revised User's Guide 8D. CAP User's Manual (1992)
VSP (MAPPER and DSS)	No	None	9A. Selective Enforcement Directed Patrol Operations Manual (1994)
VSP (SafetyNet)	Yes	None	10A. Proposed Supplemental Truck/Bus Accident Report 10B. Current Virginia Supplemental Commercial Motor Vehicle Accident Report 10C. Relevant VSP Memo

Agency (and Computer System)	*Site Visit?*	*Computer Printouts Used*	*Data Dictionaries and Other Agency-Provided Literature*
VASAP (INFERNO I & II)	Yes	None	11A. INFERNO II Data Dictionary (11/9/94) 11B. Biannual Report 1991-1992 11C. VASAP Case Management System Operations Manual (includes INFERNO 1 Data Dictionary)
OEMS (Trauma Registry and Pre-hospital Patient Care Report)	Yes	12A. EMS Trauma Registry Report	12B. Trauma Registry Report Form 12C. Trauma Registry Analysis Documentation 12D. Pre-hospital Patient Care Report 12E. Trauma Registry Data Dictionary 12F. Reports produced by Q&A software 12G. Licensed EMS Agencies in Virginia
DOE (TRASER--Pupil Transportation Service)	Yes	13A. Traser Crashes Proxy Report	13B. EB-006 Bus Crash Reporting Form and Instruction Packet 13C. PTS Annual Report (1993-1994)
DOE (no system--driver training)	No	None	14A. Insurance Institute for Highway Safety Facts (1992) 14B. DMV's Virginia *Crash Facts* 14C. DOE Newsletter (Winter) 14D. DOE Newsletter (Summer)

Agency (and Computer System)	*Site Visit?*	*Computer Printouts Used*	*Data Dictionaries and Other Agency-Provided Literature*
DOC (assorted databases)	No	None	15A. Virginia PSI Database Overview 15B. Overview of Virginia State Criminal Justice Databases 15C. National Crime Information Codes (1992) 15D. Revisions to NCIC (1994) 15E. Virginia Crime Codes

A set of the computer printouts, data dictionaries, and other agency documentation numbered in the two right-hand columns above is available separately from this report.

Additional Examination of VDOT and DMV Crash Databases

The methods thus described left some unanswered questions about how the VDOT and DMV computer systems processed crash data. Telephone calls to various agency representatives and cross-referencing between computer printouts, the FR-300P, and data dictionaries clarified which variables were entered by which agency. The DMV and VDOT narratives shown in Appendix A were modified to reflect additional information from these sources.

For example, a DMV CAP-generated "general accident" report for a particular two-vehicle crash showed a field entitled "property rep cost" with a value of $500. For the same crash, the DMV CAP-generated "vehicle" report showed a field with the name "repair cost" and an associated value of $15,000. The VDOT HTRIS-generated report for the same crash showed a field entitled "Property Damage" with the value $17,500. A subsequent telephone call to DMV revealed that a second "vehicle" report for the crash showed a repair cost of $2,000. These findings revealed several aspects of the CAP database: first, the CAP "general" report contains only the non-vehicular property damage; second, each CAP "vehicle" report contains only the property damage for a single vehicle; third, the HTRIS report contains only the total (property plus vehicular) property damage; fourth, this total amount is automatically computed since neither VDOT nor DMV enters the entire amount. (In this report note that the term "HTRIS" refers only to the HTRIS crash records subsystem; the other subsystems of HTRIS have not been explored in this study.)

In addition, a 1992-1993 CAP tape was checked against both the CAP data dictionary and data elements entered by VDOT into CAP. This revealed that some elements entered by VDOT were not on the CAP tape and that not all elements listed in the data dictionary were entered under all circumstances. This finding led to the attempt to list all of the data elements available to VDOT and DMV and to identify which elements were available to each. The attempts to cross-reference data elements among the statewide databases are shown in the VDOT and DMV narratives in Appendix A.

Lastly, telephone conversations with additional agency personnel clarified procedures for entering and maintaining crash data. For example, in the initial CAP printouts examined, the field for "railroad crossing" was blank, as expected, since the particular crashes did not involve a railroad crossing. Initially it was assumed that railroad crossing data was entered by VDOT into the CAP database, since DMV noted it did not enter crossing data. VDOT's rail division, however, said that it did not need for the rail crossing to be entered into the database; instead it used the rail crossing on the FR-300P only as a tool to identify where the crash occurred. Subsequent telephone calls to DMV revealed that no rail crossing identification numbers were entered into the CAP in 1994, although there were crashes that involved at-grade rail crossings.

Secondary Users

Appendix B describes several other agencies involved in crash records assessment. Information about these agencies was gathered almost exclusively by telephone conversations, and, though presumably accurate, has not been verified by representatives from those agencies. Information from the Virginia Transportation Research Council (VTRC) was obtained through both conversations and written responses.

Secondary users are vital for a complete picture of how crash data are collected and used in the Commonwealth. The 15 agencies identified here as "secondary users" show how the crash records system appears from outside. The selection of secondary users was based on convenience, diversity, and certain unique features. For example, the Richmond Regional Planning District Commission was selected as a local organization conveniently close for future interviews. The Albemarle County government was listed because of its special interest in geographical positioning systems (GPS). The Lynchburg MPO was selected as a contrast to some of the larger organizations. The Department of Criminal Justice Services (DCJS) was selected because preliminary discussions with researchers showed the difficulty of linking crash and incarceration data. An original goal of this effort was to discover a better source of incarceration information linked to crash records than the J7/J8 database maintained by DOC.

RESULTS: PRIMARY USERS' SUMMARY

Only the summary information concerning the primary users is presented in the text. Appendix A contain the complete narratives from each primary agency, and Appendix B contains the information gathered from secondary users.

Four groups of primary users were interviewed: local law enforcement agencies, VDOT and DMV (which process crash data at the state level), VSP, and other statewide users who potentially affect the processing of crash data.

Local Law Enforcement Agencies

Three local law enforcement agencies were interviewed about the processing of crash data: the Charlottesville Police Department, the Powhatan County Sheriff's Department, and the Fairfax County Police Department. Each agency has its own computer system for processing crash data. Charlottesville and Powhatan County use the PC-based Micro Traffic Records System (MTRS), and Fairfax County uses a system that runs on a mainframe computer and interfaces with other Fairfax County databases. The size of the systems varies. Fairfax County enters between 15,000 and 18,000 crashes per year into its database, Charlottesville enters about 1,000 crashes per year, and Powhatan County has entered 1,800 crashes over an eight year period.

The three agencies exhibit varying levels of complexity for preprocessing the FR-300P accident reports. In Fairfax County, every call to which an officer responds is recorded in the county's Computer Aided Dispatch System (CADS), including the time the officer was dispatched and the crash location. These data are then automatically transferred daily to the county's crash records system. In addition, the FR-300Ps are photocopied, sorted, and sent to various county and state units depending on the nature of the crash (DUI, fatality, involvement of local utility rights of way). For example, for fatal crashes a copy of the FR-300P report is sent to the Fairfax County Police Department's Planning and Research Bureau. In Powhatan County and the City of Charlottesville, crash report processing is much more centralized. Powhatan has a high degree of cooperation between the Sheriff's Office, VSP (which investigates 99% of the crashes), and the Virginia Game Commission (which also investigates crashes). The Sheriff's Office periodically obtains crash reports from these two agencies and subsequently enters them into MTRS. In contrast to Powhatan, Charlottesville crashes are investigated by the local police agency, and all local processing of the FR-300Ps is done by the Charlottesville police.

The FR-300P has a multiple-choice template on one side and a free-response "front" on the other side. A total of 37 data elements appear on the template and 44 data elements appear on the front. None of the three agencies enter all of these data elements. Fairfax County enters approximately two-thirds of the data elements. The two MTRS users enter about one-third of the data elements. Each agency does collect such information as the location of the crash, weather conditions, the type of crash, roadway defects, and the crash severity. Fairfax County enters every element that the officer feels is relevant to the crash on the template of the FR-300P. Charlottesville and Powhatan do not enter such items as whether the traffic control was working, the alignment of the roadway, the condition of the driver (or pedestrian), the condition of the vehicle, and whether skidding occurred. All three agencies enter some of the data elements from the front of the FR-300P, omitting such items as years of driver experience, vehicle license plate number, and repair costs for vehicles and other private property. Unlike the two MTRS users, Fairfax County records the driver's name and address. Appendix A shows the FR-300P data elements that are stored and omitted by each agency's database.

The data from each agency's database are re-entered by DMV after the FR-300P reports reach Richmond. The local databases do not have statewide application; instead, they meet a variety of monitoring, reporting, and public information needs. For example, the Charlottesville Police Department is the sole source of information for the city's traffic engineering department. An unsignalized left turn was eliminated from a major arterial when an officer from the Police Department used MTRS data to show a high number of crashes at that location. Fairfax routinely provides VDOT with a list of high-accident crash locations within the county. Selective enforcement is also guided by local crash data; in Powhatan, for example, deputies are provided with quarterly lists of high-accident locations. Local crash data are also used to apply for DMV-funded grants and to evaluate the subsequent effectiveness of the grant-sponsored programs, such as checks for seat belts and child safety seats. Finally, local data are used for public outreach efforts to a wide variety of audiences including land developers, zoning commissions, the media, students, and the general public.

Two of the local law enforcement agencies noted limitations of the crash reporting system. Usually, only reportable crashes are recorded by both DMV and the localities; there may be areas where a large number of unreported crashes are occurring. Also, the FR-300P report only captures restraint data if the occupant is injured or killed, making it difficult to measure the overall effectiveness of restraints. The local law enforcement agencies had specific suggestions for improving future MTRS upgrades, such as including the main causal factors when listing high-accident locations.

A representative from a fourth agency, the Transportation Safety Training Center, was interviewed with respect to MTRS. The Training Center maintains MTRS and provides training to localities for MTRS upgrades. The newest version (6.0) of MTRS will allow users to enter latitude and longitude coordinates for crash locations and then link this information to a user-supplied geographic information system (GIS). MTRS is important; an estimated 110 organizations in Virginia, most of them law enforcement agencies, use MTRS for processing crash data.

The Arlington County Police Department is experimenting with laptop computers to eliminate the paper accident report. The officer can enter the crash data directly into the terminal, using a keyboard for most of the narrative and an electronic pen to select menu options. The crash diagram may be drawn electronically using point and click options, where the officer begins with an intersection and vehicle template and then chooses an orientation of the vehicle within that intersection. Laptops eliminate the second data entry step, because the data can be transferred directly from the laptop to Arlington's mainframe computer system for analysis.

Department of Motor Vehicles and Department of Transportation

Three computer systems are relevant to DMV and VDOT's processing of crash data: DMV's Citizens Services System (CSS), the Centralized Accident Processing (CAP) System that is updated by both DMV and VDOT, and the *crash records portion* of VDOT's Highway Traffic Records Information System (HTRIS). Because these systems often function in coordination with one another, their purposes, processes, data elements, and data issues are more understandable if they are discussed together.

Purpose

DMV uses CAP and CSS data for a variety of purposes, including problem solving, public outreach, and reporting. For example, the CAP data are used for the annual publication of the Virginia Crash Facts and for special analyses for lawyers, schools, students, newspapers, or other citizens who need specific information (such as the total number of crashes involving a certain area, or a certain vehicle model). DMV also uses CAP data to identify problem areas statewide and locally, such as jurisdictions that have a high number of crash locations. Finally, DMV uses CAP to meet federal requirements that are the Commonwealth's responsibility. The Highway Safety Plan, which identifies the districts with the highest alcohol-related motor vehicle events, is one such responsibility, required both by the National Highway Traffic Safety Administration (NHTSA) and the Federal Highway Administration (FHWA).[4] In addition to CAP data, DMV provides "sanitized" copies of FR-300Ps to citizens, attorneys, hospitals, and insurance companies upon request. "Sanitized" means that all information that could identify individuals, such as names, social security numbers, and vehicle license plate numbers, has been removed. VDOT uses CAP and HTRIS data for road maintenance and construction decisions, as well as for providing crash information.

Process

After receiving the FR-300P crash report form from state or local police, DMV highlights special information on the form (for instance, lack of insurance) and sends the reports to the microfilm work center where each report is assigned a document number. This document number is subsequently used by DMV and VDOT to refer to that particular crash. Accident reports that indicate fatalities are separated from the regular work and photocopied, and the copies are sent to the Fatal Accident Reporting System (FARS) program for processing.

DMV then enters information pertaining to the driver of the crash into the **Citizens Services System (CSS)**, such as the document number, accident date, accident type, accident jurisdiction, social security number, and number of fatalities or injuries. If a record of the person has already been established in CSS, then the data entry operator verifies this information with the FR-300P. If there is no record of the person in the CSS, then the operator must enter identifying information such as name, address, and date of birth. The operator then presses a key to copy this information to the CAP transfer file. If this process creates duplicate records for the same person, a supervisor evaluates the records and passes them on to the Functional Development Division which combines the duplicate records into one record for each customer. The Citizens Services System is anecdotally known as the driver history file and contains a total of approximately one million crashes, with about 120,000 records entered annually. Although many people refer to the CSS database as part of CAP, they are in fact two separate databases.

CSS data are transferred each night into the CAP database using a software routine. Once CAP has been invoked, the DMV operator enters the document number, which automatically recalls the information transferred into CAP from CSS. The operator then enters data in the following categories: *general* updates, which pertain to the vehicle and driver; *vehicle* updates, which pertain to the vehicle; *passenger* updates which pertain to any passengers injured or killed; *pedestrian* updates which pertain to any pedestrians injured or killed; and *medical examiner's* updates which address toxicity information. Most of the FR-300P data are entered into CAP during these updates. DMV then sends the FR-300P forms to VDOT which subsequently enters additional data. Some of the data elements entered into CAP by VDOT then become available to DMV. Occasionally, the law enforcement agency which completed the FR-300P uncovers new information, such as the identity of a driver involved in a hit and run accident, after the FR-300P has been processed by DMV and sent to VDOT. In this case, the law enforcement agency will either contact DMV directly or send an FR-300P supplement, after which DMV updates the CSS and CAP databases accordingly.

VDOT enters roadway and location information into CAP, such as the intersecting routes, whether the road is state-maintained, the distance of the crash from the intersection, and the major factor causing the crash. In addition, VDOT enters the exact location of the crash using a link-node referencing system, where the operator enters the intersecting routes and the software then prompts the operator with a list of possible nodes and node descriptions for identifying the crash location. The operator uses these node descriptions, the officer's narrative, and additional maps to determine the node closest to the crash location. The operator also enters additional crash information, such as the lane occupied by the vehicle prior to the crash. The FR-300P is passed to another VDOT section where the report is scanned and indexed into an optical disk system, providing a permanent record of the report itself and the crash diagram. CAP contains records for approximately one million crashes.

The VDOT operator must make several decisions about the data to be entered into CAP. For example, when the intersecting road given on the crash form is not identified by the referencing system, the operator uses a scale and map of the area to scale the distance of the crash from the appropriate intersection. The operator also manually determines the zone of impact based on a grid configuration of the standard intersection. For example, crashes that occurred 500 feet from the intersection are put in a different zone than crashes that occurred 50 feet from the intersection. Finally, the operator enters a "major factor" (the cause of the crash) based on the officer's narrative.

Although VDOT has access to the CAP database for data entry purposes, VDOT does not use the CAP database directly. Instead, VDOT uses a reporting program called the Highway Traffic Records Information System (HTRIS) to retrieve data from CAP and present these data in the format VDOT uses for analysis.[1] With each crash location, HTRIS accesses a *road inventory* that contains specific roadway information such as the type of intersection, surface width, shoulder width, surface type, and functional class of the road.

The time required by this process was not formally measured. A VDOT representative said that crashes can generally be retrieved via HTRIS within three months of when they occurred, and that some crashes may be processed sooner. When VDOT begins to enter the crash data depends on when the officer sends the report to DMV and when DMV sends the report to VDOT. By comparison, a DOE representative said that DOE receives crash reports directly from DMV two to six weeks after the crash occurred.

DMV has the primary responsibility for sending fatal crash data to NHTSA's Fatal Accident Reporting System. When a fatal crash occurs, DMV's FARS contact enters accident, vehicle, driver, and person data from the FR-300P and the officer's accompanying Daily Activity Report into NHTSA's database. Before this happens, however, DMV obtains data from several different agencies, such as the arrival time at the hospital from the EMS provider, the death certificate from the Department of Health, and a 20-digit code describing the roadway location of the crash (the county, city, route, functional class, etc.) from VDOT. While the FARS data are more detailed than the routine data for non-fatal crashes, note that all FARS data are entered into the FARS database manually even though some of the data are stored in an electronic format in DMV's CSS and CAP databases.

Data Entered by VDOT and DMV

Representatives from DMV and VDOT mentioned that others had suggested that VDOT and DMV were entering the same data elements twice. One way to answer this question was to pinpoint exactly which data elements were entered by each organization. A comprehensive effort was undertaken to classify which agency, if any, enters each data element shown on the FR-300P as well as the difference between the data elements available to CAP users and the data elements available to HTRIS users. The FR-300P Reference Matrix in Appendix A shows which data elements from the FR-300P are entered by VDOT, which elements are entered by DMV, which elements are omitted, and into which database each element is entered.

As Appendix A shows, several elements that appear on the FR-300P are not entered into the CAP database, such as the milepost number, landmarks, the offenses charged against the

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[1] This report did not determine whether HTRIS internally copies selected CAP elements and displays them for VDOT, or simply establishes an electronic link to the CAP database. Instead, the author focused on whether data elements were entered more than once into the statewide database.

driver (although the driver's action is recorded), the officer's name, the reviewing officer, and the date the report was filed by the police. In addition, the narrative is not recorded per se, although it does influence how DMV and VDOT data entry operators code the report. Also, BAC test results are recorded only for fatal crashes.

Beyond the data elements shown on the FR-300P, additional data elements within the CAP database are linked to a particular crash based on its location, such as the population of the county or city where the crash occurred and whether the road is rural or urban. These data elements are not shown on the FR-300P, nor are they entered by hand for each crash; instead, they are already present within the database. The data elements stored within CAP or reported by HTRIS are listed in the CAP/HTRIS Reference Matrix, shown in Appendix A. Not all of the elements are reported by HTRIS and not all of the elements are shown on the CAP 1992-1993 data tape. In some cases, there is a difference of aggregation. For example, CAP contains separate fields for the damage to each vehicle and the non-vehicular property damage but no field for total property damage, while HTRIS reports only a single field with the total amount of property damage. HTRIS reports the total number of persons killed but not the number of persons killed in each vehicle, as CAP does. In other cases, there are elements that are simply not reported by HTRIS, such as whether the crash occurred in a rural or urban location, the population of the city or county where the crash occurred, the BAC of the driver, and whether a passenger was ejected from the vehicle.

Several pieces of information entered by VDOT or provided by the road inventory did not appear in the tape of CAP data for 1992 and 1993. Two types of information are understandably omitted from the tape: personal identifying information (social security numbers and vehicle license numbers) and HTRIS-specific location information (nodes and node offset). Other data elements that were not shown on the CAP Tape were:

1. intersection type
2. lane direction where the crash occurred
3. lane type where the crash occurred
4. lane in which the crash occurred
5. lane direction of travel before the crash
6. type of lane occupied by the vehicle prior to the crash
7. lane in which the vehicle was traveling prior to the crash
8. road system type
9. total damage amount
10. total number of lanes
11. facility type
12. traffic counts
13. name of street if not maintained (although it is possible that all crashes in 1992 and 1993 occurred only on state-maintained roads).

A field for the variable "intersection type" appeared in the CAP general report but was blank for the particular reports examined. Several 1992 and 1993 crashes reported by the HTRIS software, however, do indicate that crashes occurred at intersections. The second screen of the CAP general report does show the field "accident lane," which may entail the lane direction, lane type, and particular lane where the crash occurred, but it too was not completed for the particular CAP report examined.

Following the interviews, a question arose about data consistency involving the method of coding road inventory data. While analyzing motorcycle crashes, researchers found that according to the crash records subsystem of VDOT's HTRIS (HTRIS has many subsystems; this project focused on the crash records subsystem, and that is what "HTRIS" refers to in this report), crashes had occurred in lane four of a road with supposedly only three lanes. The reason for this problem was that road inventory personnel count the number of full travel lanes, and crash records personnel count lanes shown on the officer's diagram, including merge lanes. If the officer has drawn a shoulder lane (temporarily used during High Occupancy Vehicle periods) or a merge lane as a full travel lane, then crash records personnel will consider it as a full travel lane even though the road inventory indicates otherwise. Additional non-intuitive features of the road inventory data, not presently documented, appear in Appendix A. Road inventory personnel noted that they are revamping a 1991 user's manual; the new manual will include some of this information.

Department of State Police

Unlike local law enforcement agencies, VSP has access to a reporting program that extracts data from the CAP database. Both the main office in Richmond and the 47 field offices throughout the Commonwealth can access the database via a wide area network, but there are occasions when VSP requests that DMV conduct special CAP runs because the data sets are too large. VSP uses the CAP data to evaluate the effectiveness of selective enforcement programs such as VSP-funded DUI or federally-funded speed enforcement. Analyses are conducted through examination of variables such as the number of crashes by day of the week, time of day, causative factor, and alcohol involvement.

VSP's acquisition of CAP data is similar to VDOT's, in that both VSP and VDOT use a reporting program to extract data from CAP in a form more amenable to that agency. The VSP program reports the data somewhat differently than HTRIS. For example, the DMV CAP data dictionary shows that the data element denoting the driver's residential jurisdiction has three possibilities within HTRIS: the driver is a resident of Virginia, the driver is not a resident of Virginia, and the driver's residence is not stated. For VSP, however, that same data element is used to define the population of the driver's residence (e.g. under 1,000, between 1,000 and 4,999, etc.) In some cases these differences do not appear to be significant: for example, VSP and VDOT each have their own system of jurisdictions in which they assign crashes. There are, however, some rather important differences. For example, according to the CAP data dictionary, VSP's system reports the number of injured pedestrians as well as the passenger's position in the vehicle, unlike VDOT's reporting software. According to the VSP's user's guide, VSP also has access to many CAP features not available to HTRIS users, such as information about drivers and vehicles. The VSP field office visited, however, did not appear to use all of these capabilities in determining its selective enforcement program: the considered parameters were the number of crashes by time of day, day of the week, month of the year, causative factor, and alcohol involvement.

Following the VSP interview, another representative from VSP noted in a telephone conversation that the statewide database "really belongs to DMV and VDOT" and that VSP submits requests for changes to the reporting structure of the database to a CAP User's Committee. This same representative stated that VSP does use a lot of the reporting features found in HTRIS, such as the straight line diagram for representing crash locations, but that certain roadway data are not collected by VSP. Examination of the VSP User's Manual, however, suggests that most of the roadway elements are available to VSP. Two additional VSP representatives noted that VSP was not familiar with the structure of the database, and relied on the Department of Information Technology (DIT) to make specific programming changes. One of these persons noted that unfortunately VSP had no way of confirming the accuracy of the data.

In addition to CAP, VSP uses for its own evaluation purposes two computer systems, the Data Summary System (DSS) and Maintaining, Producing, and Preparing Executive Reports (MAPPER). The former stores over 100,000 records on an annual basis, is run on a mainframe computer, and contains enforcement data recorded by the officer, such as the total number of miles patrolled or the total number of man-hours devoted to a particular program. DSS is also used to evaluate selective enforcement activities such as speed and DUI enforcement. MAPPER, which VSP notes is significantly larger than DSS, processes data collected during five specific periods of high intensity enforcement: Memorial Day, July 4th, Labor Day, Thanksgiving Day, and D-Day, an annual nationally coordinated effort of increased enforcement. An officer completes an Enforcement Data Collection Form within 12 hours of the selective enforcement period. In addition to enforcement information, this form contains crash facts such as the number of crashes by severity, the total number of persons killed, and the number of persons killed not wearing seat belts.

Finally, VSP contributes data to SafetyNet, a national database maintained by the Office of Motor Carriers. SafetyNet has motor carrier data pertaining to crashes and inspections. Forty-eight states and several territories are contributors to SafetyNet through the Motor Carrier Safety Assistance Program (MCSAP). Currently, when a crash occurs involving a motor carrier, VSP fills out the "Virginia State Police Supplemental Commercial Motor Vehicle Accident Report" at the crash site in addition to the regular FR-300P. The data from this form are then entered into the State Police mainframe system by personnel who are specially trained in processing this form. Once the data are entered into the State Police mainframe system, a software routine converts the data into a format compatible to SafetyNet, and then the data are transferred by modem from the State Police mainframe system to SafetyNet. Three changes to this process are envisioned within the coming year. First, although local law enforcement agencies do not now complete this report when they investigate a commercial crash, they will soon begin to do so. Second, the form will be revised, splitting the data elements into separate sections (screening, vehicle, carrier, driver, location/environment, and general). Certain variables will be less detailed, such as the cargo type, while others be more detailed, such as the sequence of events involving the crash. Finally, the revised form will replace both the current form and the FR-300P, both of which are now filed when a crash occurs.

Other Statewide Users

Representatives were interviewed from four other statewide agencies, VASAP, OEMS, DOC, and DOE, which could either benefit from improved access to crash records or supply additional information to enhance crash records.

Virginia Alcohol Safety Action Program

VASAP becomes involved with crash records only when an officer, suspecting alcohol was involved in a crash, issues a uniform traffic summons along with the FR-300P. This summons is passed from the state or local police unit to DMV, which passes a paper copy on to one of the 24 local VASAP field offices. If a conviction is obtained, then a record for the individual is stored in the local ASAP unit's computer system, INFERNO I. The central VASAP office in Richmond *has the capability* to upload this information into a statewide database, although at the time of the interview, data from the local ASAPs had not been obtained since June 1994, partly because the computer hard disk was full and partly because VASAP was focusing its efforts on INFERNO II, a revised computer system. INFERNO I data obtained before June 1994 are currently stored on magnetic tape. VASAP plans to resume regular uploading of information from the local ASAPs soon. As of June 1994, the central database contained approximately 700,000 records.

INFERNO I data are used to analyze the various VASAP efforts for treating individuals who have been convicted of a DUI motor vehicle offense: education, intensive education, and referrals to other providers for treatment. Data stored within INFERNO I include identifying information, such as an individual's name, address, and license restrictions; descriptive information, such as the person's educational level and whether they are a recidivist; and program participation information, such as the treatment being administered and whether the full cost for the course has been paid.

INFERNO 1 does not include a field that indicates whether the offense involved a motor vehicle crash. VASAP's enhanced database, INFERNO II, will contain a field indicating whether the person was involved in a crash as well as the crash severity (fatality, injury, or property damage only). INFERNO II will contain more extensive data than INFERNO I, such as a section pertaining to community service assigned to an offender (the assigned work site, the hours assigned, the hours remaining, the date of estimated completion, and any reduction in the sentence for good behavior).

Office of Emergency Medical Services

OEMS maintains the Virginia Statewide Trauma Registry, a database into which data are entered only if a patient visits an emergency room for treatment and is either immediately admitted to a hospital for additional treatment or dies. Thus patients who are treated in the emergency room and then released are not included in the trauma registry. Most of the trauma registry data are medically related (e.g. number of days in the hospital and injury outcome), but some crash information is also included, such as the position in the vehicle occupied by the victim, the type of restraint used, and the blood alcohol level. A rough estimate is that the system currently accumulates approximately 30,000 records per year and contains 120,000 records. The Virginia Trauma Registry is physically located at OEMS in Henrico County and may be directly accessed only at that office.

The trauma registry form is not necessarily filled out immediately upon the patient's discharge from the emergency room. These forms are often completed by hospitals some time afterward, with some data being transcribed from the Pre-Hospital Patient Care Report, described below. Many hospitals send batches of trauma registry forms to OEMS on a quarterly basis. Some hospitals send the data on a diskette rather than on paper. OEMS routinely updates the data to eliminate inconsistencies. For example, when a patient transfers from one hospital to another, there may be two trauma records for the same patient. OEMS runs a software routine to identify such duplicate records and combines them into a single record for each patient.

OEMS's Pre-Hospital Patient Care Reports, although not stored in the form of a computer system at the statewide level, are another potential source of data. Every time a local EMS unit encounters a potential patient, a form entitled the Pre-Hospital Patient Care Report (PPCR) should be completed at the site, during the ambulance ride to the emergency room, or upon arrival at the emergency room. The PPCR is used by 656 licensed providers, which include volunteer, commercial, and municipal enterprises. Because a database for storing these forms does not exist, OEMS no longer requires providers to send the form to OEMS, although the providers do complete the form and send copies to the hospital, the patient, and the pharmacy, as well as keeping a copy for their own records. Should such a database become operational, OEMS would subsequently require EMS providers to send a copy of the form to OEMS. Unlike the Virginia Trauma Registry Form, the PPCR is completed for all EMS visits. The PPCR contains a variety of data elements, such as identifying information, the specific area of the body that has been injured, the trauma type, a category of motor vehicle impact (e.g. single vehicle, overturned, trapped), and type of restraint used.

OEMS notes that it obtains data from other sources since it does not have a Pre-Hospital Patient Care Report Database. These sources include individual provider reports that are furnished to OEMS by the individual EMS provider agencies. These reports are often compiled using a software package called "Q&A," which is a user-modified database with which smaller agencies can analyze data compiled from their Pre-Hospital Patient Care Report forms. These "Q&A" databases are essentially Pre-Hospital Patient Care Report databases tailored to the specific needs of an individual EMS provider.

Department of Education

1. *Driver Education Services*

   DOE is responsible for youth (under age 19) motorist education efforts within the Commonwealth, including courses taught by public, private, and commercial schools. These efforts include motorcycle, automobile, and bicycle safety and entail both classroom and in-vehicle instruction. For this effort, DOE has no computer system of its own for crash records. It uses data published annually in DMV's *Crash Facts* and the Insurance Institute for Highway Safety's *Facts*. DOE also requests data from DMV's CSS database concerning the number of cars that are currently impounded. DOE indicated a need for a "youth-specific type of database" which could be broken down by counties or cities. This database could provide information for driver education courses. A representative from VTRC noted that the VTRC once designed and implemented such a database for DOE, but the database was not maintained.

2. *Pupil Transportation Service*

   An organization within DOE, Pupil Transportation Service (PTS), uses a personal computer-based system called TRASER,[2] which appears to be very similar to MTRS. PTS collects data for any crash or incident involving a public school bus. These crashes include, for example, children being struck by a vehicle before they board the bus, bus crashes with no children on board, and incidents where the bus caused damage to other property. PTS notes that safety at loading and unloading points is a larger problem than safety within a moving bus.

Department of Corrections

DOC maintains several databases, each with a different focus. No attempt was made to quantify the size of most of these databases, although an examination of their data elements gives

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[2] TRASER is an acronym for Traffic Services.

some insight into their potential to supplement existing crash records systems. Persons who wish to access this information may contact the Department of Corrections to perform a computer run, but the DOC databases are not available to non-DOC personnel.

The Offender Based State Correctional Information System (OBSCIS) database contains information on persons who are incarcerated in state institutions, state prisoners in local jails, and persons who are on parole. Several types of data are stored in this 250,000-record database, depending upon whether the person is or has been incarcerated. For those currently incarcerated, OBSCIS contains the person's name, date, sentence, and the various offenses of which the person was convicted. For persons who have been released, only the most serious offense is listed. The flexibility of the database also depends upon whether the person is presently incarcerated. For those incarcerated, one may perform a variety of searches based on variable values; for example, one may obtain all of the records that include a particular offense. For persons not incarcerated, one may only look at records sequentially, meaning that these searches may not be conducted.

The Time Information Processing System (TIPS) database is a subset of OBSCIS and contains information on convicted felons after June 30, 1987 who were sentenced to serve a year or more at a DOC facility. Many traffic offenses are misdemeanors, not felonies, however. A person would be listed in the TIPS database only for a felony with a sentence of a year or more. For example, a person guilty of reckless driving would never appear in the TIPS database unless that person had *also* been sentenced for a year or more for a felony at the same time.

The Jail Reimbursement System (also referred to as the "J7/J8" or simply "J7" System) allows DOC to reimburse local jails for state inmates that are housed in local jails. Every month the 99 local jails send DOC a "J7/J8" report which DOC uses to compute how much each jail should be reimbursed. It is estimated that each month 30,000 to 40,000 records are processed. DOC notes that this database provides limited research benefits, since there is no guarantee that an inmate can be identified, there are delays of up to two years before data are entered into the computer system, and little or no checking of the data is provided by the local jails. Further, if a client has committed multiple offenses, the amount of time sentenced for each offense is not shown. Only the total sentence for that offender and the most serious offense are recorded. Finally, since the primary purpose is reimbursement, a new record is created every month. Thus, for an inmate who serves six months in a local jail, there will be six records.

DOC and the Department of Criminal Justice Services jointly maintain the Pre/Post-Sentence Investigation (PSI) Database. A PSI is completed only if it is ordered by the court. Not all PSIs are entered into the database. For example, DOC notes that it does not always receive a PSI for an habitual offender, and that because of the high volume of habitual offenders, habitual offender information is usually *not* entered into the PSI database. The PSI contains a record for most *felony* convictions that have occurred in the Commonwealth since 1985. Therefore the only motor-vehicle related offenses stored within the PSI databases are hit-and-run and carjacking, the latter of which is better described as robbery. Since DOC estimates that the

PSI Database has records for only 75% of the cases for which a record should be stored, DOC's opinion is that a PSI report contains no more information than the J7/J8 report *with respect to crash data*. DOC noted that it is possible for a single person to have more than one record on the PSI database, since each record is tied to a report and a person may have several PSI reports created for them.

As explained in Appendix A, two coding schemes may be employed when defining offenses: the National Crime Information Codes (NCIC) and the Virginia Commonwealth Codes (VCC). The VCC definitions are generally more detailed than the NCIC definitions. Consider, for example, "hit and run." The NCIC number is 5401 but there are nine possible VCC definitions for the same offense, such as failure of the driver to stop, report, or assist an injured driver and failure of the driver to report an injured passenger. In some cases, the link between NCIC and VCC definitions is not clear. For example, for the NCIC offense "voluntary manslaughter with a vehicle," there is no corresponding VCC number: the closest VCC definition is "voluntary manslaughter," which does not allow one to know whether a vehicle was involved. OBSCIS, TIPS, and the J/J8 databases use the NCIC system while the PSI uses the VCC System. Finally, the Department of State Police (VSP) and DOC use different variations of the NCIC definitions.

The author's perspective of the flow of crash data throughout these agencies' systems is diagramed on the following page. Note that the single CAP database is accessed by DMV, VDOT, and VSP.

DISCUSSION

There are several ways to consider the data collected in this study. For example, the strengths and weaknesses of each system could be examined individually. Given the large number of systems, however, the overall state of the Commonwealth's computerized crash records systems is probably most intelligible if the systems are viewed collectively.

Eight areas of emphasis were identified from comments made by interviewees and problems encountered by the author during this study:

(1) *Diversity*: The various agencies have different needs, foci, and approaches to processing crash data, and these differences help explain why system capabilities vary.

(2) *Accessibility*: In addition to DMV, VSP, and VDOT, other state and local agencies need access to crash data.

(3) *Documentation*: The ability of an inexperienced user to analyze crash data will depend heavily on how well the data are explained.

(4) *Cooperation*: Users' and providers' needs and capabilities cut across agency boundaries, making interagency cooperation important.

(5) *Data Collection*: The FR-300P is the origin of most statewide crash data, hence consideration of its data elements is important.

(6) *Duplication of efforts*: Previous assessments of Virginia's crash records systems have pointed out problems arising from two or more agencies entering the same data into separate systems.

(7) *Medical data*: The potential future linkage of crash data and medical data is considered.

(8) *Consistency*: Some underlying assumptions for data from multiple sources are highlighted.

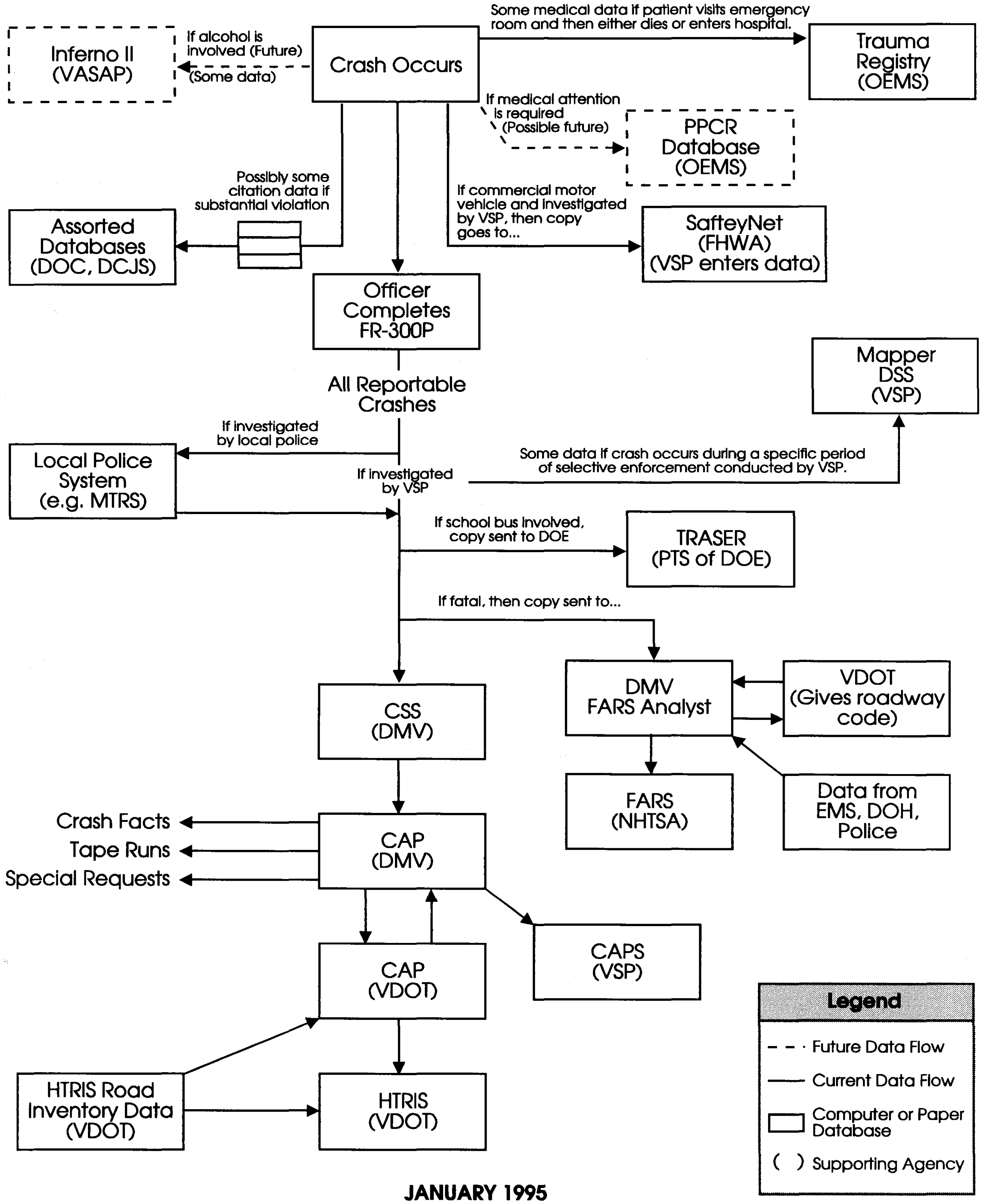
1. Diverse Crash Records Users and Providers

This report has referred to Virginia's crash records *systems* rather than using the singular "system." There are numerous systems reflecting differences in the agencies' missions, computing environments, access to technical personnel, and system evolution. DMV, VSP, VDOT, and local law enforcement agencies are not the only users and providers of crash data.

Diverse Providers Throughout the Commonwealth

Potential crash data providers include agencies such as VASAP, the Office of Emergency Medical Services (OEMS), and the Department of Corrections (DOC). Each of these three agencies has information directly relevant to quantifying the impacts of crashes and evolving effective strategies for reducing crashes. VASAP, for example, maintains data concerning motor vehicle offender participation in treatment programs for alcohol abuse, while DOC databases contain information on sentences served by offenders. OEMS and some of the 656 independent EMS providers have access to data on injuries from motor vehicle crashes through the statewide Trauma Registry database and the individual databases containing information from the Pre-Hospital Patient Care Reports. If one wanted to assess the effectiveness of certain incarceration or treatment programs, one would need access to these data. Virginia has a number of potential crash data providers.

FLOW OF CRASH DATA THROUGH *SOME* OF VIRGINIA'S CRASH RECORDS SYSTEMS



JANUARY 1995

Diverse Users Throughout the Commonwealth

Virginia's computerized crash records users are even more numerous. Not only do DMV, VDOT, and law enforcement agencies use crash data, but local governments, PDCs/MPOs, school systems, airports, and private organizations like the American Automobile Association, are users. These agencies have varying needs for crash data. The MPOs cited numerous safety and planning applications such as the design of a congestion management system, horizontal realignment of secondary roads, and the creation of a bicycle network. The Middle Peninsula PDC's need for crash data in order to improve bicycle safety illustrates how local planning organizations need crash data to perform some of their functions effectively. VTRC analyzes data for a variety of research projects, most of which require data from individual crashes. While each user applies crash data to identify potential problems, assess countermeasures, and disseminate information to the public, the users approach crash data from different angles.

Diverse Missions for Users and Providers

Each user or provider has different priorities for processing crash data depending on the agency's mission. For example, although local law enforcement agencies store some of the same data as DMV and VDOT store in the Centralized Accident Processing (CAP) System, local law enforcement agencies need hands-on access to those data for daily operations such as selective enforcement and public outreach. The issue becomes one of timeliness. VDOT or DMV *could* perform runs to identify a particular county's ten highest crash locations for a particular month, but neither agency can devote the manpower to analyzing these intersections every month for every locality in a timely manner.

Diverse Computer Capabilities and Technical Support

The disparity among the various computing environments is striking, even for users that perform the same function. For example, the Fairfax County Police Department operates a mainframe system that is closely linked to other Fairfax County agencies and is operated by the Fairfax County Department of Information Technology. The Powhatan County Sheriff's Office, however, uses a personal computer (PC) based system maintained and operated by one person within the Sheriff's Office. These systems have simply evolved separately. Pupil Transportation Services (PTS) within the Department of Education (DOE) uses the PC-based TRASER software package because PTS has become accustomed to it, even though TRASER and MTRS have similar features.

Each user has its own arrangement for technical support. The Fairfax County Police Department works directly with the Fairfax County Department of Information Technology, while VSP relies on a committee composed of representatives from VSP, DMV, and VDOT to coordinate changes through DIT. MTRS users rely on another state agency, the Transportation Safety Training Center, for technical assistance, while PTS either makes its own changes or coordinates upgrades with the Texas Transportation Institute. Contracting is an option; VASAP's INFERNO database is being upgraded with the help of a consultant.

Diverse Points of Contact

The responsibility of maintaining, processing, and applying crash data within each organization also varies. Even agencies with similar functions may handle crash data differently. As an illustration, both the Powhatan County Sheriff's Office and the Charlottesville Police Department have one point of contact for crash records. That person is responsible for verifying that the FR-300P accident reports are completed correctly by the officer, entering those data into the crash records database, maintaining and understanding the crash records database, and subsequently using crash data to help the organization with its daily operations, such as selective enforcement. The Fairfax County Police Department, on the other hand, uses three different subunits--one maintains the data, one uses the data on a daily basis, and a third conducts long-term research.

Responsibility for crash data in large organizations is shared among several subunits. In VDOT, crash data are directly processed by an accident unit and information about the road is the responsibility of the roadway inventory group--a separate unit. In this case, one needs to talk to representatives from both units if one has a question concerning crash and roadway data. Likewise, many VSP units are responsible for crash data, such as the field offices that use CAP and an office that processes motor carrier information for the SafetyNet database.

Responsibility for data from the CAP System, maintained jointly by VSP, DMV, and VDOT, is shared among the three agencies. For many data questions, there is a clear area of responsibility; it is generally understood that DMV maintains information about the driver while VDOT maintains information about the roadway. The point of contact is not known for some questions, however. A poignant example is the problem encountered by researchers at VTRC who needed certain data elements such as the lane the vehicle occupied prior to the crash. It was possible to ascertain that such elements are indeed entered into the CAP System, but no single organization is responsible for ensuring that all such data elements are available.

Diversity Makes Flexibility Necessary

The diversity of these systems is not necessarily a disadvantage. Arlington County's work with laptop computers may not necessarily be appropriate for Powhatan County, given Powhatan's small number of crashes. Both agencies, however, have aggressively implemented their own systems for processing data. The Powhatan County Sheriff's Office made numerous interagency arrangements to obtain FR-300Ps completed by other agencies within the county, while Arlington pursued technological changes to eliminate the duplication of completing crash report forms by hand and then retyping the same information into a database. To improve its pinpointing of crash locations, Albemarle County has aggressively tried to secure funding for the police department to use GPS (global positioning systems). These examples show how agencies of different size and scope can solve their own problems when given the opportunity. The challenge at the statewide level is to coordinate these agencies without taking away their autonomy. Arlington County's desire to have electronic crash data accepted by DMV, and the county's fear that DMV will eventually require localities to use pencil-based scannable forms, is an example. Clearly Virginia needs a system that will accommodate the innovations of localities within a framework that enhances data consistency and availability.

2. The Need for Accessibility to Crash Data

The value of crash data to state and local users is manifold. Police departments, planning commissions, researchers, and statewide users other than DMV, VSP, and VDOT analyze crash data to accomplish their missions.

Local Police Department Use of Crash Data

Law enforcement agencies that maintain their own databases have proven the benefits of hands-on access to data. All three local agencies in this study had immediate uses for their data. Powhatan devised innovative public outreach efforts, using crash data stored on a portable PC to quickly answer questions about crash rates near a particular location. The Charlottesville Police Department suggested the collection of Blood/Breath Alcohol Content (BAC) measurements for all drivers tested. Fairfax's practice of notifying VDOT about high crash locations that might need engineering modifications, such as the placement of traffic signals, shows what localities can accomplish when they have access to the data. Naturally, users become more adept at articulating their crash data needs when they have exposure to the data.

Applications of Crash Data by Local Governments

Other local agencies, such as PDCs, the associated metropolitan planning organizations (MPOs), and local traffic engineering departments need crash data. VDOT's decision to ask certain localities to design their own congestion management system (CMS) as part of a statewide CMS involves extensive data analysis. As noted by the Richmond MPO, a component of the CMS is to examine the effects of motor vehicle incidents and outline possible countermeasures. The CMS and the Safety Management System (SMS) have the common goal of mitigating the adverse impacts of crashes and reducing the total number of crashes, and the CMS may require crash data. A second reason why localities need crash data is that secondary road improvements are the responsibility of incorporated cities, not VDOT. As noted by the City of Richmond's Traffic Engineering Department, crash data can link crash rates to particular street segments to analyze crash trends over time. Finally, PDCs participate both in safety improvement decisions and pre-allocation hearings that affect the fate of transportation projects.

Applications of Crash Data by Other Statewide Users

The popularity of the annual *Crash Facts* publication among diverse statewide organizations shows a widespread interest in crash data. DOE explained that accurate data about crashes within a specific locality would allow it to focus driver training more effectively. For example, after one locality learned that three students were killed in run-off-the-road accidents, they knew to focus a portion of their classroom training on vehicle maneuvers. The Department of Alcoholic Beverage Control (ABC) indicated it would like to be able to obtain data on a quarterly basis to assess the impacts of alcohol sales in certain areas. Local crash data are thus of use even to statewide agencies.

The Need for Crash Data in an Electronic Format

Some users need more information than the FR-300P or DMV's *Crash Facts* show. One VTRC respondent noted that the FR-300P does not always show persons who died from injuries sustained in a crash. Another respondent noted that although the 1993 *Crash Facts* lists the number of total crashes and the number of fatal crashes by age of the driver, the age breakdown does not indicate the offenses the drivers were charged with or what the driver actions were. A third VTRC respondent recalled a study from several years ago where researchers needed to identify the number of drivers between the ages of 15 years eight months and 21 years who were involved in an alcohol-related accident. The respondent and another researcher indicated that although alcohol data are presented in the *Crash Facts*, a computer program was needed to further analyze the data because of how the *Crash Facts* had categorized it. (Data were being analyzed over a period of several years, during which the categories for age groups were changed. In 1984 there was a category for persons between the ages of 21 and 24 which was changed in 1985 to include 25-year-olds as well.) The user needs to be able to change the format of the data to suit his or her needs.

3. Documentation of Database Capabilities

The most time-consuming task of this research was to synthesize descriptions of the various crash records systems. Information was obtained by interviewing a supplier of crash information, furnishing the interviewee with a written depiction of the relevant system based on the interview and documentation provided, and then modifying the description according to the interviewee's revisions. All this sometimes required several iterations as well as time-consuming telephone calls to additional agency representatives such as data entry personnel or programmers.

Representatives from other agencies, including DIT, were also contacted to get their perspective. Much institutional memory is stored only in the minds of employees affiliated with these systems, past or present. The lack of documentation is a major deficiency that undermines the capabilities of computer systems. This problem must be corrected to maximize the effectiveness of these systems.

Undocumented Features of the CAP System and HTRIS

Four non-intuitive features of the coding of statewide crash records data, detailed in Appendix A, were only encountered by chance, not by a systematic evaluation of the logic behind each data element. This suggests that users may be making incorrect assumptions about other data being analyzed.

- *Property damage*: CAP stores in separate sub-databases the different components of the total amount of property damage incurred in a crash, while HTRIS reports only the total amount. The DMV representatives understand CAP, and the VDOT representatives understand HTRIS components, but the author found no documentation describing how the two systems handle property damage differently.

- *BAC*: An examination of the CAP database for 1993 indicated a BAC for only a few hundred crashes. A representative from DMV pointed out, however, that BAC is recorded only for fatal crashes, which explains the small number of BACs.

- *Roadway data*: Discussions with representatives from VDOT's road inventory unit and traffic engineering unit uncovered important coding details that users should know, such as the fact that secondary road data may not be current.

- *CAP tape*: Examination of the 1992-1993 CAP crash data tape provided to VTRC revealed that certain data elements entered by VDOT were not on the tape, such as the placement of the vehicle prior to the crash. Researchers had previously assumed that all crash data would be on the tape. Only after the researcher had identified specific data elements not shown on the tape, was VDOT able to say which additional data elements it could provide. Later, VDOT provided a listing of data elements stored in CAP and suggested that DMV's format for making tapes needed to be modified. This implied that DMV, rather than VDOT, should have been contacted regarding the creation of a CAP crash data tape.

In all four of these examples, DMV and VDOT personnel understood the characteristics of the CAP database and were willing to provide assistance. The confusion initially arose, however, because these features are not documented.

Insufficient Existing Documentation for CAP and HTRIS

The primary written mechanisms for learning about database capabilities appear to be data dictionaries and older user's manuals. While these items are helpful, they are not always accurate and complete. For example, the CAP data dictionary indicated that for VDOT, the data element for day of the week is not defined, when in fact that data element may be used by VDOT to query the database. As another example, the data dictionary indicates that "kind of locality" is not defined for VDOT. This datum is reflected by the field "Typ-Environment," however, which does appear as part of the HTRIS reporting screen. The HTRIS Accident Subsystem user's manual, while providing some help, does not explain some pertinent information relating to crashes, such as the meaning of the zone of impact. An intelligent long-term assessment of the data reporting format would be difficult without accurately recording this type of information.

Another example of why documentation is vital emerged when a VTRC researcher requested from DMV a special run pinpointing crashes involving pedestrians. The CAP data listed the crashes as well as the value "1" or "2" indicating whether the crashes occurred in an urban or rural location. DMV originally indicated to the researcher that "rural" and "urban" were reflected by the *population code* indicated in the CAP data dictionary and shown below:

Population Code	*Definition*
1	Town under 1,000 in population
2	City/county between 1,000 and 5,000
3	City/county between 5,000 and 9,999
4	City/county between 10,000 and 49,999
5	City/county of 50,000 or more

The researcher then pointed out to DMV that the only values shown in the data were a "1" or a "2." The CAP data dictionary indicates that the *population code* is used for the "highway definition." The data dictionary also indicates, however, that when State Police use the software the *population code* is not shown; instead, a "1" reflects a rural area and a "2" reflects an urban area. Since the data given to the researcher show only a "1" or a "2" in the *population code* field, it seems likely that somehow the data indicate an urban or rural area and not a population code. DMV was not able, however, to explain how "rural" and "urban" are defined in this context.

The Insufficiency of Institutional Knowledge for the User

Even if an agency has an extensive number of customer-service oriented personnel who can respond to user's requests, documentation of the crash record's system is still of vital importance for the user. The fallibility of relying on oral institutional knowledge is a familiar problem, wherein the expert in a particular domain may not adequately describe how he or she obtains the answers to problems.[5] A crash database "expert" may be unaware of the full extent of his own knowledge, and may fail to transmit data for that reason. If multiple users need access to information, it is not enough for institutional knowledge to be stored only in the minds of individuals.

Benefits of Documentation

Documenting database capabilities and keeping the documentation current for the Commonwealth's computerized crash records systems would benefit both the users and providers of crash data. The benefits include alerting users to the existence of additional data sources, reducing duplication among agencies performing similar functions, improved public awareness of existing database capabilities, and a better understanding of the assumptions underlying crash data.

- *Additional data sources*. Documenting the data available from other databases besides CAP may help those who need to answer crash-related questions. For example, one user felt that truck data are often coded incorrectly on the FR-300P. Knowledge of VSP's SafetyNet data would help that user, as those data represent a body of information dedicated to motor carriers. In the same vein, while the DOC database would contain motor vehicle offender information, analysts might not know that the Department of Youth and Family Services also keeps statistics on juveniles who commit motor vehicle offenses (as Appendix B shows, only non-identifying information would be available.)

- *Efficiency*. Documentation allows agencies to make decisions about streamlining the data entry process. For example, clearly there is some duplication between FR-300P data entry into the local law enforcement agency's database and into the CAP database. Would there be a "real" benefit to streamlining these processes? In other words, would DMV's data entry process be more efficient or more accurate if data entry operators entered only some of the data from the FR-300P and then verified how the local police had entered the rest of the data? The answer cannot be determined without first examining local police departments' data entry processes as well as providing DMV with an opportunity to test such a practice. Once agencies know who already does what, they can take advantage of existing resources.

- *Improved outreach*. During this study several people repeated anecdotes which turned out to be false. For example, one person said he had been told that VDOT and DMV enter the same data twice into the CAP database. In fact, DMV and VDOT do *not* enter the same data into CAP. Certain data elements are reported differently by the database, which may have been the source of confusion. In this case, VSP, DMV, and VDOT have their own system of jurisdictions. DMV enters a jurisdiction into CAP, and then each of the other agencies employs a different referencing system. The jurisdiction, however, is still entered only once. As another example, a group of crash records users from various VDOT field units spent the better part of an hour arguing that one could not find a crash location in VDOT's HTRIS software using mileposts because mileposts are not compatible with HTRIS's referencing system. Subsequent telephone calls to four of those users and further investigation of the HTRIS software revealed that one can indeed find a crash if one knows the milepost number, as Appendix C shows. The problem, however, is that one needs to be familiar with the link-node referencing system, and the database often shows only the route number rather than both the route number and route name. Clearly, agency outreach efforts will benefit from better documentation.

- *Research benefits*. From a research angle, documentation of how data are collected is crucial for understanding the limitations of analysis. O'Day notes that "The conclusions drawn from such an operation should be tempered by an understanding of the quality of the data and the process."[6] For example, the precision of the zone of impact data, which indicate the location of a crash with respect to an intersection, will affect the interpretation of analyses of events that occur at or near intersections. As an example of feedback needed by crash data users, it is well-known that reportable crashes in Virginia include only those crashes investigated by a police officer with a fatality, injury, or estimated property damage over $1,000 (this threshold has changed over the years from $250 to $500 to $750 to $1,000, and it will likely be increased in the future as vehicle prices rise). Analysts need to realize, however, that it is not known how many non-reportable crashes occur throughout the Commonwealth, although data from some police agencies suggest that there are a significant number of non-reportable crashes.

- *Long-term performance*. Finally, a crash records system with documentation can still be useful when experienced personnel leave the agency. Newer personnel can continue to use the system effectively and modify the system as priorities change. Furthermore, if database capabilities are known, then it is less likely that an agency will believe that unusual but feasible data requests are impossible to fulfill.

The Importance of Documentation From an SMS Perspective

One of the threads of the SMS concept is that data should be disseminated as necessary.[7] Since the SMS process emphasizes the participation of users who may not be familiar with crash records data, this goal should be interpreted to mean that users should be told what data are available, and not merely given data only when they request it. Brown articulates this reasoning by noting that ."..without a direct user hands-on capability, the thought process necessary for effective problem identification just cannot take place."[8] Even if local users cannot get direct access to data, it would at least be a step in the right direction to indicate to users what data are available and how to obtain them. The data dictionaries and users' manuals are a start, but to be good reference tools they need to be updated and made more understandable to the novice user.

4. Cooperation Among Users and Providers

Closely tied to documentation of crash data capabilities is the need for cooperation among users and providers. There are a number of success stories in the Commonwealth where users and providers work together to obtain the data they need. This process is not always institutionalized, however, and not all users and providers have a way to articulate changes that should be considered. Such a process would benefit those agencies that do not have access to all the data they need.

Success Stories of Interagency Cooperation

Without a centralized authority, states need a high degree of coordination among the players involved in a crash records system.[9] Several models of cooperation exist.

- *Coordination among local agencies.* The Powhatan County Sheriff's Office completes fewer than 1% of the FR-300P reports each year for crashes that occur within the county. The sheriff's office has arranged with both VSP and the Virginia Game Commission to obtain the reports completed by these agencies. As a second example, the popularity of MTRS among local law enforcement agencies has not been adversely affected by the fact that MTRS was developed by one non-enforcement agency and is maintained by another non-enforcement agency. Although multiple agencies are involved, each agency has a particular mission and someone responsible for fulfilling it.

- *Coordination among state agencies.* There are examples of interagency cooperation at the state level. DMV, VSP, and VDOT have joined efforts to maintain the CAP System, which appears to have reduced duplication of efforts among these three agencies. A CAP users' committee provides each of the three agencies with a forum to voice concerns about the database, with the Virginia Department of Information Technology (DIT) performing the actual computer manipulations for DMV and VSP at the direction of the committee. The Division of Forensic Science within the Department of General Services is used by police to investigate crashes involving criminal activity. Finally, the Supreme Court provides DMV with daily updates of traffic-related convictions.

- *Coordination between the public and private sector.* The Department of Rail and Public Transportation (DRPT) works with the VDOT traffic engineering division's rail section to ensure that at-grade crossing data are obtained from DMV, the Federal Railroad Administration, and the railroads themselves. DRPT also collects very limited data from a few of the Commonwealth's transit systems.

- *Coordination between state and local agencies.* There are also local examples of interagency cooperation. PTS works with local law enforcement in certain instances to obtain data concerning school bus crashes when such crashes are reportable. VDOT has worked with some localities to use crash data to solve common problems; for example, the Northern Neck PDC used VDOT-provided crash data to respond to a request by a VDOT residency for identification of road segments with high crash rates.

- *Informal examples of cooperation.* Ad hoc instances where agencies work together were also uncovered. DMV and VDOT data entry operators are in telephone contact to verify FR-300P data elements when the need arises; for example, if VDOT discovers that a crash has been incorrectly coded, the appropriate person alerts DMV to make the change in the database. Finally, crash data users also have the option of contacting DMV to conduct special runs of statewide data if resources and time permit.

Lack of a Formal Feedback Process

In spite of the preceding examples, many providers and users have no formal mechanism through which they can identify or discuss their data needs. The CAP users' committee, for example, last met approximately one year before the writing of this report. A representative from VSP indicated their sentiment that CAP was really an operation maintained by VDOT and DMV, owing largely to the fact that VSP did not have people with computer expertise. ABC has stated that it would like to be able to obtain crash data quarterly rather than annually as is now done with the *Crash Facts*. Finally, the Charlottesville police department requested that the MTRS software be modified to list, in addition to high crash frequency locations, reasons for these crashes--not a difficult software change to make, but local police departments need a process through which to state needs for changes.

Crash data users need a way to articulate their needs with the expectation that at least the most essential changes can be implemented. Such a process might help users to realize which problems could be solved with existing methods. For example, one user noted that "possible sleep disorder" should be included in the FR-300P, even though there already exists a space on the FR-300P to show whether or not the driver was "possibly asleep." This forum is necessary if Virginia's crash records systems are to function as a true statewide system.

Benefits of Communication Between Users and Providers

The benefits of an improved dialog between users and providers are suggested from both the literature and some perspectives obtained during this study. O'Day wrote, "There may be computer communication where appropriate, but personal communication between departments is even more important."[10] Four categories of potential benefits resulting from communication were identified during this study, in terms of making data accessible, ensuring that data requests are not lost where multiple agencies are involved, and actively encouraging potential providers to make crash data available.

- *Making data available*. The law enforcement agencies interviewed for this project collect data on age, while DOE has indicated a need for a database that gives crashes by age distribution within the various localities. Clearly there is a possibility of linking these two groups, at least in the short term. In a second instance, a traffic engineer from a locality noted he could not find information about crashes in the proximity of at-grade rail crossings, when in fact VDOT's traffic engineering department maintained this information. Once the local traffic engineer was notified of this fact, he was able to contact VDOT and obtain the necessary information.

- *Ensuring all data requests are met*. Some form of institutionalized interagency cooperation would be beneficial for filling the gaps when crash records data are not available or when the responsibility for providing data is not well defined. The difficulty is that when certain data from multiple agencies are not available, there is no single point of contact to which one may turn for an answer. For example, as stated in the Results section and Appendix A, the 1992-1993 CAP tape had fourteen missing data elements, as well as some errors in how one of the data fields were coded. A great deal of time was spent trying to determine where the data elements were stored. Initially the author thought that DIT would have the data, since thirteen out of fourteen data elements were found on coding sheets from tapes maintained by DIT. DIT noted that these elements were written to the tapes by the HTRIS software, but VDOT countered that only DMV's CAP System would have the missing elements. A subsequent VDOT printout of CAP elements showed that CAP did contain the missing elements entered by VDOT's crash subsystem unit but not those elements provided by the VDOT road inventory unit. This corresponded with a VDOT representative's suggestion that CAP tapes are made with the same format that existed prior to the creation of HTRIS. The confusion arose from the fact that two agencies (DMV and VDOT) share responsibility for data that are maintained by a third agency (DIT), with no single entity responsible for making crash data available in all cases.

- *Providing a voice to represent crash data needs*. Part of this feedback process could include outreach to other agencies that have crash data. One such example is the possible redesign of the J7/J8 database by the Department of Criminal Justice Services (DCJS) and DOC, which is now under consideration. If such an overhaul were to take place, then input from the transportation safety community concerning desired data as well as access to those data could significantly influence what corrections information would be available to those who need to analyze motor vehicle crash causes and countermeasures. Specific data deficiencies, such as not knowing whether a crash occurred (VASAP's INFERNO I database and the Supreme Court's CAIS database), or habitual offenders not being recorded (DOC's PSI database), could be addressed.

- *Learning from the experience of others*. Interestingly, each of the local law enforcement agencies entered similar data elements into their respective databases. While different agencies have different needs, there may be data analysis techniques or special data collection strategies that are worth sharing across the Commonwealth.

In sum, the Commonwealth has exhibited examples of interagency cooperation, and there are opportunities to enhance this cooperation in terms of documentation of crash data, provision of access to crash data, and acknowledgment of the diversity of crash data users and providers.

5. Collection of Crash Data

One of the benefits of an institutionalized feedback process between users and providers would be to ensure that desired data elements are initially recorded on the FR-300P. Not all of the data elements users want are necessarily feasible to collect, as each requires additional effort. Comments made during this study, however, revealed several suggestions for modifying the FR-300P that would improve crash data analysis. The specific needs will change over time as users' priorities change, but this list shows how an articulated feedback process could improve the collection of crash data.

- *Additional restraint information.* Usage of child safety seats, seat belts, and airbags is not shown on the FR-300P unless the person is injured or killed. In fact, the presence of a passenger is not reported unless the passenger is injured or killed. Having this information would greatly help to assess the effects of restraints, especially when they prevent injury.

- *More specific measures of location.* The crash location on the FR-300P generated much concern among surveyed users. Users noted that a distance of 50' to 200' makes a difference, especially when the relationship of the crash to the surroundings may be changed dramatically by a small change in this distance. For example, when a pedestrian is struck by a vehicle, whether the crash occurred in a crosswalk, near a crosswalk, or out of sight of a crosswalk is relevant. Technological enhancements to the FR-300P, such as the use of an electronic template for certain intersections, as suggested by Arlington County, or the application of GPS technology, as mentioned by the City of Richmond and Albemarle County, may be worthwhile.

- *Modification of how the driver's action is coded.* "Driver inattention" is shown as one of 37 possible choices under "driver's action" on the FR-300P Template. Cottrell wrote that "the majority of the accidents under review had driver inattention, a catch-all description with little value, as the driver action."[11] Cottrell goes on to note that other choices listed under "driver's action," such as "disregarded stop/go light," would have been more useful. This raises the question of whether the choices presented on the FR-300P as they are coded by officers are routinely meeting the needs of the users. If "driver inattention" is being selected most often because none of the other 36 choices are appropriate, then further subdivisions of this type of error may be necessary. In this case, one could consider some of the choices that are recognized as national standards but which are not shown on the FR-300P, such as "failure to keep in proper lane."[12] On the other hand, it may be that "driver inattention" is being used in instances when a more specific driver's action shown on the FR-300P Template is applicable. If so, one solution would be to alert law enforcement agencies to this problem or address it in routine officer training.

- *Additional vehicle movement information.* Right turns on red are not collected, but such information can be vital for understanding a crash. More importantly, it can help assess the utility of engineering changes and motorist education efforts.

- *Additional pedestrian data.* For example, one user noted that the type of clothing worn could be useful.

- *Additional alcohol data.* The BAC is not shown on the FR-300P and is only entered into CAP for fatal crashes after being determined by the medical examiner. In the author's opinion, variations between the BAC and another data element that is collected, the drinking category, suggest that collection of BACs could benefit further research into crashes involving alcohol.

- *Some measure of total crashes.* Lastly, many crashes are not reported because they are classified as nonreportable (no fatalities, no injuries, and property damage under $1,000 as estimated by the police officer). These crashes, however, are often larger in number than reportable crashes: they accounted for roughly 60-70% of the crashes in Fairfax County and the City of Charlottesville. The fact that the monetary threshold has changed several times over the past decade also affects the reporting of crashes.

These different categories of suggestions--the collection of additional data (e.g. right turns on red), modifications to existing reporting procedures (e.g. driver actions), and improved methods of data collection (e.g. the reporting of crash locations)--need to be considered in an orderly way. For instance, the comment about BACs is based on a limited subset of 1992-1993 data. Clearly, data providers and users need a mechanism whereby they can make their needs and capabilities known. Such a forum should include state and local law enforcement personnel since they can attest to their ability to collect these data.

6. Duplication of Effort

Duplication of effort has historically garnered attention in the crash records arena because reducing duplication is usually associated with increased efficiency. In some cases, though, duplication of effort may bring positive results, such as additional checks for errors or a strong sense of pride that translates into improved data availability. Duplicate functions are identified below, along with interpretation of the significance of duplication, and a plan to eliminate some of this duplication without inhibiting the diligence already shown by certain crash data users.

Examples of Minor Duplication of Effort

Within DMV, one potential source of duplication occurs between the CSS and CAP databases when errors are discovered after CSS data have been copied into the CAP database. Since CSS and CAP are two separate databases, changes to CAP data must also be made manually to CSS. Elimination of this duplication, provided that privacy concerns with the CSS data could be addressed, would appear to slightly increase efficiency for DMV.

A second potential source of duplication occurs when fatal crash data are entered separately into NHTSA's FARS database as well as DMV's CAP database, although Virginia has typically fewer than 1,000 fatal crashes per year, meaning that such crashes constitute less than 1% of those processed by the Commonwealth. Examination of NHTSA's 1993 FARS Data Elements shows that of the 129 data elements listed, approximately half are also entered into the CSS and CAP databases by either DMV or VDOT.[13] Additional data elements appear to be entered into the SafetyNet database maintained by the Office of Motor Carriers. Although some of the data definitions of these data elements may not be the same, there clearly is some overlap between the data elements entered into the FARS database and those that are regularly entered into the statewide databases. Since DMV does not have complete control over how data can be inputted into the FARS database, changes to that database to allow statewide data to be transferred electronically rather than manually re-entered need to be coordinated with NHTSA.

There are three duplicate functions between VDOT and DMV. First, DMV and VDOT duplicate the checking of crash data for errors: for example, DMV enters the four digit code signifying the crash jurisdiction and then VDOT may change this code should it perceive that the jurisdiction is incorrect. This duplication, however, has the benefit of additional verification of crash data. A second potential source of repetition is the storing of images of the FR-300P, which is done by both VDOT and DMV. DMV stores the FR-300P on microfiche while VDOT makes an optical disk image of the form. Third, both agencies provide sanitized copies of these reports if requested. These duplications are also beneficial, in that both DMV and VDOT are a source of crash data for customers. A potential drawback, depending on how much effort is involved, is that two types of visual representations of crash reports are maintained.

Example of Major Duplication of Effort

There is no significant duplication of effort between VDOT and DMV with respect to data entry into the CAP System. As the FR-300P Reference Matrix shows in Appendix A, each data element is entered only once into the CAP System.

A substantial duplication of effort occurs between the localities who enter the data on the FR-300P into their own systems and DMV/VDOT who enter data into the CAP System. The data elements entered by each of the local law enforcement agencies are contrasted with the data elements entered by DMV and VDOT into CAP as shown in the Statewide/Local Reference

Matrix in Appendix A. While almost all of the data elements are entered into the CAP System, and a majority of them are entered into Fairfax County's system, only some of them are entered into Powhatan and Charlottesville's systems. Clearly, the localities and the state agencies (DMV and VDOT) do not enter mutually exclusive sets of data; instead, the localities collect varying amounts of the same data stored in CAP.

A Plan to Reduce Major Duplication of Efforts

The potential exists for localities to first enter the data they need and then pass the FR-300P plus an electronic version of their data on to DMV. DMV and VDOT could still enter the additional data not needed by the localities, and if concerned with the accuracy of the localities' data entry procedures, DMV and VDOT could verify the data entered by the localities. One way to explore unforeseen difficulties with this arrangement would be for DMV and a local police department to conduct a joint pilot project where the local police department would ship to DMV an electronic version of the crash data entered into its system along with a paper copy of the FR-300P. Several possible issues arise, such as the difficulty in training DMV operators to verify data that have already been coded (although operators already do verify some of the data), confusion that might arise when localities define a data element differently from DMV, and the compatibility of data from a locality's system with DMV's CAP System. Certainly, however, these issues could be explored through a pilot project.

Such a pilot project shows promise in terms of technical feasibility. The University of Alabama has developed software that can download data from a statewide database, convert these data into a specific binary format, and subsequently convert these data into an ASCII format, meaning they could be processed by a variety of personal computer software packages.[14] These data would occupy a large quantity of disk space; for example, roughly one-third of the Virginia 1993 crash records occupied 17 megabytes on the hard disk of a personal computer. As hard disk space becomes cheaper and faster computers become the norm, this capability will prove more useful. By extension, this pilot project would provide the capability to download data for potential users who do not have access to crash data.

One challenge that would need to be overcome would be the development of a crash location referencing system compatible with both statewide and local crash records databases. The HTRIS link-node referencing system is a start in this direction, although the system does not include city/town streets that are functionally classified as local and maintained by local governments. A possible interim resolution would be for localities to continue to use their referencing system, with VDOT re-entering the location data for purposes of pinpointing the crash within the statewide referencing system. Although not explored in this research effort, a long-term possibility would be to consider interfacing statewide and local GIS referencing systems for the purpose of locating crashes within the respective databases.

Another merit of such a project is that it could allow local law enforcement agencies to continue to control how and when data are entered. The aggressiveness of the surveyed law enforcement agencies in collecting certain crash data suggests that it would be a mistake to take away from them a function they do so well. Any plan to reduce duplication should not discourage users or providers from being involved in the processing of crash data if these agencies do so effectively. It seems most logical that the data entered by local law enforcement agencies should be electronically transferred to the state database, allowing state data entry personnel to concentrate on quality control and additional data entry not performed by the localities.

7. Linkage of Crash Data and OEMS data

One of the weaknesses of Virginia's computerized crash records systems is that there is no linkage between medical and crash data. Furthermore, not all medical data are in a computerized format. While the trauma registry allows manipulation of electronic medical data, these data reflect only incidents where an emergency room patient is either admitted to a hospital or dies, meaning only the worst cases are stored in a computer database. More extensive data, such as the information contained within the Pre-Hospital Patient Care Reports (PPCR), are not stored in electronic format statewide. Finally legal issues arise with respect to linking crash and medical data, since items such as social security numbers and patient records are confidential.

A Method for Linking Medical and Crash Data

One possibility Virginia has for linking crash and medical data is to follow the approach used by NHTSA's Crash Outcome Data Evaluation System (CODES) project. The CODES project involves the use of software to probabilistically link crash and medical records based on commonalities between key variables. Several sources describe the algorithm for this technique; the key is to identify variables that will be common to both medical and crash files.[15,16,17] Wisconsin has successfully used this technique to link crash data to four sets of medical data: Medicare claims, Medicaid claims, hospital discharge records, and paramedic data. Wisconsin found the best results when linking crash reports to hospital discharge records and Medicare data, using common variables for linkage such as the occupant's date of birth, sex, date of crash and treatment, zip code, county of crash, and type of treatment.

A NHTSA representative noted that DMV has already been given the Minicodes software, a single copy of which is available to each state free of charge.[18] Minicodes is capable of linking medical and crash data. In addition, commercially available linkage software, such as Automatch, is also available. If Virginia were to link medical and crash data, the pros and cons of each of these software packages should be considered. Based on linkage studies done by NHTSA, it appears that there are numerous benefits to linking medical and crash data, such as the ability to quantify medical costs for crash injuries or the ability to definitively state the medical result of crash injuries. The NHTSA/FHWA *Highway Safety Program Guideline* for EMS implies that crash countermeasures such as sufficient availability of trained EMS personnel, knowledge of hospital resources, and access to EMS can increase highway safety.[19] Linkage of crash and medical data at the statewide level should facilitate an understanding of these issues throughout the Commonwealth.

Obstacles to Linking Medical and Crash Data

The Wisconsin project found no "technical" problems when linking crash and medical data, although the project did identify several obstacles that would probably also be encountered in Virginia. Most importantly, the project noted that "By far, the major obstacle in linking health data to crash reports is the absence of centrally accessible computerized data on health outcomes."[20] While Virginia's PPCR runs are not computerized at the state level, there are individual EMS providers who do computerize portions of the PPCR, and the use of these could be investigated on a trial basis. A second possibility would be to consider the use of other medical data sources, such as hospital records.

Two institutional barriers encountered by Wisconsin would also be encountered by Virginia. First, multiple health care providers complicate the process. Wisconsin found that if one considered all crash occupants over 65, only 40% of those cases could be linked to Medicare files, since often participants obtain reimbursement from other insurers before tapping into Medicare. Second, the issues of data confidentiality and the experience of the linkage team may arise. Wisconsin noted that an understanding of health care services was useful for being able to analyze the data once they were linked.

Finally, the way existing data are stored will affect the linkage process. Variables common to medical and crash files may not be precise enough; in Virginia, for example, some crash databases include the age rather than the date of birth, which cuts down on linkage capabilities using that particular variable.

8. Data Integrity Issues

Three specific examples of potential data integrity issues were encountered by chance during the course of this study. A more systematic assessment of crash data may uncover more data consistency problems. Two examples are detailed in Appendix A, and a third is presented here. These three examples may be representative of similar issues not yet encountered.

Consistency: Roadway Data

The first data integrity issue arose when researchers realized that VDOT's road inventory unit and VDOT's crash records unit did not use the same set of information to locate a crash. As explained in Appendix A, the crash records unit relies on the officer's diagram and narrative to locate a crash in a particular lane on the roadway, but the lanes on this roadway are defined by the road inventory unit, which does not see the officer's report. Consequently if the officer has not clearly indicated the exact lane in which a crash occurred, the crash database and the roadway inventory database may not be consistent. The user cannot definitely know whether or not this has occurred without examining the individual crash report. Other data consistency issues described in the Results or Appendix A are also significant, such as the integrity of secondary road data. Clearly FR-300P data do not exist in a vacuum; their utility is affected by the associated roadway data.

Accuracy: Incarceration Data

DOC's description of the quality of incarceration data illustrates how linkage attempts may be hampered by the accuracy of data from other sources. The Results section and Appendix A show that from the many databases maintained by DOC and DCJS, there are limited amounts of accurate information available. Part of the problem is that traffic offense information is secondary to information about more serious offenses. A substantial part of the problem arises, however, because the key database for traffic offenses is primarily a reimbursement tool for local jails. Checks on the accuracy of these data are few, and maintenance of an accurate database for research purposes is not a priority. The value of linking crash data to other data sets, such as medical data, will thus depend on the accuracy of the linked data.

Verification: Alcohol Data

Examination of BACs and alcohol involvement for drivers killed in crashes in 1992 and 1993 suggest that it may be difficult to assess the accuracy of certain types of crash data. As shown in Appendix D, the 1992-1993 data have two variables that reflect the role of alcohol in a crash: the BAC assigned by the medical examiner and the drinking code assigned by the police officer. How consistent and complete are these data? From the 1051 cases, Table D1 shows that a BAC is available for 78% of the records while Table D2 shows that a drinking code is available for 75% of the records. Only 60% of the records have both a BAC and drinking code, as shown in the shaded portion of Table D3.

From this subset of data one notices some definite correlations (e.g. where a person is classified as "not drinking" and a BAC of zero has been measured) as well as some possible problem areas (e.g. where a person is classified as "not drinking" and a BAC over 0.20% is measured). One may make the following observations about this subset of data:

- About 6% of the records showed a BAC greater than zero and a code of "not drinking," which appears to be inconsistent.

- An additional 6% of the records showed a BAC of zero and a code that encompassed some form of drinking, which is also inconsistent.

- At the 95% confidence interval, the Chi-Square test showed that the BAC data and the drinking code data are dependent, although some grouping of the data was needed to satisfy the requirement that most cells have expected values greater than 5 (in this case dependence is a surrogate for consistency). The advantage of the Chi-Square test is that it presumes the drinking code categories are nominal; the disadvantage is that it only indicates whether or not two data sets are dependent and does not measure the degree of dependence.

- The Gamma statistic gives a value of 0.75, on a scale from 0 to 1, for the degree of dependence between the BAC and the drinking code.[21] The Gamma statistic measures association of two ordinal variables by comparing each pair of observations: a pair is considered concordant if variable values for one case are both higher than values for another case while a pair is considered discordant if one pair has a higher value for only one of its variables. A value of 1 indicates perfect association while a value of 0 indicates no association. The disadvantage of the Gamma statistic is that it presumes that drinking codes are ordinal. While "not drinking" and "obviously drunk" clearly can be ordered, there will be some overlap among the other three drinking codes, which means the Gamma statistic is not completely appropriate for all five categories. If one selects only the cases where "not drinking" or "obviously drunk" is the drinking code, then one obtains a Gamma statistic of 0.90, a relatively strong measure of association. These cases, however, constitute only 44% of the total driver fatalities for 1992-1993.

- The Eta statistic gives a measure of 0.70, where it is assumed that the drinking code data are ordinal while the BAC data are interval. Nie et al. explained that the squared value of eta, which in this case would be 0.49, is the "proportion of variance in the dependent variable [BAC] explained by the independent variable [drinking codes]." Eta ranges from a minimum of zero (no association) to a maximum of 1.[22]

In sum, this subset of data appears to be generally consistent, although the table clearly shows some areas that need improvement--for example, crashes where a BAC over 0.20% and a code of "not drinking" are recorded. One may speculate that if such cases persist for non-fatal crashes (where only the drinking category is recorded and BACs are not collected), Virginia may not be accurately reporting the role of alcohol in crashes.

As one researcher explained, it is better to record as much detailed information as possible and then let the analyst make the groupings--for instance, collecting both BACs and drinking codes for all crashes and then letting analysts decide which elements to study. The same philosophy is also relevant for other data elements; for instance, rather than simply classifying an area as "urban" or "rural," it would be better to give the populations on which those determinations are based.

Application of These Features to Research

A researcher's comment illustrates the relevance of some of the eight features discussed in this section. Briganti studied the relationship between crashes and unfamiliar drivers (tourists) on scenic byways, and noted that one difficulty was the lack of a way to identify in-state tourists in Virginia's crash records database.[23] From an examination of the CAP database description, one should *theoretically* be able to answer that question by comparing the driver's jurisdiction to the crash location jurisdiction. The fact that such a question needs to be solved highlights the relevance of each of these issues:

- *Diversity*: Users will have different, and often unforseen, applications of crash data; the relationships between tourists and crash rates is an example that was probably not foreseen when crash records systems were established.

- *Accessibility*: Data must be accessible to researchers. Either a database such as CAP or HTRIS or an agency such as VDOT or DMV who might be willing to provide information about driver's jurisdictions and crash jurisdictions would have to be available.

- *Data collection*: Driver's jurisdictions and crash location jurisdictions must be small enough to exclude tourists. A large jurisdiction might include areas which are unfamiliar even to residents of that jurisdiction, rendering the concept of jurisdiction useless for determining whether a driver should be classified as a tourist.

- *Documentation and cooperation*: In the long term, users must be able to state their data needs. If the current body of data is insufficient to answer the question, then users need to be able to articulate what future data should be collected as well as how these data can be applied.

SUMMARY OF FINDINGS AND RELATED CONCLUSIONS

Note that these remarks are based also on views expressed by secondary users, detailed in Appendix B.

(1) There are numerous and diverse users and providers of crash data. Historically the main users of crash data have been thought to be DMV, VSP, and VDOT, but many local agencies apply crash data to fulfill their missions. These local users' interest in determining crash countermeasures suggest that it is in the state's best interest to make crash data available to all organizations promoting safety. The strong active involvement of the four surveyed local

law enforcement agencies in using crash data to enhance motor vehicle safety supports this conclusion.

(2) The numerous users of crash data have different applications of these data based on their varying missions. In some instances, these variations are due to the selectiveness of certain users; for example, PTS is interested in all crashes that involve a school bus while DMV is interested in reportable crashes only. In other cases various users have different areas of interest; VDOT, for example, is much more concerned with roadway data than with vehicle data. The existence of these complementary interests, however, does not imply that users collect mutually exclusive sets of data, as described in (5) below.

(3) Virginia has numerous pockets of data relevant to crashes, such as sentencing information maintained by DOC, alcohol offender treatment information collected by VASAP, and medical data stored by OEMS. These pockets are not usually linked to one another and are not usually accessed by users of crash data. Similar data coordination issues may be encountered whether one considers large agencies with multiple divisions, or groups of smaller independent agencies. Technologies like NHTSA's Minicodes exist, however, to facilitate such linkages, provided the relevant agencies are willing to share the data.

(4) There is a great deal of undocumented institutional knowledge about the jointly-maintained CAP database, obtainable only by talking to selected persons within DMV, VDOT, VSP, and DIT. Collecting this information, especially when specific questions required the coordination of multiple agencies or divisions within a single agency (e.g. linkage between roadway data and crash data) was the single most time-consuming task of this project. When institutional knowledge is relied upon as the primary source of available information, it appears easy for misconceptions about database capabilities to abound.

(5) There does not appear to be a significant duplication of data entry efforts between VDOT and DMV. Each data element is usually entered only once, with DMV entering certain elements and VDOT entering other elements. There is minor duplication of efforts at the statewide level, such as certain corrections needing to be made manually to both the CSS and CAP databases, both agencies storing electronic copies of the FR-300P, and certain fatal crash data being entered twice by DMV.

(6) There appears to be significant duplication of data entry between the state and local levels. Based on a comparison of FR-300P data elements entered by three local law enforcement agencies and those elements entered by DMV and VDOT, there are numerous data elements that are entered twice. As a general rule, DMV and VDOT combined enter almost all of the data elements while the local law enforcement agencies enter varying amounts of FR-300P data, but by no means are these sets of data elements mutually exclusive. The interest of the local law enforcement agencies in processing crash data is a strong argument for continuing their active involvement in crash records processing.

(7) The different users and providers have different technologies for maintaining, retrieving, and analyzing crash data. Even agencies with similar functions, like police departments, are not the same: two surveyed smaller departments use the PC-based MTRS while Fairfax uses a mainframe system linked to other government functions. Some local users, such as PDCs and the Albemarle County Police Department, have Geographic Information System (GIS) capabilities that could possibly incorporate crash data today while Virginia's statewide GIS efforts are in a state of flux.

(8) A regular institutionalized flow of communication encompassing all crash data users and providers does not exist. Certain examples of communication have been cited in this study, such as the annual CAP users' meeting, the availability of technical support for MTRS users, and interaction between VDOT and a planning district commission to share data. If Virginia is to maximize its analytical capabilities, however, this communication needs to be improved so users and providers have a forum to articulate their crash data needs and capabilities.

RECOMMENDATIONS

The proposed SMS is an excellent *potential* opportunity for crash data users and providers to discuss their data needs and capabilities. Such an opportunity can be realized more easily if participants are well aware of each other's motivations. Therefore it is recommended that the SMS be viewed as a process where crash data users and providers can assess the state of their systems against the capabilities of other systems and look for improvement. At this point, the following recommendations should be considered by the SMS Steering Committee as part of Virginia's efforts to develop and refine its Safety Management System.

Each recommendation has been designated one lead SMS Steering Committee task group, short term tasks, long term tasks, and key benefits. These labels are flexible, and the SMS Steering Committee may wish to reorganize the task groups themselves or the way the recommendations have been assigned. It is strongly advised, however, that each recommendation that the SMS Committee would like to see implemented be assigned to a primary contact that can advise the SMS Committee of progress being made. In the author's opinion, the first two recommendations are the most essential.

(1) *Allow selected local law enforcement agencies to ship their FR-300P data to DMV in both an electronic and paper format.* The feasibility of having local law enforcement agencies that already maintain their own computerized crash records systems upload the FR-300P electronically to DMV should be examined on two fronts.

Short term: DMV should conduct a pilot project with a law enforcement agency that already has a computerized crash records system, where the agency would send DMV the data it keys into its system in an electronic format. The agency would also provide DMV with a paper copy of the FR-300P so DMV could enter the data into CAP that the local agency does not enter into its system.

Long term: A larger number of law enforcement agencies should be surveyed with respect to which FR-300P data elements they store within their systems. There are well over a hundred such agencies in the Commonwealth.

Lead: Data Systems Group. It is crucial that either the Enforcement Group joins this effort, or at least one MTRS user and one non-MTRS user are represented.

Key Benefit: Reduced duplication between local and statewide data entry efforts.

(2) *Consider methods of making crash data available to users who currently do not have access to these data.*

Short term: One possibility would be for local law enforcement agencies to make non-identifying crash data available to users. This would require agencies to be willing and able to do so fairly easily. For example, an agency would need a subroutine that automatically removed any confidential information from the crash data as well as a method for easily transferring these data to another agency that needed them.

Long term: A longer-term measure worthy of investigation would be to provide users who do not have access to CAP or HTRIS with sanitized crash data in an ASCII format. Software to extract crash data from statewide databases, such as CARE, is available, although the best way to transfer these data to users was not determined by this study.

Lead: Data Systems Group. Again, it is crucial that either the Enforcement Group join this effort, or at least one MTRS user and one non-MTRS user are represented. Furthermore, the Public Information and Education Group should provide input for how to actively identify and communicate information to these users.

Key benefit: Agencies that need crash data get crash data.

(3) *Make improvements to the CAP System maintained by DMV and VDOT as well as DMV's CSS and VDOT's HTRIS databases.* Several categories of **short-term** improvements are suggested:

(A) *Ensure that all data elements entered by VDOT and DMV into the CAP System are available to users (excluding those data elements that are specifically withheld due to privacy concerns) in the form of a single tape.* Software changes, with the cooperation of VDOT, DMV, and DIT, should be made to address the three following areas of concern:

- Thirteen data elements identified in Appendix A are not shown on the CAP Tape even though they are entered into CAP, including the lane in which the vehicle was traveling prior to the crash, and the total number of lanes. A VDOT traffic engineer noted that the format for making CAP tapes is the same as the format used prior to the creation of HTRIS. This engineer logically pointed out that certain data elements entered by VDOT would be lost when the CAP tape is created. The tape format needs to be altered so all thirteen data elements, some of which are entered by the VDOT operator and some of which are provided by the VDOT road inventory unit, are placed on the CAP tape.

- Representatives from both DIT and VDOT suggested that a few of these data elements are possibly being lost by additional software errors when the CAP tape is created. An illustrative example is the "intersection type"; the HTRIS software (correctly) shows that at least some crashes occurred at intersections; the CAP tape (incorrectly) shows that all but two crashes did not occur at intersections.

- Six of these thirteen data elements, such as the road system type and the facility type, do not appear within the CAP Inquiry or Reporting screens even though they are shown on DIT's printouts and are available through HTRIS. These six data elements are provided by VDOT's road inventory, which suggests that CAP's format may need to be modified in response to the fact that HTRIS has been created.

(B) *Remove data elements that are not being coded.* Data elements such as the section number, the accident residency, and the milepost number appear within the HTRIS reporting screen but are not coded by VDOT and do not have any meaning. In addition, DMV's request that the field for listing the total number of injured passengers be changed from "number of passengers" to "number of *injured* passengers" should be heeded.

(C) *Investigate the use of software flags when entering data.* If the HTRIS-recorded milepost number is not removed from the database, one possibility would be to verify it on the straight line diagram with the milepost number indicated by the officer for crashes that occur on the Interstate system. Additional software checks may be feasible, such as prompts for the operator to enter additional information when the lane in which a crash occurs is greater than the total number of lanes. (Even if the operator can not determine the exact lane from the FR-300P, he or she may be able to add some clarifying information in a "text" section).

(D) *Install software help for some individual screens within HTRIS.* The HTRIS software has a "help" option which provides guidance when users encounter certain screens within HTRIS. Other screens, however, have no such option. Unfortunately, the information in the 1991 HTRIS user's manual for the accident subsystem is not current in all cases.

(E) *Address the discrepancy between the way crash data are entered and the way roadway information is stored.* When VDOT enters crash data, the lane in which the crash occurred is based on the officer's diagram only. The total number of lanes, however, is based on VDOT's roadway inventory which does not include acceleration and deceleration lanes as regular lanes. This difference in coding needs to be resolved, and several options are possible. First, VDOT could at least provide additional information, in the form of an added field on the individual accident portion and on the straight line diagram of HTRIS, to indicate that a crash had occurred *on a roadway segment* that contained an acceleration or deceleration lane. A second step would be to include a spot on the FR-300P that allowed the officer to indicate the type of lane (through, turning, HOV, shoulder, acceleration, deceleration) in which the crash occurred. In conjunction, a third step would be to ask that when officers complete the crash diagram, they include at least the lane where the crash occurred as well as any lanes between that location and *one* of the shoulders. Officers then would not have to draw all of the lanes, thereby minimizing their reporting time for crashes on multiple lane facilities, and VDOT would be able to link crash locations with roadway inventory locations. This linkage would require a software subroutine that prompted the crash data entry operator with the road inventory information regarding the number of lanes.

(F) *Establish a point of contact to provide up-to-date information regarding secondary roads.* VDOT noted that secondary road data updates are the responsibility of the residencies, yet some residencies have not provided this information. Examination of crash statistics suggests, however, that secondary roads deserve at least as much attention as primary roads and interstates. On a national scale in 1993, non-federal-aid local rural roads had the highest fatality rates while non-federal-aid local urban roads had the highest injury rates.[24] In cases where the residency is not able to provide secondary road information, the appropriate VDOT district office might be considered.

(G) *Develop a software subroutine that allows data modifications made in CAP to be automatically transferred to CSS and vice versa.* When data are initially entered into CSS, they are transferred overnight to CAP. Subsequent corrections to these data, however, must be made twice (once for each system). Ideally a subroutine could automatically update one database when data corrections are made to the other database.

(H) *Establish a single point of contact to respond to broad crash data requests at the state level.* For many data needs, the existing division of responsibilities for crash data is sufficient; clearly VDOT will have roadway information while DMV will have driver information. Confusion results, however, when responsibility for missing data cannot be ascertained. DMV, VDOT, and DIT should agree upon a point of contact to whom crash data requests that are not satisfactorily answered should be directed. The point of contact could be a representative from one of the agencies or a committee. The contact's mission would be to respond to crash data requests rather than placing the burden of determining the source of crash data back on the user.

(I) *Investigate with NHTSA the possible use of a software subroutine to pass selected data elements from a statewide database to FARS.* Approximately half of the data elements entered into NHTSA's FARS database by DMV are also entered into the CAP or CSS databases. While DMV's FARS analyst would still need to perform additional data entry and editing, such a subroutine could reduce the amount of data entry done by DMV's FARS analysts. Since NHTSA controls the FARS database, the first step should be for DMV to submit to the NHTSA program manager a request that, in future FARS database upgrades, the ability for states to transfer certain data directly from their databases to the FARS database be considered. This transfer capability could allow data that have already been entered into Virginia's database to be displayed on the screen for the FARS analyst, allowing more time to be spent checking them for accuracy. Editing features that convert Virginia data to a format desired by NHTSA would be an improvement. (Note that Virginia would have the responsibility for implementing the *logic* that would convert Virginia crash data to a suitable NHTSA format, but NHTSA would need to modify the *communications* capability so data could be transferred electronically to NHTSA and modified by Virginia.)

Lead: Data Systems Group. The Public Information and Exchange Group should assist with tasks (H) and (I) and the VDOT Good Practices Committee should assist with task (F).

Key Benefit: Improved crash records processing at the statewide level.

(4) *Describe fully the capabilities of existing databases, beginning with VDOT and DMV's systems and expanding to include systems maintained by other organizations, such as VASAP, OEMS, DRPT, and local law enforcement agencies.*

Short term: Virginia's crash records systems contain a great deal of information, and the data dictionaries and existing HTRIS accident subsystem user's manual are a start in this direction, but it is difficult for novice users to know how to obtain the data they need. For example, from looking at the HTRIS data dictionary a user would not know that VDOT enters a vehicle's direction of travel prior to a crash. At a minimum, the various users and providers need to make the extent of their data understood so they can make better decisions about the resources they need to invest in data processing. Efforts such as HTRIS training courses, which are currently underway, should be encouraged. If this first step is taken, an opportunity will exist for users to articulate their data needs better and determine how specific data elements could best be collected.

Long term: As part of this process, data maintained by other agencies such as DRPT, DOC, VASAP, and even local law enforcement agencies should be documented, as specific requests for these data are made by other agencies. The goal would be for users to have a concrete guide for how to access and process data.

Lead: Public Information and Exchange Group. The Data Systems Group should provide input into the updating of data dictionaries and other reference material.

Key benefit: Improved use of existing data sources.

(5) *Study the implementation of laptop computers in Arlington County's crash reporting system.*

Short term: Arlington County's use of laptop computers to electronically complete the FR-300P will likely involve learning how to overcome obstacles in areas of training and maintenance of technological compatibility. In addition, Arlington County will likely discover new benefits, such as being able to collect additional data elements rapidly. These lessons would be valuable to other law enforcement agencies who might consider such a system.

Long term: One user suggested a standard form for all crashes coupled with specific additional forms for certain crashes, such as those involving pedestrians, bicycles, trucks, etc. While such a process might be cumbersome with a paper FR-300P, software like that used by Arlington might make this idea very attractive.

Lead: Evaluation Group. This task force should provide this information to the SMS Steering Committee immediately.

Key benefit: Insights that can improve the quality and efficiency of crash reporting.

(6) *Establish a regular feedback process between crash data users and providers.* This process should also be coordinated with Virginia's SMS and would allow consideration of topics such as:

Short term: *Changes to software*. Charlottesville, for example, suggested that the MTRS software list the major factor(s) responsible for most of the crashes at each high crash location in addition to the number of crashes and crash severity. Such a change would be relatively easy to make, but there needs to be a forum through which a user can voice such suggestions.

Short term: *Additions to the FR-300P*. Users presented several additional ideas for data collection that should be considered, such as collection of restraint data for uninjured persons. BACs, when measured, could be recorded for all crashes, not just those involving fatalities, in order to provide more information about relationships between alcohol involvement and crashes. In addition, one police officer noted that in some instances BACs are measured twice; once in the field (an unofficial reading) and once at the station. Recording both BACs on the FR-300P would provide a data set that could be used to study BAC change over time and its effect on crash involvement. (The legal problem of recording unofficial BACs on a crash report form would need to be addressed in this instance.) Finally, addition of medical-related variables, such as medical response time, should be considered until this information can be obtained through linkage of crash and medical data as outlined in recommendation (8).

Short term: *Changes to the FR-300P.* Some portions of the form may need to be changed to enhance data collection. For example, the term "driver inattention" may need to be divided into subcategories if that term is too general to be of any analytic use. Other data elements may be removed if there is no need for them (the mile post number and landmarks are not entered into any of the computerized crash records systems studied for this report). Unless these data elements are currently used or can be used in some other capacity (e.g. for legal purposes or verification), they should be removed from the FR-300P.

Long term: *Involvement of potential additional providers and users of crash data.* Organizations such as VASAP, DCJS, and DOC are upgrading or considering an upgrade of their databases. These enhanced data sets could provide additional information for analysis of crash data. It would be beneficial if these database upgrades could be influenced by a representative of such crash data users as DMV, VSP, VDOT, local law enforcement agencies, and other local organizations such as MPOs or city traffic engineering departments. These other entities have data that would benefit crash data analysts, and their databases could be improved to benefit crash data analysts (for instance, recording habitual offender information in DOC's PSI database).

Long term: *Knowledge of useful data that should be collected.* Even among users with similar missions, like police departments, different data elements are collected. This may result from different driver populations, but there may be reasons for collecting certain types of data for statewide dissemination.

Lead: Public Information and Exchange. The Enforcement task group should play a heavy role in evaluating the FR-300P while the Evaluation task group should ensure that a reasonable process is followed.

Key benefit: Better applications of crash data.

(7) *Develop methods for routinely checking data integrity.*

Long term: It is possible that some of the data may be checked routinely to ensure data consistency and integrity. One example could be the analysis of BAC levels and drinking codes discussed earlier in the report. Such checking in itself would not reveal the source of the problem. For example, drinking codes and BACs might not match because the officer had made a mistake in judgement or because the medical examiner had written down the wrong BAC. This checking would, however, at least highlight problem areas. A second example of data integrity checking would be to examine data elements that are routinely omitted, such as rail crossing identification numbers (none of which were entered into CAP in 1994 in spite of accidents that involved at-grade rail crossings).

Lead: Evaluation Group. In the short term, this task force should identify problem areas, and in the longer term the Data Systems Group should implement the analysis.

Key benefit: Improved data accuracy.

(8) *Conduct a pilot project to link crash data and medical data.*

Short or long term depending on scope: Technology is available to accomplish this linkage, but it is not clear what tradeoffs would occur if one were to use trauma registry data, hospital data, or individual EMS provider databases. Therefore OEMS and DMV should consider linking medical and crash data on an experimental basis for a small area, such as a single county. Both medical and crash data expertise would be needed to facilitate linkage.

Lead: Medical Response Group. The Data Systems Group should provide input into the feasibility of this linkage and the Public Information and Exchange Group should be willing to explain to potential medical data providers the benefits of these data.

Key benefit: Better knowledge of the medical consequences of crashes.

SUGGESTIONS FOR FUTURE RESEARCH

This project identified several unresolved issues that need further study:

- *Evaluation of crash data elements in light of national standards.* One of the benefits of statewide crash data is the ability to compare them to data from other states or the nation. To compare two sets of data, their elements need to have similar definitions. One way to accomplish this is to ensure that Virginia's data element standards meet national standards, as expressed by the American Association of Motor Vehicle Administrators. While this study compared the databases and the FR-300P for which data elements were stored or omitted, it did not examine all possible values for all elements.

- *Application of crash data to an agency's GIS.* At the outset of this study, the author envisioned development of a plan to coordinate Virginia's crash records systems with a statewide GIS effort. Virginia's GIS efforts, however, are in a state of flux, with various attempts to coordinate GIS efforts at the state level, and localities implementing their own GIS. It seems more beneficial to investigate the use of GIS by working with a locality that already has implemented a GIS and needs to analyze crash data. Lessons learned from such a pilot project could provide insight into benefits and obstacles associated with applying a GIS to crash data, such as standards that need to be maintained to obtain meaningful data and the transferability of crash location data between a local and a statewide GIS. It is recommended that the benefits of (a) more precise data, (b) a better data format, or (c) improved graphics, each be evaluated separately within the GIS environment.

- *Storage of optical copies of the FR-300P by VDOT and DMV.* Both DMV and VDOT store a visual copy of the FR-300P. VDOT maintains a copy on optical disk while DMV maintains a copy on microfilm. The cost and necessity of this duplicate practice has not been examined.

- *Enhanced graphics capabilities for VDOT's HTRIS reporting software as an interim measure.* One person suggested that VDOT's HTRIS straight line diagram might be improved by using better graphics capabilities when displaying crashes. For example, one might more easily understand a crash problem with a better visual representation of the roadway (like a graphic log). Such capability might also be achieved through a GIS.

- *Improved non-automobile crash data.* DRPT collects a very limited amount of public transportation crash data with the exception of at-grade rail crossing crashes. While DMV's *Crash Facts* does contain some information, the adequacy of rail data, bus data, and aviation data for users was not assessed. It is logical, however, that such modes would be considered as part of an SMS if the SMS is to address an intermodal transportation system. DRPT, the Department of Aviation, and the Virginia International Terminals, whose roles in processing crash data are described in Appendix B, would be relevant to such an effort.

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APPENDIX A:

COMPLETE INTERVIEWS OF PRIMARY USERS

This appendix presents results of the previously summarized interviews with the primary users. For most of the interviewees, the following information is provided:

- the name of the agency
- a contact within the relevant agency
- the name of the agency's computer system for processing crash data
- the process through which crash data are used
- the purpose for which crash data are used
- a description of the software, if applicable
- additional notes

As each agency's involvement with crash data varies, the emphasis of the interviews also varies. For example, since CAP is central to the processing of the FR-300P, the specific FR-300P data elements stored in CAP were particularly relevant for DMV. DOC, on the other hand, has computer systems that contain a large amount of data with only a subset of those data being relevant to crashes, hence for DOC only those relevant data elements are discussed. (The DMV and VDOT narratives were first verified and then updated as additional clarifying information became available.)

Relevant data collection forms, computer printouts, data dictionaries, and other literature are included in a set of attachments, available separately.

Finally, clarifying information obtained after the narratives had been verified is shown as an "Addendum" in the relevant sections.

AGENCY: Transportation Safety Training Center, Virginia Commonwealth University

CONTACT: Robert J. Breitenbach, Director (804) 828-6235

SYSTEM: Micro Traffic Records System (MTRS) version 5.0

SUMMARY: MTRS contains crash and traffic offense information that is of interest to local law enforcement agencies, such as the locations of crashes and traffic offenses, crash causal factors, times when crashes occurred, and crash frequency distributions by age. MTRS is not used to track individual drivers as it does not contain information that would be stored in a driver's history file, such as names and license plate numbers.

PROGRAM: The current version of MTRS (5.0) is written in Microsoft QuickBASIC version 4.5 and will run on a personal computer. The size of MTRS depends upon the user; for example, one user, Powhatan County, has approximately 1800 crashes and 17,500 records of citations stored in MTRS.

PROCESS: The local organization enters selected data directly from the FR-300P. The organization may decide which data to enter depending upon its needs. MTRS is public domain software and may be customized by the Training Center at the request of the local jurisdiction. Once the agency has entered the data, it forwards the FR-300P to DMV for processing with the CAP System.

PURPOSE: MTRS allows local law enforcement entities to analyze crash data as often as necessary (e.g. monthly) for a variety of purposes, including determination of high accident locations, monitoring the effectiveness of various selective enforcement strategies, evaluation of officers' productivity, and public outreach. Examples of these uses are detailed in the modules describing MTRS implementation by law enforcement organizations in the City of Charlottesville and Powhatan County.

DATA: Only some of the data from the FR-300P are entered into MTRS. Driver identifying information (license number, vehicle number, name, address), the crash diagram, and the narrative are not entered into MTRS. Specific data elements entered into MTRS for Charlottesville and Powhatan are listed below.

NOTES: The current version of MTRS, version 5.0, has been in operation for the past six years. Version 6.0 is under development and will become operational at some point in the future. Unlike the previous version, version 6.0 is being written in the Foxpro database language. One advantage of this version is that it will allow a user to enter the latitude and longitude of a crash location and then link this information to a specific location on a user-supplied GIS (geographic information system). Looking further ahead, version 7.0 will have a direct link to an included GIS, thereby allowing agencies to directly mark their crash locations on a map even if they do not have their own GIS.

ADDENDUM: As of September 1995, version 6.0 has not been completed, although the Transportation Safety Training Center plans to hire a person in the future to continue working on version 6.0.

As of September 1994, there were an estimated 110 organizations, mostly law enforcement agencies, that used MTRS within Virginia. This number is only an approximation as agencies may stop or start using MTRS without necessarily alerting the Transportation Safety Training Center.

AGENCY: City of Charlottesville Police Department

CONTACT: Sgt. Ronnie Roberts (804) 971-3294

SYSTEM: Micro Traffic Records System (version 5.0)

SUMMARY: The Charlottesville Police Department is a user of MTRS (version 5.0) which is described in the previous module.

PROCESS: After a crash has occurred and the police officer has completed the FR-300P, an officer in the management ranks reviews the FR-300P for errors and returns it to the appropriate officer if the form has not been completed correctly. Once the form has been correctly filled out, staff enter the data from the FR-300P into the PC-based MTRS. Every month, the Department uses MTRS to print the 25 locations with the highest number of accidents in the City of Charlottesville.

PURPOSE: The Department uses MTRS in order to determine a program of selective enforcement based on the locations of both crashes and citations. Police management also use the citations data, recorded by MTRS, in order to evaluate the productivity of their officers in terms of the number of tickets and the type of arrests made by the officers.

The Police Department also uses MTRS to justify the location of its sobriety checkpoints. The department cited the example of the Supreme Court "Jimmy Dale Lowe" Case which required a justification for stopping motorists who are not thought to be committing a traffic infraction. MTRS data, which can be used to identify locations where a high number of DUI citations have been given, can provide that justification. For example, the Chief of Police can determine what percentage of motor vehicle crashes resulted in a citation being issued. The department also uses crash data to respond to requests from the media about crash statistics.

The department has also used MTRS data to recommend high-accident locations that need to be re-engineered. For example, an unsignalized left turn from Route 29, a major arterial highway, was eliminated after MTRS data showed a high number of crashes at that location. The department also noted that it is the sole source of crash data for City of Charlottesville traffic engineers. Although state agencies such as VDOT rely upon DMV for crash records, the local government for the City of Charlottesville contacts the local police department for crash data within the city.

Finally, the department uses MTRS data for DMV-funded grants.

DATA: The monthly printout given to the officers contains each location, which is denoted by an intersection of two roads or a location on a particular road, the number of crashes that occurred at that location, and a severity index that reflects the severity of the crashes.

Not all data from the FR-300P are entered into the MTRS database. The following data are entered into MTRS:

- *Template* — *Position on the FR-300P*

Template	*Position on the FR-300P*
type of traffic control	1
weather	4
surface condition	5
roadway defects	6
lighting	7
if vehicle occupant fatality or injury:	
number of fatalities or injuries	9
which vehicle occupied	9
position in/on the vehicle	10
safety equipment used	11
date of birth	13
sex	14
if pedestrian involved:	
date of birth	13
sex	14
killed/injured/unknown	15
pedestrian actions	16
drinking (alcohol involvement)	33
driver's action	17, 18
vehicle maneuver	19, 20
type of collision	21, 22, 23
collision with fixed object	24, 25
driver vision obscured	26, 27
drinking (driver)	31, 32
whether or not the crash is reportable (all crashes involving city vehicles are recorded even if they are "nonreportable")	judgement of the officer

- *Body of the report* — *Position on the FR-300P*

Body of the report	*Position on the FR-300P*
accident date	2
day of the week	3
time	4

city or town	8
two intersecting streets (if crash occurred at an intersection)	12, 13
street and two closest cross streets (if crash occurred on a stretch of road)	12, 13
driver's date of birth	18
driver's sex	19
whether the driver is a Charlottesville resident	23
type of vehicle (e.g. automobile, pickup truck)	24
speed category (stopped/park, under speed limit, equal to speed limit, 1-15 mph over speed limit, more than 15 mph over speed limit, unknown, other)	35
offenses charged driver	38
officer's badge number	41

The following data are NOT entered into MTRS:

- *Template* — *Position on the FR-300P*

whether traffic control was working before crash	2
alignment of the road	3
kind of locality (school, church, etc.)	8
ejection from the vehicle	12
pedestrian injury type (although it is noted whether the pedestrian was killed or injured only)	15
condition of drivers and pedestrian	28,29,30
vehicle condition	34, 35
skidding	36, 37

- *Body of the report* — *Position on the FR-300P*

county of accident (all crashes occur within Charlottesville)	5
mile post number	6
railroad crossing	7
landmarks at scene	9
number of vehicles	10
number of miles or feet of the crash from an intersection	13
driver's name	14
driver's occupation	15

driver's address	16
driver's years of driving experience	17
driver's license number, state, and type	20, 21
vehicle owner's name and address	22, 23
whether the vehicle is a commercial vehicle	24
whether the vehicle contains hazardous material	24
year of vehicle	25
repair cost of vehicle	26
license plate number and state	27, 28
name of insurance company	29
damage to property other than vehicles (object struck, owner's name and address, repair cost)	30, 31, 32
points of impact	33
speed:	
speed before accident,	35
speed limit,	35
maximum safe speed	35
(Note only these possibilities are entered: stopped/park, under the speed limit, equal to the speed limit, 1-15 mph over the speed limit, more than 15 mph over the speed limit, unknown, other)	
accident diagram	34
vehicle damages (e.g. overturned, motor, etc.)	36
accident description	37
names of injured or deceased	39
officer's name	40
department name (all accidents are recorded by Charlottesville)	42
reviewing officer	43
date report filed	44

NOTES: The above section presents those data elements that are entered into MTRS and those that are not entered into MTRS. Note that some data elements are listed in both categories as only portions of them are stored by MTRS. For example, data element 24 shown in the body of the FR-300P denotes the type of vehicle, whether it is a commercial vehicle, and whether it is a hazardous materials vehicle. MTRS records the vehicle type but not the remaining information, so data element 24 appears in both categories. Furthermore, data elements 1 and 11 on the body of the report refer to the number of completed pages and the DMV-assigned crash number respectively. These items are not relevant to MTRS and have not been shown in the above list.

The Charlottesville Police Department noted difficulties with MTRS version 5.0. These difficulties include the following:

- *A badge number being assigned to multiple officers.* In high-turnover situations, it is not unusual for an officer to leave the force and then for a newer officer to assume the same badge number as the previous officer. The problem, therefore, is that MTRS assigns events associated with both officers to the same badge number.

- *A street can only be entered into the system by typing an index number rather than the name itself.* The Police Department noted that one cannot enter the name "Angus Road"; instead, one has to enter a three digit number which represents Angus Road. (Proposed MTRS upgrades may solve this problem.)

- *Recent legislative changes are not reflected in MTRS version 5.0.* Changes in the law such as avoiding stoplights by cutting through private property, tinting violations, and child safety seat laws are not represented in the violation codes that can be recorded by MTRS. (Future versions of MTRS may alleviate this problem.)

The department also noted that it would be advantageous if the major factor that contributed to most of the crashes could be included with each of the top 25 crash locations. The reason is that officers patrolling near each location would have a better sense of what problems were likely to occur. For example, the current printout might show a particular intersection as having a large number of crashes, but if officers knew that many of these crashes were due to rear-end collisions, then they could be alert to driver behavior that might cause those types of collisions, such as following too close.

Finally, the department noted that in the City of Charlottesville, 2500 crashes occurred but only 997 were reportable.

AGENCY: Powhatan County Sheriff's Office

CONTACT: Deputy W. E. Lawson (804) 598-5656

SYSTEM: Micro Traffic Records System (version 5.0)

SUMMARY: Powhatan County uses MTRS in order to have access to both motor vehicle crash data and citation data in a timely manner.

PROGRAM: MTRS is stored on a single personal computer, and for Powhatan County contains approximately 1800 records of crashes and 17,500 records of citations collected over an eight year period.

PROCESS: When a reportable crash occurs, the crash may be investigated by the Department of State Police (VSP), the Virginia Game Commission, or the Powhatan County Sheriff's Office, although VSP investigates 99% of the crashes. If a sheriff's deputy completes the FR-300P and/or the Uniform Traffic Summons, then the deputy gives a copy of that form directly to the sheriff's office. The sheriff's office obtains copies of any crash report forms completed by VSP from the local VSP headquarters four times per year. The sheriff's office obtains Uniform Traffic Summons completed by VSP from the clerk of the General District Court, who provides copies to the Sheriff's office on a daily basis: an average of 250 summons are completed by VSP every month. The Game Commission also provides copies of FR-300P forms it completes to the sheriff's office. The data are then manually entered into MTRS, with the deputy looking up street names in a handbook and then entering the appropriate three digit code for each street mentioned in the FR-300P crash report.

PURPOSE: The MTRS data are used for a variety of purposes, including (1) in-house monitoring of officers, (2) selective enforcement programs, (3) provision of data to other authorities, and (4) public outreach efforts. These applications are discussed below:

(1) *Monitoring of deputies*. The productivity of each deputy can be examined by management in order to ensure that enforcement is being used as necessary.

(2) *Selective enforcement*. The sheriff's office noted that they combine their knowledge of the area with both crash and citation histories of various locations. For example, knowledge that the state correctional facilities draw a large number of employees helps deputies understand the influences on local traffic patterns. Four times a year the sheriff highlights in the quarterly accident report locations with high accident frequency rates or

high accident severity rates of which the sergeants should be aware. In some cases, high accident locations may justify additional patrols during peak periods.

(3) *Reporting of data to authorities*. Powhatan provides DMV with quarterly and annual traffic summons summaries and accident summaries. The summons summary contains information about the number of offenses by time of day, day of week, month, year, residence, race, age, sex, district, and STEP code. (The STEP code identifies a particular holiday or other peak traffic flow period where DMV grants Powhatan funds to pay additional officers to perform selective enforcement type activities, such as DUI, 55 mph enforcement, or checks for seat belts and child safety seats. Thus Powhatan and DMV may use the STEP code in order to evaluate the effectiveness of these grants.) Also included are the type of offense, blood alcohol content (BAC) levels, the percentage of the offenses that went to juvenile or district court, and the percentage of offenses that involved an accident.

The accident summary includes the number of accidents distributed according to the following categories:

- month, time of day, and day of week
- number of vehicles involved (e.g. 1, 2, 3, etc.)
- severity (property damage only, injury only, fatality)
- weather conditions
- surface conditions
- lighting conditions
- traffic control
- roadway defects
- primary and secondary collision types
- general type (e.g. driver error, hit & run, roadway defect)
- vehicle type
- whether the person was a resident or non-resident of Powhatan County.
- driver action
- driver offense,
- vision (e.g. not obscured, headlight glare, crest, etc.)
- alcohol involvement
- vehicle maneuver
- speed involvement.
- driver age and sex
- district

The accident summary also contains the number occupant injuries and fatalities that occurred with and without the use of seat belts.

(4) *Public outreach.* The sheriff's office noted that public dissemination of crash information is an application of MTRS at community events, such as church luncheons, and other instances where there is a visible law enforcement presence (e.g. spot seat belt checks at shopping centers). In these situations, an officer who has MTRS on a portable personal computer can quickly answer a citizen's questions about crash rates near a particular location. The sheriff's office noted that the use of graphics can greatly enhance this capability, allowing the citizen to quickly understand the relative frequency of crashes at a particular location as compared with the rest of Powhatan County.

In addition, data are provided on request to the Powhatan County Traffic Safety Commission, land developers, driver's education instructors, students doing school reports, and even the local media. These data can be trends that grab attention (e.g. over 50% of all crashes involve drivers between the ages of 16 and 30) or site specific (e.g. the number of accidents occurring on a road accessing a parcel of land under consideration for development). For example, VDOT and the Powhatan County Highway Commission installed two new traffic lights after reviewing a variety of data, some of which was provided by the sheriff's office. The sheriff's office had provided a five year study of all the accidents in Powhatan County, and from this study it was possible to determine which accident locations had the highest frequency and severity of accidents. Finally, land developers, the Powhatan County Zoning Commission, and even private citizens request data concerning current traffic accidents and violations in areas planned for residential or current development.

DATA: Not all data from the FR-300P are entered into the MTRS database. The following data are entered into MTRS:

- *Template* — *Position on the FR-300P*

type of traffic control	1
weather	4
surface conditions	5
roadway defects	6
lighting	7
driver's action	17, 18
vehicle maneuver	19, 20
first event collision type	21

second event collision type	22, 23
driver vision obscured	26, 27
alcohol involvement	31, 32, 33
whether or not the crash is reportable	judgement of the officer
number of persons killed wearing seat belts	11
number of persons killed not wearing seat belts	11
number of persons injured wearing seat belts	11
number of persons injured not wearing seat belts	11

- *Body of the report* *Position on the FR-300P*

date of the crash	2
day of the week	3
time (hour)	4
intersection or location nearest to the crash	12, 13
number of vehicles	10
district	8
driver's age or date of birth	18
driver's sex	19
driver's residence (whether they are a Powhatan County resident)	16
vehicle type	24
vehicle speed	35
driver offense	38
officer's badge number	41

The following data are NOT entered into MTRS:

- *Template* *Position on the FR-300P*

whether traffic control was working before crash	2
alignment of the roadway	3
kind of locality (school, residential, interstate)	8
for injuries or fatalities:	
which vehicle was occupied	9
position in/on vehicle	10
ejection from vehicle	12
birth date	13
sex	14
injury type (e.g. bleeding, limping, etc.)	15
pedestrian actions	16
type of fixed object hit in collision	24, 25
condition of drivers and pedestrian	28, 29, 30

vehicle condition	34, 35
skidding	36, 37

- *Body of the report* — *Position on the FR-300P*

county of the accident (all accidents occur within Powhatan County)	5
mile post number	6
number of miles or feet of the crash from an intersection	13
railroad crossing	7
landmarks at scene	9
driver's name	14
driver's occupation	15
driver's address	16
driver's years of driving experience	17
driver's license number, type, and state	20, 21
vehicle owner's name, address, city, state, zip	22, 23
vehicle year	25
vehicle repair cost	26
license plate and licensing state of the vehicle	27, 28
whether or the vehicle is a commercial vehicle or contains hazardous material	24
name of insurance company	29
fixed object collision information	
type of fixed object	30
object's owner and address	31
repair cost	32
points of impact on vehicle	33
speed limit	35
maximum safe speed	35
accident diagram	34
damage to the vehicle (no damage, motor, etc.)	36
accident narrative	37
names of injured or deceased	39
officer's name	40
department name and code number (from the badge number one may determine if Powhatan County, VSP, or the Virginia Game Commission completed the report)	42
reviewing officer	43
date report filed	44

NOTES: The Sheriff's Office noted the following items which are addressed in order to record information with MTRS version 5.0.

- *Multiple badge numbers being assigned to officers.* The sheriff's office does not assign the existing badge number to officers, but instead they assign each officer a "computer" badge number: for example an officer with a real badge number of 5 might have a computer badge number of 12, and then when that officer retires and a new officer takes his place, that new officer might be assigned a computer badge number of 13 even though he holds in reality badge number 5.

- *Only sheriff's badge numbers are tracked.* FR-300P crash report forms filled out by VSP are all assigned a badge number of 9999, while for all Game Commission personnel the badge number is 8888. Thus from the badge number one may identify the particular Powhatan County trooper who filed the report, but not the particular State Police Officer nor Game Commission Officer.

- *Additional descriptors for violations may be needed.* The sheriff's office noted that a new type of offense, called DUI-D (where the blood alcohol content is not measured) has been established since the creation of MTRS 5.0. There is not a specific code dedicated to this particular offense. As an interim measure, the sheriff's office noted one may code this offense under either the label "other" or the label "miscellaneous #1."

- *Only reportable crashes are recorded.* The sheriff's office explained that the dollar figure for determining whether a non-injury crash is reportable keeps rising, and this affects the number of reportable crashes, although of course the dollar amount rises because repair costs rise.

- *Seat belt data are not recorded for uninjured persons.* This is not the fault of the deputies but instead is a result of the FR-300P itself: there is no spot on the form to indicate a person's seat belt or child safety seat usage unless the person is injured or killed.

AGENCY: Fairfax County Police Department

CONTACTS: William Heffron (703) 246-3190, Glenna Krouse (703) 246-4241, and Mike Uram (703) 280-0500

SYSTEM: Case History File Subsystem

SUMMARY: The Case File History Subsystem contains crash information from the FR-300P as well as driver information and is part of a larger police database entitled Police Management Information System, or PMIS. Unlike Charlottesville and Powhatan, Fairfax County does not use the MTRS software. Instead, Fairfax County uses a mainframe system that provides a limited interface to other County databases such as the County Sheriff's office, the General District Court, and the Circuit Court. All of Fairfax County's databases are maintained by the Fairfax County Department of Information Technology (Fairfax County DIT) which should not be confused with the Virginia Department of Information Technology.

PROGRAM: About 15,000-18,000 crashes are entered into the database each year, although about 12,000 of these are non-reportable crashes. However, the database stores each crash record for 60 days only, after which the record is transferred to magnetic tape. In the event one needs to perform analysis requiring crash records older than 60 days, then one may contact Fairfax County's DIT and request that they load the tape with the appropriate data. The tapes are stored on a monthly basis.

The database is stored on an IBM mainframe with the database programmed in COBOL. One may query the database using software entitled "Easytrieve Plus" which is similar to the SPSS and SAS statistical packages in that it allows the user to perform searches based on selected values for certain variables. For example, one may determine what percentage of rear end collisions occurred under wet surface conditions.

PROCESS: The data entry process begins with the police dispatcher who receives either a phone call from a citizen or a radio communication from an officer that a crash has occurred. The dispatcher then enters into the Computer Aided Dispatch System (CADS) pertinent information such as the time of dispatch, the location of the crash, and the fact that a crash occurred. (Note that CADS contains other types of police information besides crashes, such as crimes, requests for assistance, etc.) CADS data are copied daily to the Case History File Subsystem.

FR-300Ps for fatal accidents investigated by the Department of State Police, as well as FR-300Ps for all accidents investigated by Fairfax County Police, are received at Fairfax County's Central Records Section, where photocopies of the FR-300Ps are made. The original forms for all public property accidents are sent to DMV and copies of all FR-300Ps are sent to the County's DWI Coordinator. The FR-300Ps are then photocopied and distributed as follows:

- *County vehicle accidents, bus accidents, and roadway/utility damage accidents* are sent to local telephone and power utilities, the Fairfax County Equipment Management Transportation Agency, the Virginia Department of Transportation (VDOT), and the Fairfax County School Board.

- *County-investigated fatal accidents* are sent to Fairfax County Police's Planning and Research Bureau, the Fairfax County DWI Coordinator, the Fairfax County Public Information Office, VDOT, and the Virginia Alcohol Safety Action Program (VASAP) main office in Richmond.

- *State Police-investigated fatal accidents* are sent to Fairfax County Police's Planning & Research Bureau as well as the Fairfax County Police's Traffic Division.

The data entry operator then enters the case number written on the FR-300P by the investigating officer, or in the case of VSP-investigated crashes, the number assigned by the Central Records Section when it received the FR-300. This number invokes the data entry screen, which contains the information entered into CADS. The operator verifies the existing data and refers any corrections that need to be made to another staff member who enters them directly into CADS. The data from the FR-300P are then entered into the Case History File Subsystem.

The hard copies of the FR-300P are kept on file for two years, after which they are microfilmed and destroyed.

PURPOSE: The crash data serve a variety of purposes, ranging from citizen requests to in-house allocation of personnel. For example, citizens who are involved in an accident may request a copy of the crash report directly from the Central Records Section. In addition, twice each year the Fairfax County Police Department reviews the top ten crash locations and forwards pertinent information to its VDOT liaison officers, who notify VDOT of these crash locations in order to consider engineering modifications (e.g. the placement of signs or traffic signals) that would reduce the number or severity of crashes at those locations. A third type of usage is selective enforcement, where high frequency crash locations are examined in conjunction with the type of citations issued at those locations to determine what types of enforcement activities (e.g. sobriety checkpoints) would be most effective. Finally, the crash data serve to answer questions from citizens and other agencies. For example, schools may be interested in knowing about vehicle and pedestrian crashes in order to determine where a crosswalk is needed. Developers, citizens, and newspapers who have an interest in the potential effects of construction on traffic safety may also request data from the Fairfax County Police Department.

DATA: Data Entered into the System

The following data are downloaded from CADS once the operator enters the case number:

- type of event (there are six possibilities: hit and run fatality, hit and run injury, hit and run property damage only, fatality, injury, property damage only)
- organization (whether Fairfax County Police or State Police)
- officer's badge number (shown as field "CEIN" on the data entry screen)
- patrol number (refers to the police vehicle used)
- time the crash was called in to the Fairfax County Police
- whether or not the crash is reportable (the code 1099 indicates the crash is non-reportable)
- the date the Fairfax County Police were notified of the crash.

The operator then enters the following data:

- the subcensus tract in which the crash occurred (obtained by manually looking up the crash location)
- today's date (the date on which the crash data are entered)
- the operator's initials.

The operator then enters the following data from the FR-300P:

- date of the crash
- day of the week the crash occurred
- time which the crash occurred
- number of vehicles involved in the crash
- for each vehicle, the type (e.g. vehicle number 1: dump truck, vehicle number 2: automobile, etc.)
- street name, number, and label (e.g. pike, avenue, boulevard, drive, etc.)
- the closest intersecting street name, number, and label

- (if the crash occurred at an intersection) the number of the intersection where the crash occurred (this number is obtained by manually looking it up in the appropriate reference)
- (if the crash occurred a certain number of feet or miles from the intersecting street) the distance and direction of the crash from that intersecting street. The distance may be given in miles or feet.
- the name and address (street, city, state) of each driver involved
- the driver's date of birth and sex
- the "accident type" which is believed to be the same as the type of event noted above (e.g. hit and run fatality, hit and run injury, hit and run property damage only, fatality, injury, property damage only)
- the name, address (street, city, state) of each vehicle owner
- (if private property was damaged) the name and address (street, city, state) of the property owner.

Data shown below are entered by the operator *provided the data elements are recorded by the officer.* The officer will complete only those data elements that he or she deems crash related. For example, consider alignment [of the roadway] which is the third data element on the template. The officer will indicate the type of alignment only if the alignment was viewed by the officer as a factor in the crash.

1. type of traffic control
2. whether or not traffic control was working before the crash
3. alignment
4. weather
5. surface condition
6. roadway defects
7. lighting conditions
8. kind of locality
9. which vehicle was occupied (only if person was injured or killed)
10. position in or on the vehicle (only if person was injured or killed)
11. safety equipment used (only if person was injured or killed)
12. ejection from the vehicle (only if person was injured or killed)
13. date of birth (only if person was injured or killed)
14. sex (only if person was injured or killed)
15. injury type (only if person was injured or killed)
16. pedestrian actions (only if pedestrian was injured or killed)
17. vehicle one driver's action
18. vehicle two driver's action
19. vehicle one maneuver
20. vehicle two maneuver
21. type of collision (vehicle one, first event)

22. type of collision (vehicle two, second event)
23. type of collision (vehicle two)
24. collision with fixed object (vehicle one)
25. collision with fixed object (vehicle two)
26. first vehicle driver's vision obscured
27. second vehicle driver's vision obscured
28. condition of first driver
29. condition of second driver
30. condition of pedestrian
31. drinking (first driver)
32. drinking (second driver)
33. drinking (pedestrian)
34. condition of first vehicle
35. condition of second vehicle
36. skidding of first vehicle
37. skidding of second vehicle

Data not entered into the system

The following data are not entered into the system, even if they are recorded on the FR-300P.

- county of accident (since all entered accidents occur within Fairfax County)
- mile post number
- railroad crossing identification
- landmarks at the scene
- occupation of the driver
- number of years of experience of the driver
- driver's zip code
- repair cost of the vehicle
- driver's license number and state
- license plate number
- insurance company
- repair cost to private property (excluding the vehicle damage)
- speed before accident [of the vehicle]
- speed limit
- maximum safe speed
- type of damage to the vehicle (e.g. no damage, overturned, motor, fire, etc.)
- accident description (narrative)
- crash diagram
- officer's name
- reviewing officer

- date FR-300P was filed (although note the date that the crash was investigated is reported by CADS and the date the data from the FR-300P was entered into the system was recorded. It appears, however, that the date the officer actually completes the FR-300P is not recorded by the system.)

NOTES: There are three key sections within the Fairfax County Police Department who have a significant impact on the maintenance and usage of crash data. The Central Records Section is responsible for the *processing* of crash information, while both the Bureau of Planning and Research and the Traffic Section use the crash data for various selective enforcement activities and requests from the public for information. A representative from each of the three sections participated in the interview.

AGENCY: Arlington County Police Department

CONTACT: Was: Lieutenant Florence Starzynski, (703) 358-4279
Now: Sgt. Jim Caldwell, (703) 358-4008

SYSTEM: Pen-based computing

SCOPE: The Arlington County Police Department was visited and asked specifically about its application of a newer technology, pen-based laptop computers, for reporting crashes. As with the other primary users, Arlington County was provided an opportunity to make modifications to the narrative describing its processing of crash records. The emphasis of this interview, however, was on Arlington's application of a newer technology rather than its entire crash records system. Thus the narrative follows a different format than that used for the other agencies.

OVERVIEW: The Arlington County Police Department has contracted for the development of software which would allow the officer in the field to electronically complete the FR-300P crash report form using an electronic pen and a laptop computer. With this technology, the officer will be able to complete the entire form without creating a paper copy. The software provides pop-up menus for most of the data elements on the form. For example, in order to record the location of the crash, the officer picks from a list of intersecting streets that have been coded for Arlington County. The officer then chooses between the crash being at the intersection or the crash being near the intersection, and if the choice is the latter, an image of a compass prompts the officer for the direction and distance of the crash location from the intersection. Theoretically the officer may use the pen or a keyboard for all completing all data on the FR-300P, although in practice the officer uses the pen for every data element except for the narrative which is entered by typing. (The optical character recognition algorithm is too limited to effectively convert handwritten characters into text.)

Construction of the crash diagram is also guided by a variety of pop-up menus: the officer may reconstruct an intersection using typical diagraming tools such as rotation, zoom, and various types of lines. An intersection may also be recalled from a repository of intersections that have already been stored for Arlington County. A library image of the vehicle may be positioned with the pen, thereby permitting the officer to relate the vehicle's position to the intersection.

Arlington County noted several positive features of this system as well as some worries regarding its implementation. First, one of Arlington's goals is to have the state accept an electronic version of the FR-300P rather than a paper copy.

This electronic version could be transmitted by floppy diskette or modem. Currently the Department of Motor Vehicles (DMV) will not accept an electronic version of the FR-300P in lieu of the paper copy, which means that once this system becomes operational, DMV will be re-entering the same information furnished by Arlington County unless DMV elects to accept an electronic transmittal of the crash information. In addition, one of Arlington's worries is that the state will require the local police departments to begin using carbon-based scannable forms. These forms are similar to those used by school systems that administer multiple choice tests: for most data elements, the user simply "bubbles in" the correct choice from a preset list. However, there are at least three difficulties with this technology as compared to Arlington's pen-based recording system: first, the scannable form cannot capture all the information on the FR-300P. Most notably the crash diagram, the narrative, and the address must be completed by hand and then manually entered (or scanned in the case of the diagram) into the system. Second, the scannable form locks the user into a specified data collection process: one may not collect extra pieces of data that may be of interest to the locality, such as more detailed restraint information. Third, the scannable form does not provide help capabilities that may be offered by the pen based computing system. For example, with the pen-based software, the user may be given a list of streets from which to pick a crash location. The pen-based software may also provide a spell check of the narrative, thereby reducing the amount of editing that must be done by the police. Arlington notes that it would be forced to abandon its laptop project if the state required localities to use the carbon-based scannable form, since the laptop computer cannot produce a scannable form and police officers cannot be expected to complete the FR-300P twice for each accident.

Arlington noted that the officers have already been using mobile data terminals (MDTs) to download information electronically to the vehicles. Therefore the cost of acquiring the laptops should not be viewed as solely as a cost for completing the FR-300P crash forms. Arlington has spent approximately $2,000 for each laptop plus about $30,000 thus far developing the accident reporting software. Arlington County is not yet actually using pen-based computers for crash reporting; officers still complete the paper version of the FR-300P. However, Arlington County has learned some practical lessons from the use of pen-based computers for other functions, such as crime incident reporting. Training for the use of the computer software has not posed a large problem, as officers must also be trained for completing the paper FR-300P. The Department did note that the pens have not been as rugged as would be desirable, as there have been problems with pens breaking and the original hardware not being as durable as expected.

Finally, Arlington notes that direct entry of crash records data would not eliminate the possibility of checking the data for errors. DMV could still validate the FR-300P data as is currently done; the only exception would be that DMV would be examining an electronic copy rather than a paper copy.

ADDENDUM: Lt. Starzynski was the contact for the interview as well as verifying the narrative. Since that time, however, she has retired and Sgt. Caldwell has taken over responsibility for the project.

AGENCY: Department of Motor Vehicles

CONTACTS: Debbie Fleet (804) 367-1016 and David Mosley (804) 367-1143

SYSTEM: Citizens Services System (CSS)

SUMMARY: CSS records licensing, crash, and offender information for Virginia drivers as well as out-of-state drivers who are involved in a crash or receive a traffic citation. CSS is anecdotally referred to as the "driver history file," and is linked with the Centralized Accident Processing (CAP) System, described in the next module.

PROGRAM: CSS is written in a mainframe programming language entitled *Natural* (version 2.2).[3] About 120,000 crashes are recorded annually within CSS, with the database containing approximately one million records to date.

PROCESS: After receiving the FR-300P crash report form from state or local police, DMV highlights special information on the form itself, such as town codes, unique medical conditions, whether a regular driver's license or commercial driver's is held by the driver, and lack of insurance. Accident reports that indicate fatalities are separated from the regular work and photocopied, with the copies being sent to the Fatal Accident Reporting System (FARS) program for processing. All accident reports are sent to the microfilm work center where each report is assigned a document number.

Two days later when the reports are returned to the CAP Work Center, the report numbers are recorded in a log book, the document numbers are verified to be accurate, and all pages of the FR-300P are stapled in consecutive order.

DMV then enters into the Citizens Services System (CSS) the document number, accident date, accident type, accident jurisdiction, number of fatalities or injuries, customer number (usually a social security number), owner/operator code, commercial/hazardous material indicator, uninsured motorist indicator, fatality indicator (yes or no), and a reason for the crash not being reportable (if applicable). If a record of the person (either their social security number or a CSS generated customer number) has already been established in CSS, then the operator will see a screen appear with the name, date of birth, and sex of the customer. If these are verified by the operator as being correct, then the operator presses a key to copy this information to the CAP transfer file.

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[3]It was later pointed out that the database itself is created in ADABAS while Natural is used to design programs that query the database.

If there is no record of the person in the CSS, then the operator must enter the customer [driver]'s name, date of birth, sex, type (individual driver or commercial driver), weight, height, eyes, hair, reason code (applicable only if the customer's social security number is not available, in which case CSS will generate a customer number), primary mailing address, city, state, zip code, and jurisdiction. The operator next enters the accident information cited in the paragraph above and presses a key to copy this information to the CAP transfer file.

If during this process there are duplicate records made for the same person, then a message will be flashed on the screen and the operator will obtain printed copies of all records and transcripts of all changes that have been made to the records. The operator then passes this information to the supervisor, who evaluates the records and decides whether or not they are duplicates. If they are duplicates, the records are sent to the Functional Development Division which combines the duplicate records into one record for each customer.

The CSS information is then transferred overnight to the Centralized Accident Processing (CAP) System, which is described in the next section.

PURPOSE: In addition to providing driver's license information, the CSS data are used in conjunction with the CAP data to accomplish several functions that are described in the CAP module.

DATA: The following data elements are entered from the FR-300P into CSS unless otherwise noted. These data elements are shown on a CSS report and the element names are given in italics.

- *document number*. This number consists of 9 digits: the first two are the year, the next three are the Julian date, and the last four are sequential for that day, so the first accident coded on February 22, 1994 might be assigned the document number 94/053/0001. Note that this number reflects the date the accident was coded rather than the date of the accident.
- *accident date*
- *accident type* (fatal, injury, property damage)
- *juris*: DMV accident jurisdiction (county or city)
- *number of fatalities or injuries*
- *customer number* (usually a social security number unless no number is available and no record of the person may be found in the system, in which case CSS generates a customer number). If for some reason this number cannot be associated with an individual, then it may be linked to an employer if the individual is a commercial driver. If the customer number does not match an existing record, then the following are entered:

-- *name*
-- *date of birth*
-- *sex*

- *own/op*: whether the person owns or operates the vehicle
- *comm/haz*: whether commercial or hazardous material was present
- *umv*: whether or not an non-motorized vehicle was used
- *fatality*: whether or not the crash involved a fatality
- *non-rpt rsn*: non-reportable reason (the reason cited by the law enforcement agency for the crash not being reportable, if applicable)

NOTE: CAP and CSS are two separate databases, but they are linked by a software routine which is run overnight. Most users simply refer to DMV's crash reporting system as "CAP" without distinguishing between these two databases, because the separation is not evident to the user.

CSS contains additional data beyond those shown above, such as the state where the driver is licensed, the driver's address, and the driver's residential jurisdiction.

ADDENDUM: Following verification of the narrative, additional persons were consulted for more detail on the Fatal Accident Reporting System. These persons include the following:

Janice Grimm, DMV, (804) 367-2783
Sheila Taylor, DMV, (804) 367-8764
Cliff Wooten, VDOT, (804) 225-3827
Betsy Binkowski, NHTSA (202) 366-5387

Fatal crash data are entered not only into the CAP System but also into NHTSA's FARS database. DMV enters fatal crash data in four categories: *accident data* (e.g. the conditions under which the crash occurred, such as the weather conditions and the roadway alignment), *vehicle data* (e.g. the number of people in the vehicle and how fast it was traveling), *driver data* (e.g. the driver's previous record of suspensions), and *person data* (e.g. age, sex, and seating position). These data are obtained from the FR-300P, the police officer's Daily Activity Report (DAR), the EMS provider, and the Department of Health. In addition, DMV sends the paper copy of the crash data to VDOT in order for VDOT to look up a 20-digit code that contains roadway information, such as the county in which the crash occurred and the functional class.

AGENCY: Department of Motor Vehicles (DMV)

CONTACTS: Debbie Fleet (804) 367-1016 and David Mosley (804) 367-1143

SYSTEM: Centralized Accident Processing (CAP) System

SUMMARY: CAP is primarily a Highway Safety Traffic Records System established to provide statistical data. Although run by DMV, CAP is a product which resulted from a joint agreement between DMV, the Virginia Department of Transportation, and the Department of State Police. DMV enters into CAP all of the data shown on the FR-300P crash report form except the narrative, the crash diagram, the crash location, (e.g. the intersection or location on the road where the crash occurred), and a few other data elements. In a later step VDOT enters the crash location into CAP, but the crash diagram and narrative are not entered into CAP, although DMV keeps a copy of the crash report form on microfilm and VDOT keeps a copy on optical disk.

PROGRAM: CAP is written in a mainframe programming language entitled *Natural* (version 2.2). CAP contains records for about one million crashes, and these records may have as many as one hundred data elements or more.

PROCESS: Once the FR-300P driver information has been transferred from CSS to CAP, the operator enters the remaining crash information. The operator first enters the document number, which automatically recalls the information transferred into CAP from CSS. The operator then enters data in the following categories: *general* updates, which pertain to the vehicle and driver; *vehicle* updates, which pertain to the vehicle; *passenger* updates, which pertain to any passengers injured or killed; *pedestrian* updates, which pertain to any pedestrians injured or killed; and *medical examiner's* updates, which address toxicity information. Most of the FR-300P data are entered into CAP during these updates.

DMV then sends the FR-300P forms to VDOT which subsequently enters location and roadway data. (VDOT's entry of data into CAP is described in a subsequent module.) Some of these data elements become available to DMV. Occasionally the law enforcement agency uncovers new information (e.g. the identity of a driver involved in a hit and run accident) after the FR-300P has been processed by DMV and sent to VDOT. In this case, the law enforcement agency will either contact DMV directly or send an FR-300P supplement, after which DMV updates the CSS and CAP databases accordingly.

In addition, VDOT occasionally discovers errors in the coding of the FR-300P within the CAP System (e.g. an injury being labeled as a fatality) in which case DMV is contacted to correct the entry in the CAP System.

PURPOSE: DMV uses photocopies of crash report forms and the CAP database for a variety of purposes:

- To provide photocopies to citizens, attorneys, hospitals, and insurance companies upon request, although it should be noted that the photocopies are "sanitized" such that they do not contain identifying information such as names, addresses, telephone numbers, and social security numbers.

- To publish the annual *Virginia Traffic Crash Facts*, which aggregates crash data for the Commonwealth according to a variety of factors, such as type of vehicle (bus, car, motorcycle, etc.), time of day, geographical location, alcohol involvement, and type of driver violation.

- To identify problematic areas on a statewide and local basis. For example, DMV uses CAP to determine jurisdictions that have a high number of crash locations.

- To provide monthly updates to law enforcement agencies about the total number of fatalities, injuries, and motorcycle crashes.

- To provide statistical data to law enforcement agencies, private organizations, state or federal agencies, and the news media upon request for various data such as fatalities, injuries, seat belt usage or non-usage, total crashes, etc.

- To evaluate safety related programs. For example, CAP provides an identification of districts with the highest alcohol related statistics as part of the Highway Safety Plan.

- To conduct special runs for lawyers, schools, students, newspapers, or other concerned citizens who need specific information such as the total number of crashes in a certain area.

- To fulfill federal requirements that are the responsibility of the state, such as the Highway Safety Plan, evaluation of that plan, and review and analysis of federally funded safety programs.

DATA: The link between the CSS files and the CAP files is only established by running a software routine, which is usually done overnight after the CSS data have been entered. Thus if after entering the CSS data and CAP data for a particular crash one discovers an error in the CSS data, then one must enter the correct information into both the CSS System and the CAP System.

The section of the FR-300P from which each data element is collected is shown in the right column: "front" denotes the main portion of the form while "template" denotes the boxes which are located on the side of each form. An asterisk (*) means that the operator must interpret information in order to make a decision. For example, in order to determine the number of injuries, the operator may read the section entitled "all injured" shown at the bottom of the FR-300P as data element 39 and then count the number of persons listed. Because a few of the CAP data element names may be cryptic to the reader, both the full element name and the CAP variable name have been provided.

CAP General Data Elements

These data elements are entered directly from the FR-300P by DMV except where otherwise noted. Modifications and inquiries can be made for any data element entered into CAP. The data elements are shown in the order in which they appear on CAP General Accident Updates when read from left to right followed by top to bottom.

Element	*CAP Name*	*Position on FR-300P*
document number	gen-document-number	front #11
accident date (transferred from CSS)	gen-accident-month gen-accident-day gen-accident-year	front #2
DMV jurisdiction (transferred from CSS)	gen-acc-jurisdiction	front #5, 8
day of the week	gen-acc-day-of-week	front #3
time	gen-accident-time	front #4
railroad crossing identification number	gen-railroad-xing-id	front #7
number of vehicles involved in the crash	gen-no-of-vehicles	front #10
type of traffic control	gen-traffic-control	template #1
whether or not the traffic control was working	gen-trfc-ctl-dev-wkg	template #2
alignment of the road	gen-alignment	template #3
weather	gen-weather	template #4
surface condition	gen-surface-conditn	template #5
roadway defect	gen-roadway-defect	template #6
lighting	gen-lighting	template #7
kind of locality: school, church, etc.	gen-kind-of-locality	template #8
number injured (prompt from CSS)	gen-numbered-injured	front #39*
number killed (prompt from CSS)	gen-number-killed	front #39*
number of pedestrians involved	gen-tot-pedestrians	front #39*
number of pedestrians injured	gen-pedestrians-injd	front #39*
number of pedestrians killed	gen-pedestrians-killed	front #39*
speed limit	gen-speed-limit	front #35

maximum safe speed	gen-max-safe-speed	front #35
badge number of the officer	gen-officer-badge-no	front #41
whether State or local police filed the report	gen-report-filer	front #42
property repair cost (does not include vehicles)	gen-prop-repair-cost	front #32
month coded	gen-month-report-coded	CAP-generated
injury, fatality, or property damage only crash (transferred from CSS)	gen-inj-kill-prp-dmg	front #37

CAP Vehicle Data Elements

The following CAP Vehicle elements are transferred from CSS and are shown in this order on the DMV Vehicle Report when read from left to right and top to bottom.

Element	*CAP Name*	*Position on FR-300P*
document number	car-document-number	front #11
vehicle number	car-number	front #14 (or equivalent*)
social security number	driver-soc-sec-number	front #20
driver identification number (often the same)	driver-id-number	front #20
sex	ppd-sex	front #19
date of birth	ppd-birthdate, ppd-age	front #18
driver owner identification (relationship of driver to vehicle owner)	ppd-drivr-owner-code	front #22, #23
driver license state	ppd-license-state	front #21
driver name (last, first, middle initial)	ppd-last name ppd-first name ppd-initial	front #14
driver address (street, city, state, zip code)	ppd-address, ppd-street ppd-city, ppd-state ppd-zip	front #16

The following CAP Vehicle data elements are entered directly from the FR-300P and are shown in this order on the DMV Vehicle Report when read from left to right and top to bottom.

Element	*CAP Name*	*Position on FR-300P*
number of *injured* passengers in vehicle	car-number-passengers	template #9*
driver occupation	ppd-drivr-occupation	front #15
driver experience	ppd-dr-dsp-hwy-exper ppd-driver-exp-years ppd-driver-exp-months	front #17
residential jurisdiction of driver	ppd-resid-juris	front #16

vehicle type	car-vehicle-type	front #24
vehicle age	car-vehicle-age	front #25
repair cost	car-veh-repair-cost	front #26
vehicle license number	car-license-number	front #27
vehicle license state	car-licensed-state	front #28
whether or not driver has insurance	car-insurance-ind	front #29
point of impact of the crash	car-point-of-impact	front #33
before accident speed	car-estimated-speed	front #35
vehicle damage location (motor, totaled, etc.)	car-veh-damage	front #36
regular or commercial driver's license	car-veh-dl-cdl	front #20
position inside or on the vehicle	ppd-position-in-veh	template #10
safety equipment (seat belts, child safety seats)	ppd-safety-equipment	template #11
whether ejected from vehicle	ppd-ejected-from-veh	template #12
injury type	ppd-injury-type	template #15
driver action	ppd-action	template #17, #18
vehicle maneuver	car-veh-maneuver	template #19, #20
vision obscured	ppd-vision-obscured	template #26, #27
driver condition	ppd-condition	template #28, #29
driver drinking code	ppd-drinking-code	template #31, #32
vehicle defect (vehicle condition)	car-vehicle-defect	template #34, #35
skid	car-veh-skid	template #36, #37
truck covered	car-truck-covered	??
whether commercial or hazmat vehicle	car-veh-cmv-haz-ind	front #24
tractor length	car-tractor-length	front #37
trailer #1 length	car-trailer-length1	front #37
trailer #2 length	car-trailer-length2	front #37
trailer width	car-trailer-width	front #37
number of axles	car-number-of-axles	front #37
2 wheel or 4 wheel drive	car-two-four-wheel	front #34
height of vehicle (ground to bottom of front bumper)	car-altered-suspensn	front #34
largest tire size	car-tire-size	front #34
number of tires of the largest tire size	car-mult-tire-size	front #34
whether or not steering has been altered	car-altered-steering	front #34
whether modified vehicle helped cause accident	car-caused-accident	front #34
extent to which modified vehicle caused accident	car-degree-of-cause	front #34

CAP Pedestrian Data Elements

The following data elements are entered directly from the FR-300P. Note that these elements apply only if a pedestrian is injured or killed. These elements are shown on the CAP Pedestrian printout:

Element	*CAP Name*	*Position on FR-300P*
document number	ppd-document-number	front #11
pedestrian number	ppd-number	template #9
pedestrian name	ppd-last-name ppd-first-name ppd-initial	front #39
pedestrian date of birth	ppd-birthdate ppd-age	template #13
pedestrian sex	ppd-sex	template #14
pedestrian injury type	ppd-injury-type	template #15
pedestrian action	ppd-action	template #16
pedestrian condition	ppd-condition	template #30
pedestrian drinking code	ppd-drinking code	template #33
shown as the report title: whether the person is a passenger, pedestrian, or driver	ppd-indicator	template #9, 10

CAP Passenger Data Elements

The following data elements are entered directly from the FR-300P. Note that these elements apply only if a passenger is injured or killed.

Element	*CAP Name*	*Position on FR-300P*
document number	ppd-document-number	front #11
vehicle number	ppd-which-veh-occupd	template #9*
passenger number	ppd-number	template #9, #10*
passenger name	ppd-last-name ppd-first-name ppd-initial	front #39
position in/on vehicle	ppd-position-in-veh	template #10
safety equipment (seat belts, child safety seats)	ppd-safety-equipment	template #11
ejected from vehicle (yes, no)	ppd-ejected-from-veh	template #12
passenger date of birth	ppd-birthdate ppd-age	template #13
passenger sex	ppd-sex	template #14
passenger injury type	ppd-injury-type	template #15
shown as the report title: whether the person is a passenger, pedestrian, or driver	ppd-indicator	template #9, 10

Medical Examiner's Updates

DMV also enters information from the medical examiner's toxicology report. After using the document number to reference a particular crash, DMV adds the data listed below which are also shown on the CAP medical examiner's screen. Note that the first six elements (document number through address) come from the FR-300P while the remaining elements come from the medical examiner's report.

Element	*CAP Name*
document number	ppd-document-number
vehicle number	car-number
whether person is a driver, passenger, or ped.	ppd-indicator
name	ppd-name
social security number	ppd-driver-soc-sec-number
address	ppd-address
medical examiner's certification number	ppd-med-exam-cert-no
type of alcohol content test administered	ppd-body-fluid
breath alcohol content (BAC) level	ppd-alcohol-content
first drug found in the patient's system	ppd-1st-drug
second drug found in the patient's system	ppd-2nd-drug
homicide/suicide/death/indicator (indicates whether the accident involves a homicide, suicide, or some other form of death that occurred before the crash)	gen-homi-sui-dth-ind

Additional Data Elements

Additional data elements are entered into CAP besides those named above and are shown in the CAP General Report. These include the following:

- *Elements entered by the VDOT operator.* The VDOT operator also enters data into CAP, as described in a subsequent module. However, only some of these elements appear in the CAP-generated "General" Report. These elements are the following:

Element	*CAP Name*
zone of impact (in relation to the intersection)	gen-acc-zone-impact
major factor (as a contributor to the crash)	gen-major-factor
collision type	gen-type-of-collision
fixed object struck (if applicable)	car-coll-fixed-object
second event collision type	car-typ-coll-2nd-evt

accident route number	gen-acc-route-number
type of accident location	gen-accident-location
intersecting route number	gen-inter-route-no
whether or not the road is state maintained	gen-state-maint-hwy
accident lane (appears on second screen)	gen-accident-lane
vehicle lane (appears in inquiry but not in update)	car-vehicle-lane
direction of travel prior to the crash	car-veh-placement
node number (second screen)	node-no
node offset (second screen)	node-offset
old document number (second screen)	old-document-number

- *Elements provided by the HTRIS road inventory.* The road inventory contains numerous data elements, some of which are passed back to CAP. These data elements are discussed within the VDOT module that describes HTRIS. A subset of these data elements appear in the CAP-generated General Report. This subset is provided here:

Element	*CAP Name*
intersection type (T-leg, 5-way, etc.)	gen-intersection-type
computed mile post number (see Note):	gen-mile-post-no
surface width	gen-surface-width
shoulder width	gen-shoulder-width
surface type (e.g. unpaved)	gen-surface-type
functional class (of the road)	gen-functional-class
federal aid (see Notes)	gen-federal-aid
kind of highway	gen-kind-of-highway
optical disk identification number (second screen)	optical-disk-id
accident-lane (second screen)	gen-accident-lane
node type (second screen)	node-type
HTRIS route identification (second screen)	HTRIS route-id

- *Elements generated by the CAP database automatically.* Several data elements are not entered but instead are automatically computed by the CAP software. These elements include the following:

Element	*CAP Name*
whether the road is in a rural or urban location	gen-rural-urban-ind
month report entered in CAP (*month report cd*)	gen-month-report-coded
last transaction date	gen-last-trans-date
last transaction coded (*last trans cd*)	gen-last-trans-code
transaction creation date	gen-trans-create-dt

validation indicator (whether the record needs to be verified with a subroutine)	gen-validation-ind
incomplete indicator (whether VDOT should update the record)	gen-incomplete-ind
accident county population	gen-acc-county-pop
accident city population	gen-acc-city-twn-pop
highway jurisdiction	gen-hwy-district gen-hwy-county gen-hwy-town
Department of State Police jurisdiction	gen-dsp-acc-juris
driver violation indicator (whether the driver was charged with a violation as shown by template #17)	gen-drvr-violation-ind
driver drunk indicator (whether the crash was alcohol related as shown by template #31)	gen-drvr-drunk-ind
defective driver indicator (whether driver was impaired as shown by template #28)	gen-defectve-dvr-ind
vehicle defect indicator (whether vehicle was defective as shown by template #34)	gen-veh-defectve-ind

- *The element "gen-accident-severty."* This element is shown on the DMV "General Inquiry Screen" as a blank until after VDOT has updated the CAP database, but VDOT does not manually enter this information and nor is it required from the road inventory. It would appear that this element is computed based on the gen-inj-kill-prp-dmg value plus whether or not a pedestrian is involved as described in the HTRIS data dictionary. Thus either HTRIS or CAP determines this element.

NOTES:

- DMV has noted that CAP contains some built-in validation procedures to check for contradictory entries. For example, the operator is queried if both a dry roadway and rainy weather are keyed into the system.

- In the "CAP General Data Elements" section, the third element shown is "railroad crossing identification number." DMV notes that no such number was entered into CAP in 1994, but a 1993 CAP tape examined by VTRC did show 54 entries of railroad crossings numbers compared to 51 train/vehicle crashes listed in the *Virginia Traffic Crash Facts*. DMV states that there have been cases where a crash involved an at-grade rail crossing yet the officer had not indicated such a number on the FR-300P. DMV also notes that it is possible that data entry operators are not entering the railroad identification number into CAP even though such a number is provided on the FR-300P.

- In the "CAP Vehicle Data Elements" section, the first field listed under "Data Elements Entered Directly from the FR-300P" is shown in this description as number of *injured* passengers. However, this field is shown in CAP as "number of passengers," which could be misleading as an operator might mistakenly believe the field calls for the total number of passengers in the vehicle rather than only the injured passengers. DMV, therefore, believes the word "injured" should be added to this field description in CAP.

- The field "section number" appears in the CAP database but data are no longer entered into that field. In the past, the section number was used with graphic logs which have since been replaced by HTRIS's link-node referencing system. Therefore the element gen-graphic-sect-nc should be removed both from the CAP Record Layout Sheet and the CAP Report.

- A separate field for the vehicle owner's name and address appears only if the vehicle owner is not the driver.

- It appears the following data elements are not entered into CAP even though they are on the FR-300P:

  -- mile post number, shown on the front as item #6 (This has been replaced by HTRIS's link-node referencing system. A milepoint is computed by HTRIS, but VDOT indicates that this milepoint does not necessarily correspond to the mile marker on the roadway. VDOT also indicates that it does not use this number for any application. For further discussion on this topic, see Appendix C at the conclusion of this report.)
  -- landmarks, shown on the front as item #9
  -- crash diagram, shown on the front as item #34 (although information gleaned from the diagram is recorded in CAP and the diagram is optically scanned by VDOT)
  -- narrative or description, shown on the front as item #37 (although that information is used for other CAP fields)
  -- offenses charged driver, shown on the front as item #38 (although driver's action from template #17 is recorded)
  -- officer's name, shown on the front as item #40
  -- reviewing officer, shown on the front as item #43
  -- date report filed by police, shown on the front as item #44

- It is possible that the data element "owner of fixed object," which is shown on the front of the FR-300P as data element 31, is entered into CAP, but since it did not appear in the CAP runs observed by the author, this should be verified by DMV.

- In the past, "federal aid" meant whether or not the road was eligible for federal funds, but this definition is no longer being used since the passage of ISTEA and it is expected that VDOT will remove this variable soon from the CAP database.

- Several data elements appear in the CAP Record Layout that appear to be automatically computed from source CAP elements since these computed elements are entered neither by DMV nor VDOT. These computed elements are given in the right-hand column below:

Source Element entered by DMV	*Resulting Element computed by CAP*
accident date	gen-accident-month
	gen-accident-day
	gen-accident-year
date of birth	ppd-age
total driver experience	ppd-driver-exp-years
	ppd-driver-exp-months

- BAC test results *(ppd-alcohol content)* and type of tests administered *(ppd-body-fluid)* are entered into CAP only for fatal crashes. These data are obtained from the medical examiner's report.

FR-300P Reference Matrix

This table presents each data element of the FR-300P and the corresponding database into which that element is entered, following the order in which the elements are shown on the FR-300P. DMV enters all elements unless otherwise noted. A copy of the FR-300P is shown as attachments 5-A and 5-B and includes the number that corresponds to each data element. Note that any variable beginning with "ppd" may describe a driver, passenger, or pedestrian: this distinction is made with the "ppd-indicator."

Front of the FR-300P

Data Element	Computer Subsystem	CAP Name
1. number of pages	*not entered into CAP*	
2. accident date	CSS gen-accident-month gen-accident-year	gen-accident-day
3. day of the week	CAP (General)	gen-acc-day-of-week
4. time of day	CAP (General)	gen-accident-time
5. county of accident	CSS	gen-acc-jurisdiction
6. mile post number	*not entered into CAP*	
7. railroad crossing identification number	CAP (General)	gen-railroad-xing-id
8. city or town	CSS	gen-acc-jurisdiction
9. landmarks	*not entered into CAP*	
10. number of vehicles in the crash	CAP (General)	gen-no-of-vehicles
11. document number	all systems	gen-document-number
12. route number/street name	CAP (entered by VDOT)	gen-acc-route-number
13. intersecting street	CAP (entered by VDOT)	gen-inter-route-no
14. driver's name	CSS	ppd-last name, first name, initial
15. driver's occupation	CAP (Vehicle)	ppd-drivr-occupation
16. driver's address	CSS, CAP (Vehicle)	ppd-address, city, state, street, zip, ppd-resid-juris
17. driver's experience	CAP (Vehicle)	ppd-dr-dsp-hwy-exper ppd-driver-exp-years ppd-driver-exp-months
18. driver's date of birth	CSS	ppd-birthdate
19. driver's sex	CSS	ppd-sex
20. driver's license number	CSS	driver-soc-sec-number driver-id-number
21. driver's license state	CSS	ppd-license-state
22. vehicle owner's name	CSS, CAP (if driver not owner, then new name entered into Vehicle)	ppd-drivr-owner-code

Front of the FR-300P (Continued)

Data Element	Computer Subsystem	CAP Name
23. vehicle owner's address	CAP (if driver is not owner, then new address entered into Vehicle)	ppd-address, street, city, state, zip
24. vehicle type	CAP (Vehicle)	car-vehicle-type
25. vehicle year	CAP (Vehicle)	car-vehicle-age
26. vehicle repair cost	CAP (Vehicle)	car-veh-repair-cost
27. license plate number	CAP (Vehicle)	car-license-number
28. license plate state	CAP (Vehicle)	car-licensed-state
29. insurance company	CAP (Vehicle)	car-insurance-ind
30. fixed object struck	CAP (entered by VDOT)	car-coll-fixed-object
31. fixed object owner's name	*not entered into CAP*	
32. fixed object property repair cost	CAP (General)	gen-prop-repair-cost
33. point of impact	CAP (Vehicle)	car-point-of-impact
34. crash diagram	*stored on optical disk by VDOT and on microfilm by DMV*	
35. before accident speed	CAP (Vehicle)	car-estimated-speed
35. speed limit	CAP (Vehicle)	gen-speed-limit
35. maximum safe speed	CAP (Vehicle)	gen-max-safe-speed
36. vehicle damage	CAP (Vehicle)	car-veh-repair-cost
37. accident narrative/description	*not entered into CAP*	
38. offenses charged driver	*not entered into CAP*	(may affect driver action)
39. names of deceased	CAP (General, Passenger, Pedestrian) *names not entered but used to tally deaths and injuries*	gen-numbered-injured gen-number-killed gen-tot-pedestrians gen-pedestrians-injd gen-pedestrians-killed
40. officer's name	*not entered into CAP*	
41. officer's badge number	CAP (General)	gen-officer-badge-no
42. department name and code number	CAP (General)	gen-report-filer
43. reviewing officer	*not entered into CAP*	
44. date report filed by police	*not entered into CAP*	

Template of the FR-300P

Data Element	Computer Subsystem	CAP Name
1. type of traffic control	CAP (General)	gen-traffic-control
2. whether traffic control was working	CAP (General)	gen-trfc-ctl-dev-wkg
3. alignment of the road	CAP (General)	gen-alignment
4. weather	CAP (General)	gen-weather
5. surface condition	CAP (General)	gen-surface-conditn
6. roadway defect	CAP (General)	gen-roadway-defect
7. lighting	CAP (General)	gen-lighting
8. kind of locality (school, church, etc.)	CAP (General)	gen-kind-of-locality
9. which vehicle occupied	CAP (General, Passenger, Pedestrian)	car-number
10. position in/on vehicle	CAP (Vehicle, Passenger)	ppd-position-in-veh
11. safety equipment used	CAP (Vehicle, Passenger)	ppd-safety-equipment
12. ejection from vehicle	CAP (Vehicle, Passenger)	ppd-ejected-from-veh
13. date of birth	CAP (Passenger, Pedestrian)	ppd-birthdate
14. sex	CAP (Passenger, Pedestrian)	ppd-sex
15. injury type	CAP (Vehicle, Passenger, Pedestrian)	ppd-injury-type
16. pedestrian actions	CAP (Pedestrian)	ppd-action
17. driver's action (for vehicle 1)	CAP (Vehicle)	ppd-action
18. driver's action (for vehicle 2)	CAP (Vehicle)	ppd-action
19. vehicle maneuver (for vehicle 1)	CAP (Vehicle)	car-veh-maneuver
20. vehicle maneuver (for vehicle 2)	CAP (Vehicle)	car-veh-maneuver
21. type of collision (event 1)	CAP (entered by VDOT)	gen-type-of-collision
22. type of collision (vehicle 1, event 2)	CAP (entered by VDOT)	car-typ-coll-2nd-evt
23. type of collision (vehicle 2, event 2)	CAP (entered by VDOT)	car-typ-coll-2nd-evt
24. collision with fixed object (vehicle 1)	CAP (entered by VDOT)	car-coll-fixed-object
25. collision with fixed object (vehicle 2)	CAP (entered by VDOT)	car-coll-fixed-object
26. driver vision obscured (vehicle 1)	CAP (Vehicle)	ppd-vision-obscured
27. driver vision obscured (vehicle 2)	CAP (Vehicle)	ppd-vision-obscured
28. condition of driver (vehicle 1)	CAP (Vehicle)	ppd-condition
29. condition of driver (vehicle 2)	CAP (Vehicle)	ppd-condition
30. condition of pedestrian	CAP (Pedestrian)	ppd-condition
31. driver drinking (vehicle 1)	CAP (Vehicle)	ppd-drinking-code
32. driver drinking (vehicle 2)	CAP (Vehicle)	ppd-drinking-code
33. pedestrian drinking	CAP (Pedestrian)	ppd-drinking-code
34. Vehicle condition (vehicle 1)	CAP (Vehicle)	vehicle defect
35. Vehicle condition (vehicle 2)	CAP (Vehicle)	vehicle defect
36. Skidding (vehicle 1)	CAP (Vehicle)	car-veh-skid
37. Skidding (vehicle 2)	CAP (Vehicle)	car-veh-skid

Addendum: Statewide/Local Reference Matrix

After the narratives had been verified, the following table was compiled to present the data elements in a more coherent fashion. The table below contrasts the FR-300P data elements stored in the CAP statewide crash records system with those stored in the local crash records systems for the Charlottesville Police Department, the Powhatan County Sheriff's Office, and the Fairfax County Police Department. An "X" indicates the data element is stored by the system while a blank indicates the data element is not stored by the system.

Body or "Front" of the FR-300P

Data Element (Body of the FR-300P)	CAP	Charlottesville	Powhatan	Fairfax
1. number of pages of the FR-300P				
2. accident date	X	X	X	X
3. day of the week	X	X	X	X
4. time of day	X	X	X	X
5. county of accident	X			
6. mile post number				
7. railroad crossing identification number	?			
8. city or town	X	X	X	
9. landmarks				
10. number of vehicles in the crash	X		X	X
11. document number	X			
12. route number/street name	X	X	X	X
13. intersecting street	X	X	X	X
13. number of miles/feet from intersection	X			X
14. driver's name	X			X
15. driver's occupation	X			
16. driver's address	X		only whether or not County resident	X

Data Element (Body of the FR-300P)	CAP	Charlottesville	Powhatan	Fairfax
17. driver's experience	X			
18. driver's date of birth	X	X	X	X
19. driver's sex	X	X	X	X
20. driver's license number	X			
21. driver's license state	X			
22. vehicle owner's name	X			X
23. vehicle owner's address	X	only whether or not city resident		X
24. vehicle type	X	X	X	
24. commercial/hazardous vehicle	X		X	
25. vehicle year	X			
26. vehicle repair cost	X			
27. license plate number	X			
28. license plate state	X			
29. insurance company	X			
30. fixed object struck	X			
31. fixed object owner's name				X
32. fixed object property repair cost	X			
33. point of impact	X			
34. crash diagram	X			
35. before accident speed	X	speed category only	X	
35. speed limit	X			
35. maximum safe speed	X			
36. vehicle damage	X			

Data Element (Body of the FR-300P)	CAP	Charlottesville	Powhatan	Fairfax
37. accident narrative/description				
38. offenses charged driver		X	X	
39. names of deceased				
40. officer's name				
41. officer's badge number	X	X	X	X
42. department name and code number	X			
43. reviewing officer				
44. date report filed by police				

Template of the FR-300P

Data Element (Template of the FR-300P)	CAP	Charlottesville	Powhatan	Fairfax
1. type of traffic control		X	X	X
2. whether traffic control was working	X			X
3. alignment of the road	X			X
4. weather	X	X	X	X
5. surface condition	X	X	X	X
6. roadway defect	X	X	X	X
7. lighting	X	X	X	X
8. kind of locality (school, church, etc.)	X			X
9. which vehicle occupied	X	X		X
10. position in/on vehicle	X	X		X
11. safety equipment used	X	X	X	X
12. ejection from vehicle	X			X
13. date of birth	X	X		X
14. sex	X	X		X

Data Element (Template of the FR-300P)	CAP	Charlottesville	Powhatan	Fairfax
15. injury type	X	killed/injured is noted only		X
16. pedestrian actions	X	X		X
17. driver's action (for vehicle 1)	X	X	X	X
18. driver's action (for vehicle 2)	X	X	X	X
19. vehicle maneuver (for vehicle 1)	X	X	X	X
20. vehicle maneuver (for vehicle 2)	X	X	X	X
21. type of collision (event 1)	X	X	X	X
22. type of collision (vehicle 1, event 2)	X	X	X	X
23. type of collision (vehicle 2, event 2)	X	X	X	X
24. collision with fixed object (vehicle 1)	X	X		X
25. collision with fixed object (vehicle 2)	X	X		X
26. driver vision obscured (vehicle 1)	X	X	X	X
27. driver vision obscured (vehicle 2)	X	X	X	X
28. condition of driver (vehicle 1)	X			X
29. condition of driver (vehicle 2)	X			X
30. condition of pedestrian	X			X
31. driver drinking (vehicle 1)	X	X	X	X
32. driver drinking (vehicle 2)	X	X	X	X
33. pedestrian drinking	X	X	X	X
34. Vehicle condition (vehicle 1)	X			X
35. Vehicle condition (vehicle 2)	X			X
36. Skidding (vehicle 1)	X			X
37. Skidding (vehicle 2)	X			X

Note that Fairfax County enters items from the template only if the officer deems them related to the crash.

AGENCY: Department of Transportation (VDOT)

CONTACTS: Bob Rasmussen (804) 786-6219 and Gerald Venable (804) 786-2961

SYSTEM: Centralized Accident Processing (CAP) System

SUMMARY: CAP was created as a joint venture between VDOT, DMV, and the Department of State Police (VSP). In addition to the information entered into CAP by DMV, VDOT adds additional information from the FR-300P and the HTRIS road inventory to CAP.

PROGRAM: As noted in the DMV module, CAP is written in a mainframe programming language entitled *Natural* (version 2.2). CAP contains records for about one million crashes, and these records may have as many as one hundred data elements.

PROCESS: After being held by DMV for three to six weeks, the FR-300P crash report form is forwarded to VDOT, which enters crash location and roadway information into CAP, using the same accident document number assigned by DMV. The VDOT operator first enters the route on which the crash occurred as well as the route number of the cross road referenced on the FR-300P. The CAP location referencing system then provides at least one node number denoting this location. With each node, CAP also provides a corresponding route milepoint and description, such as "ramp of Interstate-81 North to Route 381." In the event of CAP providing multiple nodes (which can occur when two roads intersect more than once), the operator then uses these node descriptions, the officer's narrative, and additional maps to determine the closest node to the crash location. The operator then enters additional crash description information and subsequently passes the FR-300P report to another VDOT section where the report is scanned and indexed into an optical disk system, thereby providing a permanent record of the report itself and the crash diagram. Note that VDOT enters data into CAP, but using an extract program certain data elements are brought into HTRIS which allows summary data to be analyzed in order to support data requirements statewide. Further analysis can be accomplished by accessing the FileNet Optical Disk System which stores an optical copy of the crash report.

PURPOSE: In addition to DMV's uses, VDOT extracts CAP data into the HTRIS reporting system as described in the next module. Some of the data elements entered into CAP by VDOT also become available to DMV.

DATA: The following data elements are entered into CAP by VDOT. Note that the "road inventory" information is obtainable from the road inventory once the operator enters the crash location by route, node, and if necessary, node offset.

Element	How Determined	HTRIS name	CAP name
accident document number	operator uses to access report	accid-doc-no	gen-document-number
state-maintained road (Y, N)	operator decision	state-maint-ind	gen-state-maint-hwy
district where route is located	initially DMV, but may be changed by operator	accid-dist	gen-hwy-district
county where route is located	initially DMV, but may be changed by operator	accid-cnty	gen-hwy-county
town where route is located	initially DMV, but may be changed by operator	accid-city	gen-hwy-town
route number	operator decision	route-id	gen-acc-route-number
intersecting route	operator decision (but HTRIS verifies whether routes intersect)	inter-route-no	gen-inter-route-no
node number	road inventory	node-no	node number
offset (distance of crash from node)	FR-300P+operator computation	node-offset	node offset
offset direction (node in relation to crash)	FR-300P + operator decision	*several HTRIS internal variables are used*	
name of street if not state maintained	FR-300P + operator	none given	none given
optical disk (obscan) identifying number	generated by the system	opt-disk-id	optical-disk-id
zone of impact (crash location with respect to the intersection)	operator looks up in manual	accid-impact-zone	gen-acc-zone-impact
collision type	FR-300P + operator decision	capp-coll-type	gen-type-of-collision
major factor	FR-300P + operator decision	accid-major-factor	gen-major-factor
type of accident location	FR-300P + operator decision	accid-loc	gen-accident-location
lane direction where crash occurred	FR-300P + operator decision	accid-lane-dir	gen-accident-lane
lane type where crash occurred	FR-300P + operator decision	accid-lane-type	gen-accident-lane
lane in which crash occurred	FR-300P + operator decision	accid-lane-no	gen-accident-lane
for each vehicle involved in the crash:			
direction of travel before crash	FR-300P + operator decision	none given	car-veh-placement
second event (if applicable)	FR-300P + operator decision	none given	car-typ-coll-2nd-evt
fixed object (if applicable)	FR-300P + operator decision	none given	car-coll-fixed-object
direction of lane before crash	FR-300P + operator decision	none given	car-veh-lane
lane type before crash	FR-300P + operator decision	none given	car-veh-lane
lane used before crash	FR-300P + operator decision	none given	car-veh-lane

NOTES: The data elements "lane direction where crash occurred," "lane type where crash occurred," and "lane in which crash occurred" are shown simply as "accident-lane" in the data entry screen. Likewise, the data elements "direction of lane before crash," "lane type before crash," and "lane used before crash" are shown simply as "vehicle lane" in the data entry screen.

"Accident location" denotes the type of intersection closest to the crash (e.g. between intersections, an intersection of a primary or Interstate route with a secondary or frontage route, etc.)

The operator must make several interpretations about the data. These include:

- *Location of the crash.* There are instances where the intersecting roads given on the FR-300P are not found in HTRIS. When this occurs, the operator, using a scale and a map of the area, manually scales the distance of the crash from an intersection which is found in HTRIS.

- *Direction vehicle was traveling.* There are instances where the operator, using the crash diagram and a map of the route, must correct the direction given by the police officer.

- *Zone of impact.* The operator determines this based on a grid configuration of the standard intersection. For example, crashes that occurred 500 feet away from the intersection are put in a different zone of impact than crashes that occurred 50 feet away from the intersection.

- *Major factor.* This is based upon the officer's narrative.

AGENCY: Department of Transportation (VDOT)

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SYSTEM: Accident and Road Inventory Subsystems of the Highway Traffic Records Information System (HTRIS)

SUMMARY: HTRIS is a reporting program that extracts information from CAP and puts it into a more usable form for VDOT. HTRIS is a database that includes nine different inventories of traffic records and roadway data elements. Only two of these inventories, entitled "roadway inventory" and "accidents," are linked to CAP and are discussed in this module. The accident data included in HTRIS are used only for data retrieval and data analysis to support decisions for highway construction and maintenance activities as well as providing information to other interested parties.

PROGRAM: HTRIS is written in a mainframe programming language entitled *Natural* (either version 2.25 or version 2.26). HTRIS has approximately half a million crash records but the total number of other records in the other inventories is about six million.

PROCESS: HTRIS crash records are periodically updated with selected CAP data.

PURPOSE: HTRIS data are used primarily by VDOT employees who need to analyze various aspects of the highway transportation system.

DATA: The accident subsystem of the HTRIS data dictionary contains the following data elements. Because the HTRIS names of data elements may be cryptic to the reader, both the full element name and the HTRIS variable name have been provided. For example, the "accident document number" is stored in HTRIS as "accid-doc-no." An asterisk indicates that the item does <u>not</u> appear on the screen of the HTRIS Accident Record Inquiry, at least for the few individual records sampled.

Element	HTRIS name	Description	How Computed
accident document number	accid-doc-no	identifies the accident document	CAP (DMV)
previous document number*	prev-accid-no	report's previous document number (only if document has been supplemented with additional information)	CAP (DMV)
creation date*	capp-cre-date	date created by CAP	CAP (DMV)
update*	capp-upd-date	last date file was updated by CAP	CAP (DMV)
route number within HTRIS*	route sin	internal HTRIS variable	road inventory
link sequence*	link-seq	denotes a particular segment of a route	road inventory
node offset	node-offset	distance from crash location to closest node	CAP (VDOT)
offset-object-sin*	offset-object-sin	internal HTRIS variable	road inventory
node number	node-no	node closest to the crash location	road inventory
accident node type*	accid-node-type	internal element that describes the type of node	road inventory
route identification	route-id	route name or number	CAP (VDOT)
next node number*	next-node-no	node second closest to the crash location	road inventory
reverse direction indicator*	revrs-dir-ind	internal HTRIS node referencing variable	road inventory
reverse node offset*	revrs-node-offset	internal HTRIS location reference variable	road inventory
link length*	link-leng	the length of the particular road segment	road inventory
road system type	road-sys	identifies road as primary, secondary, city street, or county road	road inventory
intersecting route number	inter-route-no	the number of the intersecting route	CAP (VDOT)
accident location type*	accid-loc	type of intersecting roads were the crash occurred	CAP (VDOT)
accident district	accid-dist	district where the crash occurred	CAP (DMV)
accident residency*	accid-res	residency where the crash occurred	see Note
accident county	accid-cnty	county where the crash occurred	CAP (DMV)
accident city	accid-city	city where the crash occurred	CAP (DMV)
optical disk identification*	opt-disk-id	references disk image of FR-300	CAP-generated
accident year	accid-year	year of the accident	CAP (DMV)
accident date	accid-date	date of the accident	CAP (DMV)
accident weekday*	accid-wk-day	day of the week of the accident	CAP (DMV)
accident hour	accid-hr	hour of the accident	CAP (DMV)
lighting	capp-light-code	lighting condition during accident	CAP (DMV)
collision type	capp-coll-type	type of collision	CAP (VDOT)
functional class	capp-func-class	type of road	road inventory
federal aid route	fedaid-route	*this element will soon be eliminated*	road inventory
traffic control	capp-traff-cntrl	traffic signal, sign, etc.	CAP (DMV)
surface condition	capp-surf-cond	wet, dry, etc.	CAP (DMV)
accident severity	capp-accid-sev	property damage, injury, or fatality	CAP (DMV)
number of fatalities	accid-numb-fatal	number of crash fatalities	CAP (DMV)
number of injuries	accid-numb-injur	number of crash injuries	CAP (DMV)
pedestrian fatalities	accid-pedes-fatal	number of pedestrians killed	CAP (DMV)
pedestrians injured	accid-pedes-injur	number of pedestrians injured	CAP (DMV)
damage amount	accid-damag-amt	total property damage (vehicles plus fixed objects)	CAP or HTRIS
rail identification*	capp-rail-id	railroad crossing identification	CAP (DMV)
number of lanes	accid-numb-lane	number of roadway lanes	road inventory
facility type	accid-facil-type	one-way, two-way, divided, etc.	road inventory
surface type	surf-type	concrete, asphalt, etc.	road inventory
weather	capp-weath-code	weather conditions	CAP (DMV)
alignment of the road	accid-align	straight, curve, crest, grade, etc.	CAP (DMV)
impact zone	accid-impact-zone	location of crash in relation to the intersection	CAP (VDOT)

intersection type	capp-inter-type	geometric configuration (e.g. T, 5-way, etc.)	road inventory
traffic count*	accid-traff-count	ADT (average daily travel)	road inventory
number of vehicles	accid-veh-numb	number of vehicles involved in the crash	CAP (DMV)
roadway defects	capp-road-dfect	deficiencies in the roadway system	CAP (DMV)
locality type (Typ-Environment)	accid-local	community setting (school, church, etc.)	CAP (DMV)
major factor	accid-major-factor	cause of the accident	CAP (VDOT)
lane direction of travel*	accid-lane-dir	direction of travel at the crash site	CAP (VDOT)
lane type where crash occurred*	accid-lane-type	merge lane, etc.	CAP (VDOT)
lane where crash occurred	accid-lane-no	number of lane counted toward the center	CAP (VDOT)
surface width	surf-width	width of the road	road inventory
shoulder width	shld-width	width of the shoulder	road inventory
state maintained*	state-maint-ind	state maintained or not state maintained	CAP (VDOT)
milepoint of crash	calc-milept	calculated state milepoint (VDOT notes, however, that this is NOT the mile marker)	road inventory
vehicle fields	accid-veh-flds	vehicles involved in the crash an aggregate field containing 18 variables derived from CAP (shown below)	CAP (DMV)
person fields	accid-pers-flds	persons involved in the crash an aggregate field containing five different variables derived from CAP (shown below)	CAP (DMV)

NOTES:

- The field "accid-veh-flds" contains the following data elements obtained from CAP (except for "fixed object" which is obtained from VDOT):

  vehicle type
  vehicle estimated speed
  vehicle maneuver
  vehicle placement
  vehicle skidding
  fixed object
  tractor length
  trailer 1 length
  trailer 2 length
  trailer width
  number axles
  vehicle condition (defects)
  driver age
  driver sex
  driver action
  driver condition
  driver drinking
  driver visibility (vision obscured)

- The field "accid-pers-flds" contains the following data elements obtained from CAP:

  pedestrian age
  pedestrian sex
  pedestrian drinking
  pedestrian condition
  pedestrian action

- The data element *accid-damag-amt* refers to the total property damage resulting from a crash (vehicles plus fixed objects). Since DMV only enters the individual components of the property damage (e.g. the property damage resulting from a fixed object and subsequently the property damage resulting from vehicles) it is presumed that either the HTRIS or CAP software automatically add these components to obtain the total amount of property damage.

- The CAP variable *car-veh-placement* denotes the vehicle's direction of travel prior to the crash. The CAP data dictionary notes that this information should be entered by VDOT, but the HTRIS data dictionary makes no mention of this information. Conversations with VDOT and inspection of data entry reports indicate, however, that this information is entered by VDOT operators. Examination of a CAP tape from the year 1993 showed that the "vehicle placement" field had indeed been coded. *Therefore the HTRIS data dictionary should be updated to account for this variable.*

- The variable *car-veh-lane* denotes the lane in which a vehicle was traveling prior to a crash (the lane direction, the lane type, and the lane number). This information is shown only in the CAP "inquiry" reports but is not shown in the CAP "update" reports. The CAP data dictionary gives an incomplete description of this variable while the HTRIS data dictionary makes no mention of such a variable. Examination of a CAP tape from the years 1992 and 1993 showed that the "car-veh-lane" field had not been coded, in spite of the fact that VDOT enters this information.

- The variable *gen-accident-lane* denotes the lane in which a crash occurred (the lane direction, the lane type, and the lane number). Only the lane number is directly displayed on HTRIS reports, however.

- Only some of the HTRIS data variables are stored as file descriptors. In other words, VDOT may perform searches based on key values only for selected variables. For example if "lighting" is stored as a file descriptor, then it would be possible to ask for all crashes that occur after dark. When such a search is needed for a variable that is not stored as a file descriptor in HTRIS, then VDOT requests that its Information Systems Division dump the HTRIS data into an ASCII format. VDOT may then put these ASCII data into a conventional database program, such as dBASE, where each variable is a file descriptor.

- Finally, VDOT's rail section notes that currently the railroad crossing identification number is used as a reference to help analysts locate rail crossings. The railroad crossing identification number is used with another HTRIS subsystem known as the "Railroad Crossing Inventory Subsystem" which is not described in this study. Thus when a crash occurs in the proximity of a rail crossing (as can be verified by examining the narrative, the crash diagram, and the rail crossing identification number) the FR-300P is processed through the normal channels except that it is subsequently passed onto the rail section of the traffic engineering division. No additional information is entered into the accident subsystem of HTRIS according to VDOT's rail section.

- From the 1992 and 1993 CAP tapes provided by DMV to VTRC, the *intersection type* was defined as "not at intersection" for every single crash except two occurrences in 1992 where the intersection type was given as "not stated or not applicable." According to this information, then, there were at most two crashes that occurred at intersections in Virginia during 1992 and 1993. The HTRIS reporting software, however, does show that crashes occur at intersections.

- The data element *accid-res* is not used nor coded by VDOT.

ADDENDUM: Several months after this interview, a VDOT representative provided the author with DMV CAP printouts, listed as attachment 6-I, illustrating VDOT's point that while data elements are entered into CAP, certain data elements provided by VDOT's road inventory and the VDOT operator are not shown on the CAP tape. The reason may be that the CAP tape is made incorrectly, using the same format today as was used prior to the creation of HTRIS.

Several data elements appear in the HTRIS data dictionary that do not explicitly appear in the CAP data dictionary. Two of these, the number of lanes and traffic counts, are not found in CAP's data dictionary. The *total* damage amount also does not appear in CAP's data dictionary, although it does contain individual vehicle damage amounts as well as the fixed object damage amount. It appears that the HTRIS data element "facility type" corresponds to the CAP dictionary's "general kind of highway" and that CAP's "general functional class" could be derived in part from HTRIS's "road system type." (Previously the narrative stated that these data elements were not found in the CAP data dictionary).

CAP/HTRIS Reference Matrix

The table presented below summarizes the information contained within the CAP database and the HTRIS accident subsystem. A description of each data element is provided in the first column. The second column, entitled "CAP Name," gives the CAP element name according to the CAP Data Dictionary (*Predict*, version 3.1.4, dated 6/28/94) and the CAP Record Layout Sheet (dated 2/08/91). The column "HTRIS Name" gives the corresponding HTRIS name according to the Accident Subsystem HTRIS Data Dictionary (dated 5/1/92). An "X" in the column entitled "CAP Report" means the particular data element is available through generating a CAP general, vehicle, passenger, or pedestrian report. An "X" in the column "CAP Tape" indicates that the data element was found on a 1993 CAP tape supplied by DMV. An "X" in the column "HTRIS Report" means the data element may be obtained if one generates a report through an HTRIS Accident Record Inquiry within the Accident Subsystem of HTRIS. The last column "Entered By" shows DMV if a DMV operator enters the information, VDOT if a VDOT operator enters the information, CAP or HTRIS if the information is generated automatically by the CAP or HTRIS software, and ROAD for information that is automatically transferred from the HTRIS Road Inventory.

All person-identifying information such as social security numbers, names, and vehicle license numbers were removed from the CAP tape prior to its examination by VTRC. Nor would it be expected that data elements specific to the HTRIS referencing system (e.g. node numbers) be on the CAP tape. These elements are denoted with an "a" or "b" respectively in the CAP Tape column. Finally an asterisk (*) indicates an explanation follows in the Notes section.

Data Element Description	*CAP Name (Record Layout Sheet or Data Dictionary)*	*HTRIS name (Data dictionary)*	*CAP Report*	*CAP Tape*	*HTRIS Report*	*Entered By:*
document number	gen-document-number	accid-doc-no	X	X	X	DMV
previous document number	old-document-number	prev-accid-no	X*			DMV
accident date	gen-accident-month	accid-date	X	X	X	DMV
	gen-accident-day	accid-date		X		CAP
accident year	gen-accident-year	accid-year		X		CAP
DMV accident jurisdiction	gen-acc-jurisdiction	*none*	X	X		DMV
day of the week	gen-acc-day-of-week	accid-wk-day	X	X		DMV
time	gen-accident-time	accid-hr	X	X	X	DMV
railroad crossing identifier	gen-railroad-xing-id	capp-rail-id	X	X		DMV
number of vehicles in crash	gen-no-of-vehicles	accid-veh-numb	X	X	X	DMV
type of traffic control	gen-traffic-control	capp-traff-cntrl	X	X	X	DMV
whether traffic control was working	gen-trfc-ctl-dev-wkg	*none*	X	X		DMV
alignment of the road	gen-alignment	accid-align	X	X	X	DMV
weather	gen-weather	capp-weather-code	X	X	X	DMV
surface condition	gen-surface-conditn	capp-surf-cond	X	X	X	DMV
roadway defect	gen-roadway-defect	capp-road-dfect	X	X	X	DMV
lighting	gen-lighting	capp-light-code	X	X	X	DMV
kind of locality: school, church, etc.	gen-kind-of-locality	accid-local (Typ-Env.)	X	X	X	DMV
number injured	gen-numbered-injured	accid-numb-injur	X	X	X	DMV

Data Element Description	*CAP Name (Record Layout Sheet or Data dictionary)*	*HTRIS name (Data dictionary)*	*CAP Report*	*CAP Tape*	*HTRIS Report*	*Entered By:*
number killed	gen-number-killed	accid-numb-fatal	X	X	X	DMV
number of pedestrians involved	gen-tot-pedestrians	*none*	X	X		DMV
number of pedestrians injured	gen-pedestrians-injd	accid-pedes-injur	X	X	X	DMV
number of pedestrians killed	gen-pedestrians-killed	accid-pedes-fatal	X	X	X	DMV
speed limit	gen-speed-limit	*none*	X	X		DMV
maximum safe speed	gen-max-safe-speed	*none*	X	X		DMV
badge number of the officer	gen-officer-badge-no	*none*	X	X		DMV
did State or local police file report	gen-report-filer	*none*	X	X		DMV
(fixed object) property repair cost	gen-prop-repair-cost	*none*	X	X		DMV
fatality, injury, or property dmg only	gen-inj-kill-prp-dmg	*none*	X	X		DMV
vehicle number	car-number	*none*	X	X	X	DMV
social security number	driver-soc-sec-number	*none*	X	a		DMV
driver identification number	driver-id-number	*none*	X	a		DMV
driver sex	ppd-sex	accid-veh-flds	X	X	X	DMV
driver date of birth	ppd-birthdate	*none*	X	X		DMV
	ppd-age	accid-veh-flds		X	X	CAP
does driver own the vehicle	ppd-drivr-owner-code	*none*	X	X		DMV
driver license state	ppd-license-state	*none*	X	X		DMV
driver name	ppd-last name	*none*	X	a		DMV
	ppd-first name	*none*	X	a		DMV
	ppd-initial	*none*	X	a		DMV
driver address	ppd-address, ppd-street	*none*	X	a		DMV
	ppd-city, ppd-state	*none*	X	X		DMV
	ppd-zip	*none*	X	X		DMV
number of *injured* passengers in veh	car-number-passengers	*none*	X	X		DMV
driver occupation	ppd-drivr-occupation	*none*	X	X		DMV
driver experience	ppd-dr-dsp-hwy-exper	*none*		X		CAP
	ppd-driver-exp-years	*none*	X	X		DMV
	ppd-driver-exp-months	*none*	X	X		DMV
residential jurisdiction of driver	ppd-resid-juris	*none*	X	X		DMV
vehicle type	car-vehicle-type	accid-veh-flds	X	X	X	DMV
vehicle age	car-vehicle-age	*none*	X	X		DMV
vehicle repair cost	car-veh-repair-cost	*none*	X	X		DMV
vehicle license number	car-license-number	*none*	X	a		DMV
vehicle license state	car-licensed-state	*none*	X	X		DMV
whether or not driver has insurance	car-insurance-ind	*none*	X	X		DMV
point of impact of the crash	car-point-of-impact	*none*	X	X		DMV
before accident speed	car-estimated-speed	accid-veh-flds	X	X	X	DMV
location of damage on vehicle	car-veh-damage	*none*	X	X		DMV
regular or commercial driver's license	car-veh-dl-cdl	*none*	X	X		DMV
driver position in/on the vehicle	ppd-position-in-veh	*none*	X	X		DMV
safety equipment used	ppd-safety-equipment	*none*	X	X		DMV
whether ejected from vehicle	ppd-ejected-from-veh	*none*	X	X		DMV
injury type	ppd-injury-type	*none*	X	X		DMV
driver action	ppd-action	accid-veh-flds	X	X	X	DMV
vehicle maneuver	car-veh-maneuver	accid-veh-flds	X	X	X	DMV
vision obscured	ppd-vision-obscured	accid-veh-flds	X	X	X	DMV

Data Element Description	*CAP Name (Record Layout Sheet or Data dictionary)*	*HTRIS name (Data dictionary)*	*CAP Report*	*CAP Tape*	*HTRIS Report*	*Entered By:*
driver condition	ppd-condition	accid-veh-flds	X	X	X	DMV
driver drinking code	ppd-drinking-code	accid-veh-flds	X	X	X	DMV
vehicle defect	car-vehicle-defect	accid-veh-flds	X	X	X	DMV
skid	car-veh-skid	accid-veh-flds	X	X	X	DMV
truck covered	car-truck-covered	*none*	X	X		DMV
whether commercial or hazmat vehicle	car-veh-cmv-haz-ind	*none*	X	X		DMV
tractor length	car-tractor-length	accid-veh-flds	X	X	X	DMV
trailer #1 length	car-trailer-length1	accid-veh-flds	X	X	X	DMV
trailer #2 length	car-trailer-length2	accid-veh-flds	X	X	X	DMV
trailer width	car-trailer-width	accid-veh-flds	X	X	X	DMV
number of axles	car-number-of-axles	accid-veh-flds	X	X	X	DMV
2 wheel or 4 wheel drive	car-two-four-wheel	*none*	X	X		DMV
height of vehicle	car-altered-suspensn	*none*	X	X		DMV
largest tire size	car-tire-size	*none*	X	X		DMV
number of tires of the largest tire size	car-mult-tire-size	*none*	X	X		DMV
whether steering has been altered	car-altered-steering	*none*	X	X		DMV
did modified vehicle help cause crash	car-caused-accident	*none*	X	X		DMV
extent of modified veh causing crash	car-degree-of-cause	*none*	X	X		DMV
pedestrian number	ppd-number+ ppd-indicator	*none*	X	X		DMV
pedestrian name	ppd-last-name	*none*	X	a		DMV
	ppd-first-name	*none*	X	a		DMV
	ppd-initial	*none*	X	a		DMV
pedestrian date of birth	ppd-birthdate	*none*	X	X		DMV
	ppd-age	accid-pers-flds		X	X	CAP
pedestrian sex	ppd-sex	accid-pers-flds	X	X	X	DMV
pedestrian injury type	ppd-injury-type	*none*	X	X		DMV
pedestrian action	ppd-action	accid-pers-flds	X	X	X	DMV
pedestrian condition	ppd-condition	accid-pers-flds	X	X	X	DMV
pedestrian drinking code	ppd-drinking code	accid-pers-flds	X	X	X	DMV
vehicle number occupied by passenger	ppd-which-veh-occupd	*none*	X	X		DMV
passenger number	ppd-number+ ppd-indicator	*none*	X	X		DMV
passenger name	ppd-last-name	*none*	X	a		DMV
	ppd-first-name	*none*	X	a		DMV
	ppd-initial	*none*	X	a		DMV
position in/on vehicle	ppd-position-in-veh	*none*	X	X		DMV
safety equipment	ppd-safety-equipment	*none*	X	X		DMV
passenger ejected from vehicle	ppd-ejected-from-veh	*none*	X	X		DMV
passenger date of birth	ppd-birthdate	*none*	X	X		DMV
	ppd-age	*none*		X		CAP
passenger sex	ppd-sex	*none*	X	X		DMV
passenger injury type	ppd-injury-type	*none*	X	X		DMV
medical examiner's certification no.	ppd-med-exam-cert-no	*none*	X	X		DMV

Data Element Description	*CAP Name (Record Layout Sheet Data dictionary)*	*HTRIS name (Data dictionary)*	*CAP Report*	*CAP Tape*	*HTRIS Report*	*Entered By:*
type of BAC test administered	ppd-body-fluid	*none*	X	X		DMV
BAC level	ppd-alcohol-content	*none*	X	X		DMV
first drug found in the patient	ppd-1st-drug	*none*	X	X		DMV
second drug found in the patient	ppd-2nd-drug	*none*	X	X		DMV
zone of impact	gen-acc-zone-impact	accid-impact-zone	X	X	X	VDOT
major factor	gen-major-factor	accid-major-factor	X	X	X	VDOT
collision type	gen-type-of-collision	cap-coll-type	X	X	X	VDOT
accident route number	gen-acc-route-number	route-id	X	X	X	VDOT
type of accident location	gen-accident-location	accid-loc	X*	X		VDOT
intersecting route number	gen-inter-route-no	inter-route-no	X	X	X	VDOT
whether road is state maintained	gen-state-maint-hwy	state-maint-ind	X	X		VDOT
whether road is rural or urban	gen-rural-urban-ind	*none*	X	X		CAP
intersection type	gen-intersection-type	capp-inter-type	X*	X*	X	ROAD
computed mile post number	gen-mile-post-no	calc-milept	X	X	X	ROAD
surface width	gen-surface-width	surf-width	X	X	X	ROAD
shoulder width	gen-shoulder-width	shld-width	X*	X	X	ROAD
surface type	gen-surface-type	surf-type	X	X	X	ROAD
road functional class	gen-functional-class	capp-func-clas	X	X	X	ROAD
federal aid	gen-federal-aid	fedaid-route	X	X	X	ROAD
kind of highway	gen-kind-of-highway	accid-numb-lane + accid-facil-type	X	X	X	ROAD
month report entered in CAP	gen-month-report-coded	*none*	X	X		CAP
last transaction date	gen-last-trans-date	capp-upd-date	X	X		CAP
last transaction coded	gen-last-trans-code	*none*	X	X		CAP
transaction creation date	gen-trans-create-dt	capp-cre-date	X	X		CAP
validation indicator	gen-validation-ind	*none*	X	X		CAP
incomplete indicator	gen-incomplete-ind	*none*	X	X		CAP
homicide/suicide/death/indicator	gen-homi-sui-dth-ind	*none*	X	X		DMV
accident county population	gen-acc-county-pop	*none*	X	X		CAP
accident city population	gen-acc-city-twn-pop	*none*	X	X		CAP
highway jurisdiction	gen-hwy-district	accid-dist	X	X	X	CAP
accident county	gen-hwy-county	accid-cnty		X	X	CAP
accident city	gen-hwy-town	accid-city		X	X	CAP
residency of accident	*none*	accid-res				*not used*
State Police jurisdiction	gen-dsp-acc-juris	*none*	X	X		CAP
driver violation indicator	gen-drvr-violation-ind	*none*	X	X		CAP
driver drunk indicator	gen-drvr-drunk-ind	*none*	X	X		CAP
defective driver indicator	gen-defectve-dvr-ind	*none*	X	X		CAP
vehicle defect indicator	gen-veh-defectve-ind	*none*	X	X		CAP
accident severity	gen-accident-severty	capp-accid-sev	X	X	X	CAP,HTRIS
node number	node-number	node-no	X	b	X	ROAD
offset (distance of crash from node)	node-offset	node-offset	X	b	X	VDOT
offset direction (node to crash)	*several HTRIS internal variables are used*			b		VDOT

Data Element Description	*CAP Name (Record Layout Sheet Data dictionary)*	*HTRIS name (Data dictionary)*	*CAP Report*	*CAP Tape*	*HTRIS Report*	*Entered By:*
name of street if not state maintained	*none*	*none*				VDOT
optical disk identifying number	optical-disk-id	opt-disk-id	X			CAP
lane direction where crash occurred	gen-accident-lane	accid-lane-dir	X*			VDOT
lane type where crash occurred	gen-accident-lane	accid-lane-type	X*			VDOT
lane in which crash occurred	gen-accident-lane	accid-lane-no	X*	X		VDOT
direction of travel before crash	car-veh-placement	accid-veh-flds	X	X	X	VDOT
second event (if applicable)	car-typ-coll-2nd-evt	*none*	X	X		VDOT
fixed object (if applicable)	car-coll-fixed-object	accid-veh-flds	X	X	X	VDOT
direction of lane before crash	car-veh-lane	*none*	X			VDOT
lane type before crash	car-veh-lane	*none*	X			VDOT
lane used before crash	car-veh-lane	*none*	X			VDOT
road system type (primary, etc.)	*See VDOT Addendum*	road-sys		X		ROAD
total damage amount	*none*	accid-damag-amt		X		CAP,HTRIS
number of lanes	*none*	accid-numb-lane		X		ROAD
facility type	*See VDOT Addendum*	accid-facil-type		X		ROAD
traffic count	*none*	accid-traff-count				ROAD
internal HTRIS route number variable	*none*	route-sin		b		ROAD
accident node type	node-type	accid-node-type	X	X		ROAD
link sequence	*none*	link-seq		b		ROAD
internal HTRIS sin offset	*none*	offset-object-sin		b		ROAD
next node number	*none*	next-node-no		b		ROAD
reverse direction indicator	*none*	revrs-dir-ind		b		ROAD
reverse node offset	*none*	revrs-node-offset		b		ROAD
link length	*none*	link-leng		b		ROAD

NOTES: The CAP Data Dictionary (p. 93-95) describes three additional elements: *gen-htris-convert-ind, gen-htris-rel-milepost, and gen-htris-route-direction.* The first is used to flag records that were not successfully processed by the HTRIS format when they were copied from CAP and the second is used to retrieve data from CAP. The third element is not explained. These three variables have been omitted from the section above because they refer to mechanics of the software rather than to actual data related to crashes. The CAP data dictionary lists three additional elements (p. 96-98) which have been omitted here because they are composed of data elements from the above list.

Fields for previous document number, type of accident location, intersection type, shoulder width, and general accident lane are shown on the CAP General Report but these fields were blank for the particular reports examined.

The variable "intersection type" on the CAP tape indicates that all 1992 and 1993 crashes occurred at locations other than intersections. Several crashes examined through HTRIS, however, are located at intersections.

Addendum: Road Inventory Coding Methods

Several months after the interview had been completed, researchers encountered difficulties with analyzing crash data. Subsequent conversations with traffic engineering and road inventory personnel revealed seven aspects of relationships between roadway and crash data of which the crash analyst should be aware:

- Resident engineers have the responsibility of informing VDOT road inventory personnel when changes are made to secondary roads, but these updates are not always provided. For example, a particular secondary road has undergone extensive modifications over the past decade including a widening in some areas from two to six lanes, but the last time road inventory personnel received information about this particular road was 1981. The willingness to provide these secondary road updates varies throughout the state; some residencies provide updates on a monthly basis while other residencies do not provide updates at all.

- The placement of crashes occurring on ramps, acceleration or deceleration lanes, and collector/distributor roads depends heavily on the officer's diagram, the officer's narrative, and road inventory data as described here.

  Ramps: If the officer notes through either the crash diagram or the crash narrative that a crash has occurred on a ramp, then the data element "accident lane number" is coded with a "u" (but is displayed as a blank to the user) while the data element "zone of impact" is coded with the values Q, R, S, or T. Currently the crash's exact location on a ramp may not be coded; instead the crash location is designated by the node assigned to the ramp gore plus the zone of impact that reflects where this crash occurred relative to the interchange (e.g. northwest, northeast, southwest, or southeast). Road inventory personnel, however, expect to be assigning links to ramp nodes in the near future, which will enable the locating of crashes to a specific point on the ramp.

  Acceleration/Deceleration Lanes: As with ramps, VDOT does not know if a crash has occurred within an acceleration or deceleration lane unless this can be evidenced from the officer's diagram or narrative. If these reflect that a crash did occur in an acceleration or deceleration lane, then the data element "accident lane number" again is coded with a "u" (but displayed as a blank to the user) while the data element "zone of impact" is coded with a specific value. This "zone of impact" denotes the grid location of the acceleration or deceleration lane relative to the interchange.

  Collector/Distributor Roads: As with ramps and acceleration/deceleration lanes, VDOT does not know if a crash has occurred on a collector/distributor road unless this can be evidenced from the officer's diagram or narrative. If a crash can be determined to be on the collector/distributor road, then the "accident lane number" is coded with a "u" but displayed as a blank to the user. The "zone of impact " denotes the grid location of the crash relative to the interchange. Thus currently a user can know that a crash occurred on a collector/distributor road only by understanding the geometry of the particular interchange and determining from the zone of impact the crash location. VDOT notes, however, that the structure of HTRIS will permit crashes to be located at specific points on collector and distributor roads once the appropriate road inventory data have been provided. The addition of these data will also make it possible to know that the crash occurred on a collector or distributor road simply by using HTRIS.

- A crash that cannot be located on the HTRIS road network because either (a) no discernable description of the location is provided or (b) the road is under the jurisdiction of VDOT but has not been incorporated into the HTRIS road network, is coded with a node number of "9999" to signify a non-locatable crash. These crashes are included, however, when one uses the HTRIS Yearly Accident Analysis Program to look at crashes by jurisdiction and highway system. In the event that situation (b) occurs, it is usually because a new road has been built but not yet reported to the road inventory section and entered into the road inventory system.

- City/town streets that are functionally classified as local and maintained by local governments, rather than VDOT, are not coded within HTRIS. In addition, roads functionally classified as local in Arlington and Henrico counties are not coded within HTRIS. Crashes that occur on these roads are simply located within a jurisdiction rather than at a specific intersection or route. These crashes are still represented when one applies the HTRIS Yearly Accident Analysis Program.

- HOV lane designations are not available for I-66 nor other roads that have concurrent HOV lanes. Researchers at VTRC who needed to analyze motorcycle crashes initially encountered this problem, and road inventory personnel subsequently confirmed that HOV information was not available through HTRIS for these particular routes. These personnel did note, however, that information for physically separated HOV lanes is stored within the HTRIS database. In response to this problem, roadway inventory personnel noted they will include this information within the "text" section of HTRIS. This text section also includes information about the use of shoulders as travel lanes. Users who are unfamiliar with the area or unaware that this section exists, however, will not necessarily know to refer to this "text" section.

- The numbering scheme for nodes on certain secondary roads as well as one primary road, State Route 206, is the reverse of the normal convention. For example, the nodes on Route 206 are numbered from east to west instead of the normal convention which is from west to east. While this numbering scheme does not affect the accuracy of the placement of the crashes, it is something of which an analyst who is using the straight line diagram should be aware. Likewise some secondary roads have nodes running from north to south rather than from south to north. Road inventory personnel, working with VDOT's Information Systems Division, believe they will be able to correct this problem in the future without losing crash data.

- Several ongoing maintenance issues surfaced that HTRIS users would most likely need to know in order to better analyze crashes. One such item is that street names are being added to nodes on the straight line diagram, which would help users identify crash locations. In addition, certain parallel routes were originally reversed, and these mistakes are being corrected. For example, in Charlottesville, business route US 250 West includes a local street known as Grady Avenue while business route US 250 East includes a local street known as Main Street. The road inventory database, however, has these naming conventions reversed, such that a crash that occurs on Main Street would be coded in HTRIS as having occurred on US 250 West. Problems such as these are being addressed. Finally, in the future, road inventory personnel will store on a routine basis textual information describing the location and duration of construction projects.

AGENCY: Department of State Police (VSP)

CONTACT: Budd Cox (804) 674-2127

SYSTEM: Centralized Accident Processing (CAP) System

SUMMARY: VSP is a CAP user. The CAP System is described under the DMV section above.

PROCESS: Crash report forms, whether completed by state or local police, are sent to DMV for entry into the CAP System, after which they are sent to VDOT for subsequent data entry into the CAP System. Once this process has been completed, VSP may access the crash information directly through a wide area network computer system.

PURPOSE: VSP has 47 area offices throughout the Commonwealth as well as a main office in Richmond which use the direct access to CAP in order to compile selective enforcement plans. These plans detail locations within each area's jurisdiction which should receive additional enforcement because of some type of need. VSP uses CAP data to design and evaluate the following special enforcement programs:

- Department Funded DUI (Driving Under the Influence of Alcohol or Drugs)
- Federally Funded DUI
- Department Funded Speed Enforcement
- Federally Funded Speed Enforcement
- Directed Patrol

DATA: Although VSP has access to the entire CAP System, VSP uses the following data for selected routes extensively in formulating and assessing the effectiveness of its special enforcement programs:

number of accidents by time of day
number of accidents by day of the week
number of accidents by month of the year
number of accidents involving alcohol
number of accidents for each causative factor

NOTES: In order to compare the number of accidents on a particular route that involve high speeds as a causative factor against the number of accidents in an entire county, it is sometimes necessary to either wait for DMV to conduct a special run of the data or request the data for a monthly period and then add the totals for the entire year. This is the case when more than 1500 data elements are involved. (From p. 6-2 of the Selected Enforcement Directed Patrol).

ADDENDUM: Following the interview and the creation of the narrative, it became apparent that VSP accesses the CAP database through a reporting program as does VDOT. VSP, however, refers to its reporting program as "CAPS." A "CAPS" user's manual also notes that VSP may examine crashes by the following factors:

type of vehicle
vehicle condition
type of collision

The user's manual also lists additional capabilities for analyzing individual accidents by passenger, pedestrian, driver, and vehicle parameters. The user's manual suggests that VSP has access to at least most of the data elements reported by HTRIS.

At this point in time it also became clear that additional information about VSP's use of crash data could be obtained from the following contacts:

Dale Kurowski, Department of Information Technology	(804) 225-2549
Dick Peacock, Department of State Police	(804) 674-2068
Vicki Davis, Department of State Police	(804) 674-2068
Sergeant Joseph Anderson, VSP Charlottesville Office	(804) 293-3223

AGENCY: Department of State Police (VSP)

CONTACT: Budd Cox (804) 674-2127

SYSTEM: Data Summary System (DSS)

SUMMARY: DSS is maintained by VSP and contains data particular to VSP selected enforcement programs.

PROGRAM: DSS is run on a mainframe computer and a rough estimate is that it stores over 100,000 records on an annual basis.

PROCESS: After completing a shift, officers complete a form entitled SP-127 (shown in Appendix C of attachment 9-A), from which data are entered into DSS. These data are then available for use by VSP for evaluating the effectiveness of their programs.

PURPOSE: VSP uses DSS data to analyze the effectiveness of five selective enforcement projects: Department Funded DUI, Federally Funded DUI, Department Funded Speed Enforcement, Federally Funded Speed Enforcement, and the Operation Alert Patrol Task Force. (The Task Force is used to control speeding and criminal activity).

DATA: The following data elements are part of the DSS analysis:

the selective enforcement program (e.g. Department Funded DUI)
the total number of miles patrolled for the program
the total number of man-hours devoted to the program
the number of arrests and summonses resulting from the program
other relevant data elements (see the MAPPER module that follows)

AGENCY: Department of State Police (VSP)

CONTACT: Budd Cox (804) 674-2127

SYSTEM: Maintaining, Producing, and Preparing Executive Reports (MAPPER)

SUMMARY: MAPPER is a program designed by VSP to process data collected during the Combined Area Reduction Effort (CARE), which is a period of high intensity enforcement over four annual holidays: Memorial Day, July 4th, Labor Day, and Thanksgiving Day. In Virginia, CARE applies only to Interstate Highways, and it is noted that CARE is a national effort conducted by many states simultaneously.

In addition, MAPPER is also used to record data collected during D-Day. D-Day is a nationally coordinated effort where once per year, enforcement efforts are concentrated on all highways, not just Interstates.

PROGRAM: MAPPER is also run on the mainframe. No attempt to estimate MAPPER's size has been made, although VSP notes that it is significantly larger than DSS and is integral to VSP's use of information.

PROCESS: An Enforcement Data Collection Form includes enforcement and crash information. The form is completed within 12 hours of the end of the holiday or D-Day period. This form is shown in Appendix C of attachment 9-A, the *Selective Enforcement Directed Patrol.*

PURPOSE: No specific evaluation of the data is required.

DATA: A variety of crash, enforcement, and behavior data are shown on the Enforcement Data Collection Form, including the following:

<u>Crash Data Elements</u>

number of property-damage-only crashes
number of personal injury crashes
number of fatal crashes
number of persons killed
number of persons killed who were not wearing seat belts

<u>Behavior Data Elements</u>

average speed of all vehicles*
number of motorist assistance efforts*

Enforcement Data Elements

number of speeding citations for passenger vehicles*
number of speeding citations for commercial vehicles*
number of citations for exceeding the 65 mph speed limit*
number of citations for exceeding the 55 mph speed limit*
number of citations for exceeding other speed limits*
number of reckless driver citations for passenger vehicles*
number of reckless driver citations for commercial vehicles*
number of DUIs (Driving Under the Influence) for passenger vehicles
number of DUIs for commercial vehicles
number of other hazardous citations*
number of seat belt citations
number of child restraint citations
equipment passenger*
equipment commercial*
other passenger
other commercial
number of drug citations*
number of felonies
number of misdemeanors*
average blood alcohol content

NOTE: Items marked with an asterisk (*) are not collected for non-Interstate highways.

AGENCY: Department of State Police (VSP)

CONTACT: Lt. H. R. Bridges (804) 674-2018

SYSTEM: SafetyNet

SUMMARY: SafetyNet is a national database, maintained by the Federal Highway Administration Office of Motor Carriers, which contains motor vehicle carrier data pertaining to crashes and inspections. Forty-eight states and several territories are contributors to SafetyNet through the Motor Carrier Safety Assistance Program (MCSAP).

PROGRAM: No attempt has been made to estimate the size of SafetyNet as it is a national database which is only used but not maintained by VSP.

PROCESS: The current practice is that when a crash occurs involving a motor carrier, VSP fills out the "Virginia State Police Supplemental Commercial Motor Vehicle Accident Report" at the crash site in addition to the regular FR-300P. The data from this form are then entered into the State Police mainframe system by personnel who are specially trained in processing this form. These personnel are at the Chesterfield Office and three other locations throughout the Commonwealth. Once the data are entered into the State Police mainframe system, a software routine converts the data into a format compatible to SafetyNet, and then the data are transferred by modem from the State Police mainframe system to SafetyNet. This supplemental commercial vehicle report is completed only if the crash is investigated by VSP; local law enforcement agencies do not complete this report at the time of this writing. This form is shown as attachment 10-B.

Data from the 40,000 motor carrier inspections conducted by VSP annually are entered in a similar manner into SafetyNet. These data are also used by VSP through their MAPPER System, described above.

PURPOSE: With respect to crash data, SafetyNet is used for a variety of purposes on a national scale, but VSP's only role is to furnish SafetyNet with Virginia commercial motor vehicle crash data. With respect to inspection data, however, VSP extensively uses the same data it sends to SafetyNet.

DATA: Two categories of crash data elements are described: the data which are currently entered into SafetyNet by VSP, and the data which in the future will be entered into SafetyNet by VSP.

Currently the following crash information are entered into SafetyNet:

1. crash date
2. crash location (city, county, jurisdiction code)
3. carrier information:
   - name of carrier
   - source of carrier name (vehicle side, shipping papers, driver)
   - carrier address (city, state, zip code)
4. type of operation (private, common, contract, exempt commodity, household goods, passenger, rental, other)
5. permit information
   - permit type (U.S. DOT, ICC/MC, SCC or VA stamp)
   - permit number
6. trip information
   - type of trip (over the road, local pickup/delivery, charter, regular route, city, other)
   - trip origin
   - trip destination
   - number of miles from trip origin to crash location
7. name of driver, social security or operator's number, and state
8. years employed by carrier
9. actual hours driven since last 8 off
10. estimated hours driven since last 8 off
11. driver' status (normal, asleep, sick, drinking, drugs, medical waiver, eyesight, hearing, other)
12. medical examiner's certificate and expiration date
13. driver qualification training (Yes, No, a description of the training)

13a. driver/carrier at fault in crash (Yes, No)

14. fatalities (driver, co-driver, carrier personnel, passengers, others)
15. injuries (driver, co-driver, carrier personnel, passengers, others)
16. seat belts (driver, passenger, installed, in use)
17. vehicle information:
    - type (truck, tractor, semi-trailer, full trailer, bus, other)
    - year
    - number of axles
    - make
    - vehicle identification number
    - company number
    - type of body (van, flat, tank, car carrier, cement, dump, other)
18. length of the cab (feet)
19. length of the first trailer (feet)
20. length of the second trailer (feet)
21. width (inches)

22. height
23. gvwr (gross vehicle weight rating)
24. fuel type (gas, diesel, LPG)
25. mechanical defect (not applicable, other, engine, transmission, driveline, coupling, suspension, fuel system, brakes, steering)
26. bus information (seating capacity, total passengers)
27. cargo type (general freight, motor vehicles, explosives, bulk gases, bulk solids, bulk liquids, mobile home, driveaway/towaway, farm products, ref. foods, logs/poles/lumber, household goods, metal, heavy machinery or other large objects, empty, other)
28. placards (yes, no)
29. hazardous material class
30. non collision accident type if applicable (ran off road, jackknife, overturn, units separated, loss/spill cargo, cargo shift, fire, other)
31. total number lanes
32. type of highway (interstate, non-interstate but limited access, 4-lane divided, undivided)
33. accident results (explosion, fire, spillage--non-hazardous, spillage--hazardous, property damage, other)

33a. towaway (yes, no)

34. investigating trooper
35. code number
36. division number
37. supervisor
38. date filed

In the future, however, VSP and DMV are planning to use a simplified form, which would contain the following data:

Screening information

number of trucks with 6 or more tires or a HAZMAT placard:
number of buses designed to carry 16 or more persons
number of fatalities
number of injured persons transported for immediate medical treatment
number of vehicles towed from the scene or provided with assistance

Vehicle information

gross vehicle weight rating (truck, tractor, or bus)
gross vehicle weight rating (total assembly)
total number of axles (total assembly)

vehicle configuration (choose one)
-- 4 tire vehicle
-- bus
-- single unit truck (2 axles and 6 or more tires)
-- single unit truck (3 or more axles)
-- truck with trailer
-- truck tractor only (bobtail)
-- tractor with semi-trailer
-- tractor with double trailers
-- tractor with triple trailers
-- other
cargo body type (choose one)
-- bus
-- van/enclosed box
-- cargo tank
-- flatbed
-- dump
-- concrete mixer
-- auto transport
-- garbage or refuse
-- other
HAZMAT placard (yes, no)
name or number from HAZMAT placard
hazardous material released (yes, no)
sequence of events (choose up to four)
-- ran off road
-- jackknifed
-- overturned or rollover
-- downhill runaway
-- cargo loss or shift
-- explosion or fire
-- separation of units
-- other event
-- collision with pedestrian
-- collision with motor vehicle in motion
-- collision with parked vehicle
-- collision with train
-- collision with bicycle
-- collision with animal
-- collision with fixed object
-- collision with other object

Carrier Information

name
source of name: shipping papers, vehicle side, driver, or other
address (street, city, state, zip code)
identification number (U.S. DOT)
identification number (Interstate Commerce Commission Motor Carrier)
identification number (State)
state of registration

Driver information

name
license number
state
apparent driver condition (choose one)
-- normal
-- drinking
-- illegal drug use
-- sick
-- fatigue
-- asleep
-- medication
-- unknown
date of birth

Accident location/environment information

location (name or number of street or highway)
city or township
county
type of road (choose one)
-- two way traffic with no physical separation
-- two way traffic with a physical separation
-- two way traffic with a physical barrier
-- one way traffic
access control (choose one)
-- no control of access
-- full control of access
-- other
light condition (choose one)
-- daylight
-- dark (lighted)

-- dark (not lighted)
-- dawn
-- dusk
-- unknown
weather condition (choose one)
-- no adverse condition
-- rain
-- sleet or hail
-- snow
-- fog
-- blowing sand, soil, dirt, or snow
-- severe cross winds
-- other
-- unknown
road surface condition (choose one)
-- dry
-- wet
-- snow or slush
-- ice
-- contaminant (sand, mud, dirt, oil, etc.)
-- other
-- unknown

General Information

total number of vehicles involved in this accident
time accident occurred
date accident occurred
reporting agency
report number
investigating officer
badge or identification number
vehicle identification number (VIN)
vehicle license (state and number)

NOTES: VSP and DMV expect to be changing from the current form to the future form within the next year. With the change, they will be requiring all law enforcement officers, not just VSP, to complete the commercial carrier report if a commercial motor vehicle is involved in a crash. Finally, both the FR-300P and the commercial motor carrier form are currently completed in the event of a motor carrier crash, but in the future, only the revised motor carrier form (and not the FR-300P) will be completed in the event of a motor carrier crash.

AGENCY: Virginia Alcohol Safety Action Program (VASAP)

CONTACT: Wendy Alsop-Corbin and Bill McCollum, (804) 786-5895

SYSTEM: INFERNO I

SUMMARY: INFERNO I contains information about alcohol and drug related motor vehicle offenders who are participating in VASAP. Data stored by INFERNO I include conviction information, participation within VASAP, and license restrictions. Each VASAP field office, called an ASAP, maintains a separate INFERNO I database for that ASAP's purposes, and the central VASAP office in Richmond *has the capability* to download this information into a statewide database.

PROGRAM: INFERNO I data files are compatible with dBASE III, and INFERNO I is written using the Clipper database language. The central VASAP database for INFERNO I had approximately 700,000 records as of June 1994. INFERNO I may be accessed from VASAP's main office in Richmond as well as from its 24 ASAP field offices throughout the Commonwealth.

PROCESS: When a motor vehicle crash occurs and the officer suspects alcohol was involved, the officer completes a uniform traffic summons along with the FR-300P. This summons is passed from the state or local police unit to DMV, which then passes a paper copy on to the relevant local ASAP field office. At this point two possible courses of action may occur, depending upon the procedure followed by the local ASAP office. The first possibility is that the field office enters the summons data into the INFERNO I system before the trial has occurred and then deletes the file should a conviction not be obtained. The second possibility is that the field office waits until a conviction has been returned to start a file. In either case, a guilty verdict means that in addition to the summons data, conviction data are sent to ASAP from the magistrate on the paper form DC265. The DC265 contains the person's name, address, and license restrictions. Once the data have been entered into the ASAP system, they can be uploaded via modem to the main VASAP office in Richmond. It is noted here that procedures followed by the different local ASAP offices vary significantly. The process thus described is a synthesis of personal communications with the Alexandria and James River ASAP offices.

PURPOSE: INFERNO's data are used to analyze the various VASAP efforts, such as the average blood alcohol content (BAC) for referrals and the average age of referrals. INFERNO I data also help to evaluate the effectiveness of the three classes of VASAP treatment, which are education, intensive education, and referrals to other providers for treatment.

DATA: INFERNO I contains numerous data elements divided into 12 sections as viewed by the user. These sections are described in detail in the *Case Management System Operations Manual* and five screens are briefly mentioned below.

The referral section contains data pertinent to the individual's entry into VASAP, such as the name, address, social security number, race, sex, arrest and conviction dates, blood alcohol content, and license restrictions.

The intake section contains additional information such as educational levels, income, whether or not the person is a recidivist, whether or not the person has previously been treated for alcohol or drug dependency, and occupation.

The disposition section contains information relating to the status of the case and treatment, such as whether the person is actively participating in an ASAP program, awaiting return to court, the balance due for the cost of the course, etc.

The payments section contains information about the payment status of the person, such as the cost of the course and whether or not the full amount has been paid.

The treatment section contains information about the treatment program to which an individual has been referred, if applicable.

The remaining screens contain information to transfers between ASAP programs, transfers from other states, miscellaneous notes (e.g. "Keep a close watch on this probationer, he is suspected of drinking and driving again!!"), VASAP classes, and treatment agencies.

The INFERNO I data are stored in two key tables: the offense table and the defendant table. The type of offense is the primary linkage among files within the offense table and the defendant number is the linkage between various files within the defendant table. The offense table contains information about the offense and participation within the particular ASAP program, such as the time of arrest, blood alcohol content, day of enrollment within VASAP, and whether the offense involved drugs or alcohol. The defendant table contains identifying information about the offender and his/her license, such as the social security number, name, address, education level, number of DUIs, and for how long the license is suspended and/or restricted. Specific data elements stored within each of these two tables are listed below:

Defendant Table

general information

defendant number (does not link to any databases outside INFERNO I)
date record created
date of last update
record flags

identifying information

social security number
name (first, last, middle initial)
address (street, city, state, zip)
telephone (home and work)
ASAP jurisdiction of residence
date of birth
sex
marital status
number of marriages
number of children
race
education level
annual income
occupation
number of DUI's
whether or not the person has previously been treated by VASAP
whether or not the person is a recidivist

license information

operator's license number (usually the social security number)
state of the operator's license
date license restrictions begin
date license restrictions end
if restricted, whether or not license permits driving to and from work
if restricted, whether or not license permits driving to and from ASAP
if restricted, whether or not license permits driving during work
number of months for which license is suspended
number of months for which license suspension is suspended

payment information

billing remark
comments

<u>*Offense Table*</u>

identifying information

offense number (e.g. type of offense)
defendant number (links to the *Defendant* file described above)
defendant's name
social security number

conviction information

offense date
conviction date
court case number
court type
VASAP jurisdiction of conviction
judge code
alcohol or drug offense
whether or not the offender is a juvenile
BAC (blood alcohol content)
type of BAC test given
time of offense
type of arresting officer

VASAP participation information

date of VASAP referral
date of enrollment in VASAP
date of "intake" in VASAP (date person actually began participation in VASAP)
case manager
VASAP classification level
date of classification
reason for reclassification
education class number
number of times education class has changed
whether or not sobriety was verified
location for verified sobriety
date verified sobriety begins

date verified sobriety ends
VASAP program type
VASAP program code
servicing program
transfer date
transfer acknowledged received date
date of intake at receiving ASAP
date program begins
date program ends

payment information

VASAP fee assessed
fee held by other ASAPs
fee balance
amount of fee suspended
date of last payment
payment terms

case status information

date final report received
state case status
local case status
treatment status
reason case closed
date case closed
offense notes
date record created
date of last update
whether or not referral packet should be printed
record flags

NOTES: At the time of this writing, INFERNO II is currently being developed and should be operational sometime after June 1995. INFERNO II will be significantly more extensive than INFERNO I, but full documentation describing INFERNO II is not available at this time. VASAP notes, however, that INFERNO II will have several changes:

- the data stored by INFERNO II will be more extensive than those stored by INFERNO I. For example, INFERNO II will contain an entirely new subset of data pertaining to community service assigned to an offender, including the assigned work site, the hours assigned, the hours remaining, the date of estimated completion, and any reduction in the sentence for good behavior. A tentative data dictionary describing INFERNO II is available.

- the format in which INFERNO II data are stored will be more flexible: INFERNO II data will be in more of a relational database format than INFERNO I, according to VASAP.

- INFERNO II, unlike INFERNO I, will contain a field indicating whether the person was involved in a crash as well as the crash type (fatality, injury, or property damage only). Currently there is no field in the INFERNO I database that shows whether or not a crash occurred.

VASAP also notes that it is currently in a state of transition between INFERNO I and INFERNO II. Data from the local ASAPs have not been downloaded to the VASAP Richmond Office since June 1994, due in part to the hard disk being filled and due also in part to VASAP focusing its efforts on INFERNO II. INFERNO I data obtained before June 1994 are currently stored on magnetic tape. VASAP notes that it plans to resume downloading information from the local ASAPs on a regular basis in the near future.

AGENCY: Office of Emergency Medical Services (OEMS)

CONTACT: Deborah Edwards (804) 371-3500

SYSTEM: Virginia Statewide Trauma Registry

SUMMARY: The statewide trauma registry database stores all of the data from the trauma registry form, shown as attachment 12-B. Most of the trauma registry data is medically related (e.g. vital signs, number of days in an Intensive Care Unit, etc.), but some information relating to motor vehicle crashes is also included, as noted in the Data section that follows. The database is flexible enough so that analyses may be conducted for specific types of data: for example, one may obtain a listing of all the cases where the blood alcohol content was above a certain level for motor vehicle accidents.

PROGRAM: The data are stored in an ORACLE relational database management system. This system has at least three major components: SQL-forms, which is the programming language used to manipulate the database, SQL-menu, which drives the screens and menus that allow the user to access the data, and SQL which transfers the data from the database to the screen. The data format is compatible with the statistical software package SPSS, thereby allowing non-programmers to query the database. A rough estimate is that the system currently accumulates approximately 30,000 records per year and currently contains 120,000 records. The Virginia Trauma Registry is physically located at OEMS in Henrico County and may be directly accessed only at that office.

PROCESS: A trauma registry form is completed only when a patient, after visiting an emergency room for treatment, meets one of the three following conditions: (1) the patient is immediately admitted to the hospital, (2) the patient is transferred to another hospital, or (3) the patient dies in the emergency room. Thus patients who are treated in the emergency room and then released <u>are</u> <u>not</u> included in the trauma registry. Finally, the form is not necessarily filled out immediately upon the patient's discharge from the emergency room; these forms are often completed some time afterward, with some data being transcribed from the Pre-Hospital Patient Care Report, which is described in the next module. Many hospitals send batches of these forms to OEMS periodically (e.g. on a quarterly basis) rather than immediately.

Thus hospitals, who complete the trauma registry forms, send either the forms or the data (entered on diskette) to OEMS which then enters the data into the trauma registry. OEMS also routinely updates the data to eliminate inconsistencies. For example, when a patient has transferred from one hospital to another, there may be two trauma records for the same patient. OEMS runs a software routine to identify such duplicate records and combine them into a single record for each patient.

PURPOSE: The trauma registry is used by OEMS to provide reports to hospitals and state agencies.

DATA: The following data elements are collected from the Virginia Statewide Trauma Registry form, which is essentially an abstract of the patient's medical record. These data elements are listed with these numbers on this form:

1. hospital record number
2. date of birth <u>or</u> age
3. sex
4. race/ethnicity
5. injury date
6. injury time
7. information source (patient, family, pre-hospital care provider, police, medical record, transfer hospital, other)
8. arrival date (at the emergency room)
9. arrival time (at the emergency room)
10. transport mode
11. prehospital form number
12. prehospital agency number
13. prehospital care (e.g. basic or advanced life support)
14. hospital that patient was transferred from
15. location of crash (city or county)
16. residence of patient
17. emergency treatment evaluation (e.g. coma, blood pressure, respiratory rate)
18. E-code number (see 20 below)
19. E-code Place of Occurrence: one of the following with respect to crashes:*
    - home
    - farm
    - industrial place & premises
    - place for recreation & sport
    - street & highway
    - (other places are specified such as mines and public buildings)
20. source of injury: one of the following with respect to crashes:*
    - motor vehicle (position and whether driver or passenger unknown)
    - motor vehicle driver
    - motor vehicle passenger (front seat)
    - motor vehicle passenger (back seat)
    - motor vehicle passenger (unknown position)
    - motorcycle driver

- motorcycle passenger
- pedestrian
- bicycle
- all terrain vehicle
- (many other non-crash options are listed such as fall, stab, burns, etc.)

21. restraint used: air bag, seat belt, car seat, helmet*
22. blood alcohol level*
23. where admitted: operating room (OR), floor, intensive care unit (ICU)
24. total number of days in intensive care unit
25. total number of days in hospital (called L.O.S. or Length of Service)
26. patient outcome (sent home, left AMA, acute care facility, inpatient rehabilitation, skilled nursing facility, residential facility, or died)
27. name of hospital and state where it is located
28. organ donor (which organ was donated if applicable)
29. date of discharge, transfer, or death
30. discharge Dx

NOTES: An asterisk (*) denotes data which are particularly relevant to motor vehicle crashes.

In addition to the statewide trauma registry described above, other trauma-related databases within the Commonwealth include the Head Injury Central Registry operated by the Department of Rehabilitative Services (DRS), the Spinal Cord Injury Central Registry (also run by DRS), the Virginia Health Information database, and the Hospital Trauma Registry, which is run by a private organization.

AGENCY: Office of Emergency Medical Services (OEMS)

CONTACT: Susan McHenry (804) 371-3500

SYSTEM: Pre-Hospital Patient Care Report Database (future)

SUMMARY: This database does not yet exist, but OEMS would like to construct such a database if funds become available.

PROCESS: Every time a local EMS unit visits the site of a potential patient, a form entitled the Pre-Hospital Patient Care Report should be completed at the site, during the ambulance ride to the emergency room, or upon arrival at the emergency room. This form is shown as attachment 12-D. Because a database for storing these forms does not exist, OEMS no longer requires providers to send such a form to OEMS, although the providers do complete the form and send copies to the hospital, the patient, and the pharmacy, as well as keeping a copy for their own records. Should such a database become operational, OEMS would subsequently require EMS providers to send a copy of the form to OEMS.

PURPOSE: The Pre-Hospital Patient Care Report Form is a legal document which, unlike the Virginia Trauma Registry Form, is filled out for all EMS visits. Therefore OEMS would like to have this database in order to evaluate its 656 licensed providers, which include volunteer, commercial, and municipal enterprises.

DATA: A variety of data elements are available, but only those directly relevant to motor vehicle crashes are shown here.

- vital statistics (name, address, social security number, etc.)
- level of consciousness
- type of call:
  - -- motor vehicle accident
  - -- other types of accidents (farm, home, industrial, marine)
  - -- type of transport (critical vs. routine)
- site of injury on the body
- trauma type (e.g. bleeding/severe, burn, or spinal cord injury)
- medical procedures (e.g. oxygen, clear the airway, etc.)
- motor vehicle accident type
  1. automobile
  2. motorcycle
  3. truck
  4. pedestrian
  5. bicycle
  6. ATV

- location in vehicle
  1. ejected
  2. front left
  3. front right
  4. rear left
  5. rear right
  6. other
- motor vehicle impact (where hit):
  1. front left
  2. front right
  3. rear left
  4. rear right
  5. undetermined
- motor vehicle impact (accident type):
  1. single vehicle
  2. multiple vehicle
  3. overturned vehicle
  4. trapped: pinned-time_______
- restraints
  1. none
  2. lap
  3. lap and shoulder
  4. child car seat
  5. air bag
  6. other

NOTES: OEMS obtains data from other sources since it does not have a Pre-Hospital Patient Care Report Database. These sources include individual provider reports, furnished to OEMS by the individual EMS provider agencies. These reports are often compiled using a program called "Q&A," which is a computer system that smaller agencies can use to analyze data compiled from their Pre-Hospital Patient Care Report forms. Thus these "Q&A" databases are essentially Pre-Hospital Patient Care Report databases tailored to the specific needs of an individual EMS provider.

AGENCY: Department of Education (DOE)

CONTACTS: Robert Cere and Barbara Goodman (804) 225-2037

SYSTEM: TRASER (for Pupil Transportation Service)

SUMMARY: TRASER is a personal computer-based software package developed by the Texas Transportation Institute (TTI). In the case of PTS, TRASER is used to maintain crash data for incidents involving school buses, even if those incidents are not reported by state or local law enforcement agencies. TRASER contains most of the data elements shown on the FR-300P as well as additional information specific to school buses, such as whether or not pupils were on the bus at the time of the crash.

PROGRAM: TRASER currently operates in an MS-DOS environment, although PTS expects to begin using a Windows version during the summer of 1995. TRASER is used to maintain crash data for any incident involving a public school bus. Both PTS and an estimated two-thirds of the 132 school districts that have bus systems use TRASER. The remaining school districts do not use a computer system at this stage for maintaining bus data. Each copy of TRASER runs individually on a stand-alone PC.

PURPOSE: School bus data are used for a variety of purposes both by PTS and transportation coordinators within the individual school districts throughout the Commonwealth. For example, safety-related decisions such as rerouting buses, relocating stops, and providing training within specific areas (such as backing up a bus) are based in part on crash data results. In addition, the data are used to verify the role of equipment such as strobe lights, reflective tape, emergency windows, and crossing gates in a crash.

PROCESS: PTS obtains crash data from three sources: DOE EB-006 reports filed by individual school districts, FR-300Ps sent to PTS by DMV, and the media. When a crash occurs, the school district's transportation coordinator is required to investigate the crash and file an EB-006 report with PTS by the conclusion of the month. The EB-006 has much of the same data as the FR-300P as well as additional information specific to school buses. If the crash is investigated by police and an FR-300P is filed, then when DMV enters the data from the FR-30OP into its database a flag is raised that the vehicle is a school bus, and DMV subsequently forwards a copy of the FR-300P to PTS. PTS then checks the EB-006 data against the FR-300P data and calls the school district in the event of errors or no EB-006 being filed.

The school district may either send the EB-006 information to PTS in the form of a paper copy (in which case PTS enters the data into TRASER), or if the school district has the TRASER software, then it simply enters the EB-006 data into its own TRASER database, copies this information on to a floppy disk, and mails the disk to PTS. In either event, school districts send crash data to PTS on a monthly basis.

A challenge faced by PTS is obtaining data for all school bus crashes; there have been cases where PTS first found out about a crash through the media and then had to contact the local school district for more information. A second difficulty is that many incidents involving school buses are either classified by law enforcement as nonreportable, in which case no FR-300P is filed, or are not classified as involving a school bus (e.g. when children are crossing the street to access a bus). In these instances, the school district is the primary source of information.

It should be noted that PTS collects data for any crash or incident involving a public school bus. These crashes include, for example, children being struck by a vehicle before they board the bus, bus crashes with no children on board, and incidents where the bus causes damage to other property (such as pulling away from a fuel station with the fuel hose still attached to the bus.) In fact, PTS notes that safety at loading and unloading points is a larger problem than safety within a moving bus.

Finally, DMV sends FR-300Ps to PTS in batches rather than one at a time. PTS noted that it tends to receive the FR-300Ps approximately two to six weeks after the date of the actual crash.

DATA: PTS stores within TRASER most of the data elements shown on the FR-300P, although PTS and DMV have different standards for some of the elements. For example, the FR-300P identifies nine possible points of impact on the vehicle in the event of a crash, while the EB-006 offers 17 possible points specific to the nature of a bus versus an automobile. Another example is that while both the EB-006 and the FR-300P ask for the type of injury, only the EB-006 records the number of school days missed as a result of the injury.

All 37 data elements listed on the template of the FR-300P are also found on the EB-006. In addition, the following elements from the front of the FR-300P are also shown on the EB-006:

accident date
accident time
county of accident

railroad crossing identification number
city or town of accident
number of vehicles involved
route where the crash occurred
driver's name
state where the driver resides
driver's date of birth
driver's sex
driver's license number
whether the driver has a commercial driver's license
the make and type of vehicle
vehicle year
repair cost of the vehicle
fixed objects struck other than vehicles
repair cost of the fixed object
points of impact
crash diagram
speed limit
speed traveled before the crash
damages to the vehicle (e.g. motor, totaled, etc.)
offenses charged against the driver
names of those injured or killed

The following data elements shown on the FR-300P are not shown on the EB-006:

day of the week	(note, however, this is automatically computed by TRASER and is shown in the database)
mile post number	(although a mile post number may be recorded as a landmark)
landmarks	(However, PTS notes it can enter this information into the TRASER database)
intersecting route	(PTS notes it does enter this information into the TRASER database, however. The EB-006 also has a spot to indicate whether or not the crash occurred at an intersection.)
driver's occupation	(obviously the person is a bus driver)
driver's address, city, zip	
years of regular driving experience	(note that years of bus driving experience are recorded as described below)
state of the licensed vehicle	(obviously the vehicle is licensed in Virginia)

owner of fixed objects struck	(PTS notes that this can be recorded in the database, such as when a mailbox is struck).
maximum safe speed	
accident description	(The narrative is not recorded, but PTS notes that information from the narrative is stored in the other fields, such as whether or not the driver was turning).
police information	(Items such as the police officer's name and badge number are not normally recorded, although some localities have modified their databases to include this information.)

The following data elements are recorded on the EB-006 even though they are not shown on the FR-300P:

general accident information
school division that owns the bus
school bus use at the time of the crash (e.g. training, field trip, etc.)
intersection involvement (whether the crash occurred at an intersection, parking lot, driveway, etc.)
road class (Interstate, county road, etc.)
road surface type (concrete, gravel, etc.)
road feature (alley, cul-de-sac, median, etc.)
roadway related (where the crash occurred in relation to the road)
who investigated the crash (police, school district, etc.)
whether the report has been completed

driver and bus information
class of license
years of school bus driving experience
hours of pre-service training
hours of in-service training in the last 12 months
direction of travel at the time of the crash
drug test type
drug test results
bus number
body make, chassis make, and type of bus
vehicle identification number (VIN)
engine location
seating capacity
seating arrangement
whether pupils were on the bus
number of pupils standing

bus action (e.g. turning, going straight)
bus location relative to the bus stop
whether another vehicle involved in the crash passed a stopped bus
whether the warning lights, stop arm, or crossing gate were activated at the time of the crash
whether the bus is equipped to handle wheelchairs
equipment: whether the bus has an emergency escape roof hatch, a roof-top strobe light, a side emergency door exit, and an emergency window exit
the number of passengers on the bus at the time of the crash

pedestrian information
which vehicle struck the pedestrian
whether the pedestrian was loading or unloading when hit
pedestrian's location when hit (e.g. sidewalk, roadway)
which vehicle struck the bicyclist
the position of the bicyclist when hit

NOTES: PTS acknowledged that one of the biggest problems with statewide crash data is the discrepancy between DMV and DOE's definition of a reportable crash. While both DOE and DMV define an injury-related or fatal crash as being reportable, DOE needs data on all crashes while law enforcement agencies will report a crash with no injuries or fatalities only if the crash involves property damage in excess of $1,000. Furthermore, the criteria by which a school bus is judged to be involved in a crash varies among the agencies. DOE cited an example of where two children who had just alighted from a school bus were struck by an oncoming automobile. By DOE's definition, the crash involved the school bus since the bus had just previously been carrying the children, was waiting for them to cross the street, and had its warning lights flashing.[25] The police report, however, did not indicate the involvement of the bus and reported the crash as involving a vehicle and a pedestrian. PTS stated it would benefit from understanding how its data fit into the larger picture of statewide crash records. For example, the 1993 *Crash Facts* indicates that there were 523 school bus crashes. PTS would like a clearer understanding of how these crashes are defined and how they relate to PTS's definition of school bus crashes.

This problem with definitions extends beyond statewide boundaries. PTS noted that the Insurance Institutes for Highway Safety, the National Highway Traffic Safety Administration, and the U.S. Department of Transportation could potentially be using different data definitions for what constitutes a school bus accident. Indeed, the National Safety Council notes "Interpretation of school bus data [on a national scale] is complicated by the many variations between state operations, by lack of standard definition of terms, and by lack of comparable reporting by states."[26]

PTS is involved in educating the local school districts in the importance of using these crash data to both improve safety and reduce operation costs. For example, a school district may find that buses knock down a significant number of mailboxes. Although many school districts still have not seen the value in using these data, PTS cited Fairfax County as a good example of a school district that is active in that effort.

Finally, DMV maintains a list of social security numbers that correspond to persons who drive public school buses. When one of these drivers is issued a citation for a serious traffic offense, such as DUI or reckless driving, or if one of these drivers has their driver's license suspended, then a flag will be raised when DMV enters that data into its CSS database. At that point DMV calls the school district that employs the driver and alerts them to the change in the driver's record.

AGENCY: Department of Education (DOE)

CONTACT: Vanessa Crozier (804) 225-3300

SYSTEM: Driver Training (no system currently in use)

SUMMARY: DOE has no computer system of its own for the purposes of training amateur drivers. Instead, it uses data published in DMV's *Crash Facts* as well as the Insurance Institute for Highway Safety's *Facts*, both of which are published on an annual basis. In addition, DOE requests data from DMV's CSS database concerning the number of cars that are currently impounded.

PURPOSE: DOE is responsible for youth (under age 19) motorist education efforts within the Commonwealth, including courses taught by public, nonpublic (e.g. private school), and commercial enterprises. These efforts include motorcycle, automobile, and bicycle safety and entail both classroom and in-vehicle instruction.

NOTE: DOE indicated a need for a "youth specific type of database" which could be broken down by counties or cities. In this manner, information for driver education courses could be gathered.

AGENCY: Department of Corrections

CONTACT: JoAnn Terlep (804) 674-3237

SYSTEM: Offender Based State Correctional Information System (OBSCIS)

SUMMARY: OBSCIS contains information on persons who are currently incarcerated in state institutions, state prisoners in local jails, and persons who are on parole. OBSCIS does not contain probation information, and this weak link is being supplemented by the VACCIS system, which is described in a subsequent module.

PROGRAM: OBSCIS contains approximately 250,000 records.

DATA: OBSCIS contains, for current persons in the system, several types of data including the following:

- the National Crime Information Center (NCIC) codes for the various offenses committed (NCIC codes are discussed in a subsequent module.)
- the date of the offense
- the name of the person (or an inmate number)
- personal characteristics
- sentences and detainers

OBSCIS contains for historical persons (those who are no longer incarcerated or on parole) only the NCIC code for the most serious offense.

The flexibility of the database varies for each record depending upon whether the record refers to a person who is presently incarcerated or is someone who has since been released. In the event of the former, one may perform a variety of searches on any of the variables; e.g. one may obtain all of the records which include a particular offense. In the event of the latter, one does not have this ability to select certain records based on the types of data contained within; one may only look at records sequentially.

AGENCY: Department of Corrections (DOC)

CONTACT: JoAnn Terlep (804) 674-3237

SYSTEM: Time Information Processing System (TIPS)

SUMMARY: TIPS contains information on **felons** <u>after</u> June 30, 1987 who were sentenced to serve a year or more at a DOC facility. TIPS is a subset of the OBSCIS database, described in the previous module.

ACCESS: Persons who wish to know about information from selected National Crime Information Center (NCIC) codes may contact the Department of Corrections to perform a computer run, but the DOC databases are not directly available to non-DOC personnel.

DATA: It appears that there are over 700 types of crimes that are recorded using the NCIC system, and these NCIC codes are used to classify crimes recorded in the TIPS. A few of these codes refer directly to motor vehicle crashes, and these codes, with a description, have been grouped in three sections: traffic offenses, violent crimes, and vehicle theft.

The most specific code known is entered: for example, is a person was known to be under the influence of alcohol, then code 5404 would be entered, but if the person was simply known to be under the influence of something, with the something being unknown, the code 5407 would be entered.

Many of the NCIC codes listed under traffic offenses are misdemeanors, not felonies. Thus a person committing those crimes would be listed in the TIPS database only if that person had already committed a felony for which their sentence was a year or more. For example, a person who was simply guilty of reckless driving would never appear in the TIPS database unless that person had **also** been sentenced for a year or more for a felony at the same time.

NOTES: On Jan. 1, 1995, parole eligibility was drastically changed, meaning that significant changes to these databases may occur.

The Department of State Police (VSP) and DOC have different variations of the NCIC codes, which were originally intended to serve as a uniform classifying mechanism for the individual states to report crimes to the FBI.

AGENCY: Department of Corrections

CONTACT: JoAnn Terlep (804) 674-3237

SYSTEM: Virginia Community Corrections Information System (VACCIS).

SUMMARY: This database is still being designed, but once it has been implemented it will contain disposition information on persons being monitored in all probation and parole districts throughout the Commonwealth.

DATA: VACCIS will use the Virginia Crime Codes (VCC) crime identification system, and will contain information on persons who are on probation or parole. The VCC system is described in a subsequent module.

AGENCY: Department of Corrections

CONTACT: JoAnn Terlep (804) 674-3237

SYSTEM: Jail Reimbursement System (also referred to as the "J7/J8" or simply "J7" System)

SUMMARY: The primary purpose of the J7/J8 database is to allow DOC to reimburse local jails for state inmates that are housed in local jails.

PROCESS: Each of the 99 local jails manually completes a "J7/J8" report, which is then sent to DOC on a monthly basis. DOC then edits the hard copies to determine how much each local jail should be reimbursed.

PROGRAM: The size of the database is not known, although it is said to have entered into it "hundreds of thousands of records per year." It is estimated that each month 30,000 to 40,000 records are processed.

NOTES: DOC notes that the primary goal is to provide reimbursement information, and uses of the database for other purposes are limited. The reasons for these limitations are given below:

- *No guarantee of an inmate identifier.* A social security number is usually, but not always recorded. One can bypass the problem of double counting inmates, however, by using a VSP-assigned number called the Central Criminal Records Exchange (CCRE) number.

- *Data delay.* It can take up to two years for data to be entered into the system.

- *No uniformity in data collection.* Each of the 99 jails contributes independently to the database, with little or no checking to ensure that accurate data are entered. In addition, little training is provided.

- *Monthly storage of records.* With the primary purpose being for reimbursements, a new record is created every month. Thus for an inmate who serves 18 months in a local jail, there will be 18 records.

- *Only the most serious offense is recorded.* For example, an inmate who is convicted of DUI and drug possession will show up in the J7/J8 database as being incarcerated only because of the drug offense.

- *Incomplete incarceration records*. As stated previously, the primary purpose of the J7/J8 database is to serve as a reimbursement tool for time spent in jail. For example, if a client has committed multiple offenses, the amount of time sentenced for each offense is not shown. Instead, only the total sentence for that offender is given.

DATA: This database contains information on persons charged with various local ordinances, misdemeanors, and felony offenses. These persons may have only been arrested or they may also have been convicted; in theory any person being held in a jail should have a corresponding record in the J7/J8 database. Data elements include inmate race, sex, age, offense (NCIC code), and confinement and release information.

NOTE: DOC can perform special runs to cater to an individual's request if given approximately six weeks notice.

AGENCY: Department of Criminal Justice Services (DCJS) and Department of Corrections (DOC)

CONTACTS: JoAnn Terlep (804) 674-3237 and Jim McDonough (804) 371-0532

SYSTEM: Pre/Post-Sentence Investigation (PSI) Database

SUMMARY: The PSI database is jointly maintained by the DOC and the Criminal Justice Research Center (CRJC), the latter of which is part of DCJS. The PSI contains information from most **felony** convictions in the Commonwealth since 1985.

PROCESS: A PSI is completed if and only if it is ordered by the court. Furthermore, not all PSIs are entered into the database. For example, DOC notes that it does not always receive a PSI for an habitual offender, and furthermore, that the high volume of habitual offenders results in habitual offender information usually not being entered into the PSI database.

DATA: The PSI uses a set of crime identification numbers known as the Virginia Crime Codes (VCC). The VCC system is much more specific than the NCIC system.

A variety of data elements are collected in the PSI database, but the only motor-vehicle related offense contained within the PSI databases are hit-and-run and car-jacking. (Of course the latter is better described as a robbery than a motor vehicle offense).

NOTES: Unlike OBSCIS and TIPS, the Department of Corrections estimates that the PSI Database has records for only 75% of the cases that should be contained within it.

DOC noted that the PSI database only captures a report: a date is not linked to the report. In DOC's opinion, a PSI report contains no more information than the J7/J8 report with *respect to crash data.*

Finally, DOC noted that it is possible for a single person to have more than one record on the PSI database, since each record is tied to a report and a person may have several PSI reports created for them.

National Crime Information Center (NCIC) Codes

The NCIC codes for the various offenses relating to motor vehicles are shown below, with the most likely corresponding Virginia Commonwealth Code (VCC) numbers listed in the column to the right. The VCC System is an alternate coding system and is discussed in greater detail in the following module.

traffic offenses

offense	NCIC code	Corresponding VCC
traffic offense	5400	?
hit and run	5401	HIT
transporting dangerous material	5402	?
driving under the influence of drugs	5403	N/A
driving under the influence of liquor	5404	DWI
moving traffic violation	5405	MOV, SIZ
nonmoving traffic violation	5406	EQU, CYC, REG
driving under the influence	5407	DWI, see also DNG 3270
reckless driving	5408	REC
driving with a suspended or revoked license	5409	LIC 6809, 6810, 6811, 6814
habitual traffic offender	5450	LIC 6832, 6833, 6834
attempted traffic offense	5499	?

violent crime related

offense	NCIC code	Corresponding VCC
Homicide: negligent manslaughter with a vehicle	0909	?
Homicide: voluntary manslaughter with a vehicle	0945	MUR 0944[4]
Homicide: involuntary manslaughter with a vehicle	0947	MUR 0947, 0948
firing a weapon from a vehicle	5254	WPN 5248
armed carjacking	1219	ROB 1225

theft related

offense	NCIC code	Corresponding VCC
larceny (vehicle parts)	2304	?
larceny (from automobile)	2305	?
grand larceny (vehicle parts)	2321	?

[4]This VCC code applies to any type of voluntary manslaughter, whether or not a vehicle was involved.

grand larceny (from automobile)	2322	LAR 2404
petty larceny (vehicle parts)	2341	?
petty larceny (from automobile)	2342	?
stolen vehicle	2400	?
theft and sale of a vehicle	2401	?
theft and stripping of a vehicle	2402	?
theft and usage of a vehicle in another crime	2403	?
vehicle theft	2404	?
vehicle theft by bailee	2405	LAR 2319
receiving a stolen vehicle	2406	?
stripping a stolen vehicle	2407	?
possession of a stolen vehicle	2408	?
interstate transportation of a stolen vehicle	2409	?
unauthorized use of a vehicle	2411	LAR 2412, 2413
larceny: unlawful subleasing of an automobile	2412	LAR 2414
tampering with an automobile	2450	?possibly LAR 2404
attempting to steal an automobile	2499	?

ADDENDUM: A "?" means the author could not find a corresponding VCC or was not sure of the chosen VCC. "N/A" denotes not available. The three-letter VCC prefix denotes the type of offense: e.g. "ROB" refers to robbery, "LIC" refers to a license offense, etc.

Virginia Commonwealth Code (VCC) Definitions

This section describes those VCC definitions most directly related to traffic violations. The VCC numbers are for the most part considerably more detailed than the NCIC codes. For example, the NCIC code for "hit and run" is 5401; this NCIC code covers all hit and run offenses. However, for "hit and run," there are nine possible VCC definitions. The variations under "hit and run" are shown below:

offense	VCC
failure to notify police immediately of a hit-and-run injury or death	HIT-6612
failure to notify DMV of $500 damage or more in a hit-and-run property damage	HIT-6613
failure of the driver to stop, report, or assist an injured driver	HIT-6608
failure of the driver to report an injured passenger	HIT-6614
damage over $250 where the driver fails to file a report or leave a note	HIT-6610
damage under $250 where the driver fails to file a report or leave a note	HIT-6606
damage over $250 where the passenger fails to file a report	HIT-6611
damage under $250 where the passenger fails to file a report	HIT-6607
generic hit and run where the details are not clear from the record	HIT-6665

In some cases, the link between NCIC and VCC codes is not clear. For example, for the offense "voluntary manslaughter with a vehicle," which is NCIC code 0945, there is no corresponding VCC code: the closest VCC code is "voluntary manslaughter" which does not allow one to know whether or not a vehicle was involved.

Finally, in some cases the NCIC codes appear more detailed than the VCC codes. For example, consider the various theft-related offenses. There is but one VCC code (LAR 2404) which specifies grand larceny, yet there are six different types of larcenies identified by the NCIC codes as shown below:

offense	VCC
larceny (vehicle parts)	NCIC 2304
larceny (from automobile)	NCIC 2305
grand larceny (vehicle parts)	NCIC 2321
grand larceny (from automobile)	NCIC 2322
petty larceny (vehicle parts)	NCIC 2341
petty larceny (from automobile)	NCIC 2342

The VCC codes for traffic related offenses follow.

Driving While Intoxicated

offense	VCC codes
first DWI	DWI-5413
second DWI within 5 years	DWI-5410
second DWI within 5 to 10 years	DWI-5409
third DWI within 5 to 10 years	DWI-5411
third DWI within 5 years	DWI-5412
refusal of alcohol test	DWI-5408
driving on suspended license after DWI	DWI-5407
driver under 21 alcohol consumption	DWI-5416
DWI (type not known from record)	DWI-5433

Reckless Driving

offense	VCC
interference with passengers or freight	REC-6662
disregard police command to stop	REC-6624
endanger life or limb	REC-6625
failure to stop before entering highway	REC-6627
out of control or bad brakes	REC-6629
endangering life or limb in parking lots	REC-6630
pass at railway crossing or intersection	REC-6632
pass two vehicles abreast	REC-6664
pass without visibility	REC-6660
racing	REC-6634
20 mph or more over the speed limit when it is 30 mph or less	REC-6646
60 mph or more when the speed limit is 35 mph	REC-6647
disregard police command to stop and bodily injury results	REC-6560
pass or overtake emergency vehicle	REC-6671
improper driving	REC-6621
racing, aiding, or abetting	REC-6636
riding abreast in one lane	REC-6641
failure to stop for school bus flashing lights	REC-6639
failure to stop for signal turn or stop	REC-6643
speed over 80 mph	REC-6648
20 mph or more over the speed limit when it is 40 mph or more	REC-6645
speed unreasonable for conditions	REC-6651
truck exceeding 65 mph on a two-lane highway	REC-6650
reckless driving, excessive speed (type not clear from record)	REC-6638
failure to yield at a yield sign	REC-6654
reckless driving (type not clear from record)	REC-6637

General Moving Traffic Violations

offense	VCC
use of Interstate by prohibited vehicles	MOV-6417
failure of school bus driver to wear a seat belt	MOV-6442

License Violations Directly Relating to Motor Vehicle Operation

offense	VCC
displaying another license as one's own	LIC-6819
false statement or concealing facts on license applcation	LIC-6820
authorize a person to operate a vehicle on a suspended/revoked license	LIC-6830
drive without a license	LIC-6808
lend a license to another	LIC-6821
driving with a revoked license (first offense)	LIC-6809
driving with a revoked license (subsequent offense)	LIC-6810
driving with a revoked license due to no insurance (first offense)	LIC-6811
driving with a revoked license due to no insurance (subsequent offense)	LIC-6814
driving in Virginia (non-resident unlicensed at home)	LIC-6824
violate restrictions on restricted license	LIC-6827
failure to turn in registration plates with a revoked license	LIC-6816
failure to surrender revoked license	LIC-6817
driving a school bus without passing a special examination	LIC-6828
operate a school bus or motorcycle without endorsement on license	LIC-6815
driving on a learner's permit without a licensed operator (first offense)	LIC-6829
habitual offender: operating a vehicle with revoked license (endangerment)	LIC-6832
habitual offender: operating a vehicle with revoked license (no endangerment)	LIC-6833
habitual offender: operating a vehicle with revoked license (no endangerment, second offense)	LIC-6834
submit false evidence of insurance	LIC-6805
operating an uninsured vehicle	LIC-6806

Violent Crime Related

offense	VCC
involuntary manslaughter with a vehicle	MUR-0947
involuntary manslaughter with a vehicle (aggravated)	MUR-0948
discharging firearm from motor vehicle	WPN-5248
car jacking	ROB-1225

Theft

offense	VCC
failure of the bailor to return animal, auto, etc.	LAR-2319
auto theft-grand larceny	LAR-2404
unlawful sublease of a motor vehicle	LAR-2414
receipt of transfer--vehicle, aircraft, or boat	LAR-2810
unauthorized use of animal, auto, or boat worth more than $200	LAR-2412
unauthorized use of animal, auto, or boat worth less than $200	LAR-2413

DOC Example: A Hypothetical Case Study

Because of the variety of data available within each DOC database and the constraints on those data, an example of where data might be found is appropriate. Suppose, for example, one had the following question: *"How many persons at any given time were incarcerated, imprisoned, or in jail for a traffic related offense?"*

Before answering this question, several points would need to clarified. First, a "traffic related offense" is a general description that includes charges as diverse as speeding, hit-and-run, or DUI. Second, one would need to resolve how to justify cases where a person was being held for a variety of offenses, of which a traffic related offense was only one charge. Third, one would need to resolve limits placed on the population in question: should it be restricted only to institutions under the jurisdiction of DOC or should one also include local jails?

Suppose, then, that one restricted the scope to DUI-related events. One could then begin to look at the various databases for this information, although one should acknowledge the limitations of each. For example, the TIPS database is rather complete, but it only contains a record if the person has been serving a year or more for a felony. DUI is not a felony, so the TIPS database would not be beneficial unless the person was already serving a year for another felony (e.g. a DUI combined with a hit-and-run offense).

One might then look at the OBSCIS database, which also has its limitations. For persons who have already been released, OBSCIS would not include DUI as a listing unless DUI was the most serious offense. In addition, OBSCIS would only have information on persons who are under DOC control. Prisoners who are held in local jails for a short time and hence under the jurisdiction of the locality would not be included in the OBSCIS database. VACCIS will supplement OBSCIS with respect to parole and probation information, but VACCIS is not yet operational.

One could then try the J7/J8 database, which would contain DUI information only if, as is the case with OBSCIS, DUI is the most serious offense. In addition, one would risk obtaining multiple records should the period for analysis span two or more months, since a new record is made for each inmate on a monthly basis. Finally, there are serious questions about the integrity of J7/J8 database data, as these are not verified on a routine basis: the primary reason for the existence of the J7/J8 database is to serve as a reimbursement tool for local jails. It does not exist to provide accurate research data.

Finally one could consider the PSI database. However, DOC has noted several questions about the feasibility of that approach. First, the PSI database only captures about three quarters of the PSI reports. Second, the PSI data are not linked to a particular date. Third, the PSI database only captures certain felonies. DUI data would thus not be found in the PSI database; nor are habitual offender charges recorded, even though they are felonies.

In response to these difficulties, DOC has acknowledged that one would need to consider conducting some type of survey in order to determine how many persons are incarcerated or in jail for DUI. The databases currently available do not offer a complete answer to that question, although the J7/J8 database could give a partial answer. Thus the deciding factor becomes one of precision, population, and accuracy: how complete does the answer have to be? If a very precise answer is needed with verifiable data concerning the entire population of those in jail or prison, then the databases will be inadequate and one should consider a survey. On the other hand, if it is acceptable to have a rough estimate which accounts only for those for whom a DUI is the most serious offense, then the J7/J8 database might be appropriate.

APPENDIX B:

SECONDARY USERS

In addition to the primary agencies previously discussed, the representatives from the following agencies were contacted and asked about their processing or potential usage of motor vehicle crash records. With the exception of the Virginia Transportation Research Council, these agencies were telephoned rather than visited. Unlike the descriptions provided previously, representatives from the agencies described in this Appendix have not been asked to verify their respective narratives.

(1) *Department of Criminal Justice Services (DCJS)*

Contacts: Ben Wood (804) 225-4867 (software upgrade effort)
Jim McDonough (804) 371-0532 (future database linkage efforts)

DCJS and DOC are considering automating the J7/J8 System where all jails would be provided with a personal computer. In this event, it is anticipated that DCJS will be developing the software for the automation. Since the J7/J8 database covers jails, and since jails would house most motor vehicle offenders, it appears likely that this upgrade could significantly improve the quality and availability of motor vehicle offender data. A representative from DCJS noted that in the near future it is anticipated there will be an effort to link more closely databases under the jurisdiction of DOC and DJCS.

(2) *Department of Youth and Family Services*

Contact: W. Stephen Pullen (804) 371-0749

This Department is mentioned as it keeps a record of "intakes" for juveniles who commit motor vehicle offenses. These records may be analyzed <u>but not tracked</u> on a case by case basis. For example, the Department is able to state that in Virginia there are 172,000 intakes for youths who have committed offenses of any type, and 1.2% of these intakes involve traffic offenses, and of these traffic offenders, 0.7% are in jail.

(3) *Department of Rail and Public Transportation (DRPT)*

Contacts: Dave Austin (804) 786-1061 (crashes at rail crossings--DRPT)
Earl Stitzer (804) 786-8037 (crashes at rail crossings--VDOT)
Chip Badger (804) 786-8135 (public transportation--DRPT)
Jack Apostolides (804) 786-1722 (public transportation--DRPT)
Brenda Crowder (804) 281-0440 (Alexis Corporation--Virginia Transit Liability Pool)

With respect to motor vehicle crash data, DRPT has two broad categories of concern: (a) crashes in the vicinity of at-grade rail crossings and (b) crashes involving public transportation vehicles.

A. Rail Transportation

The rail section of VDOT's traffic engineering department is responsible for maintaining a statewide grade crossings inventory system. This system obtains crash records data from three distinct sources. First, reportable crashes are available from HTRIS which is maintained by VDOT: when a crash occurs in the proximity of an at-grade crossing, VDOT passes the FR-300P on to the rail section. Second, railroad companies are required to report all crashes to the rail section within VDOT's traffic engineering department. Third, the Federal Railroad Administration reports crashes on an annual basis, usually in March, to the VDOT's rail section. Crash information includes the following:

- severity of the crash (number of persons killed or injured or amount of property damage)
- location of the crash (county, route or street, and crossing number)
- date of the crash
- railroad company involved
- type of warning system used
- weather and surface conditions
- whether the crash occurred at night or during the day
- whether the train ran into the vehicle or vice-versa
- whether the jurisdiction is under the control of VDOT or a locality

One of DRPT's goals with respect to at-grade crossings is to develop a systematic approach to determine which at-grade crossings should be closed to vehicular traffic first. Such an approach would involve field inspections as well as determining changes in traffic patterns but should also include an analysis of at-grade crashes.

B. Public Transportation

With regards to motor vehicle public transportation, in the past the only data collected by DRPT have been the total number of passenger injuries, passenger fatalities, and vehicle accidents incurred by each transit system throughout the Commonwealth. For fiscal year 1993, these data were collected for four systems only: the Greater Richmond Transit Company, Pentran (Middle Peninsula), Tidewater Regional Transit (Norfolk, Virginia Beach, Portsmouth, and Chesapeake), and WMATA (the Washington Metropolitan Transit Authority operating in Northern Virginia).

At present, however, DRPT no longer collects crash information concerning motor vehicle public transportation except from transit systems who are receiving Intermodal Surface Transportation Efficiency Act (ISTEA) Section 9 Funds. These transit systems serve the areas of Charlottesville, Danville, Lynchburg, Middle Peninsula, Northern Virginia (Washington Metropolitan Area Transit Authority), Richmond, Roanoke, and Virginia Beach (Tidewater Regional Transit). For these transit systems only, the following crash data are collected using form 405: collisions with other vehicles, collisions with fixed objects, collisions with pedestrians, number of injuries, number of fatalities, the amount of *transit* property damage, and a variety of non-collision incidents (e.g. boarding and alighting the vehicle, for example). DRPT notes that Petersburg, Prince William County (PRTC), and the Virginia Railway Express had indicated that the form 405 was not applicable and had not submitted that information in fiscal year 1994.

Finally, there exists a "Virginia Transit Liability Pool" which contains crash information for a few of Virginia's transit systems. This information includes the date, severity, and cause of each crash.

(4) *Supreme Court*

Contacts: Ken Mittendorf (804) 786-6455	(Supreme Court)
Karen Ruby (804) 367-2240	(DMV)
Karen Chappell (804) 367-0406	(DMV)
Teresa Harris (804) 367-2052	(DMV)
Doug Buriss (804) 367-8382	(DMV--computer programming)

The Courts Automated Information System (CAIS) contains a history of charges, adjudication, and sentencing for all cases, including traffic information. It should be noted, however, that CAIS does not note whether a crash was involved unless that information may be inferred from the nature of the charge (e.g. hit and run). In addition, the courts provide DMV with updates for DMV's CSS database on a daily basis. These data include, for traffic related **convictions**: name, driver's license number (usually the social security number), date of birth, sex, address, date of offense, crime for which person is convicted, date of conviction, license suspension information, and whether or not a fine was paid. An estimated 10,000 convictions are transferred to DMV on a daily basis. In the past, courts have provided this information on magnetic tape, but DMV and the various courts are currently establishing one-way electronic linkages, where the courts' conviction data are transferred directly to the CSS database. 102 courts are linked to CSS at the present time, 22 additional courts will be linked to CSS in the coming year, and four courts will never be linked to CSS.

Finally the court will provide, at the request of the judge, an offender's motor vehicle crash record for the judge to use when determining an offender's sentence for a motor vehicle offense. Five courts have the ability to electronically connect to CSS to obtain an offender's driving record: the Fairfax County Circuit Court, the Fairfax County District Court, the Virginia Beach General District Court, the Williamsburg-James City County General District Court, and the Fredericksburg General District Court. DMV notes that usually the officer will have requested a driving record from DMV at the time that the traffic summons was issued, but if this was not done then often the only source of information for the offender's driving record is the offender. In DUI cases the police request that DMV provide a copy of the driver's record to the Commonwealth's attorney.

(5) *Division of Forensic Science*

Contact: Paul Ferrara (804) 786-2281

When a crash occurs and police suspect criminal activity, they may submit evidence (tissue samples, pieces of glass, fenders, instrument panels) to the Division of Forensic Science within the Department of General Services. The submitting agency explains what it is trying to ascertain with respect to the crash, such as toxicology, driver action (e.g. attempted braking), or vehicle operation (for example, lights being on). From these samples the Forensics Lab makes its determination and then submits a report to the law enforcement agency. It's quite possible that this report would not be completed for a couple of months due to the backlog of requests at the Forensics Lab. Finally, a description of the analyses are stored within the Laboratory Information Management System and from these data one may select a set of cases by time, location, and types of examinations that were performed.

(6) *Department of Aviation (DOAV)*

Contacts: John Fuller (804) 236-3639	(DOAV)
Sgt. Nickols (804) 743-2228	(VSP)
Skip Watson (804) 222-7494	(FAA)

The Department of Aviation keeps paper records of aircraft crashes that have been investigated by VSP. DOAV can tabulate statistics for these crashes although this is not done on a regular basis. VSP initially investigates all aircraft crashes and then sends a record of the investigation to DOAV, the Federal Aviation Administration (FAA), and the VSP Division office. For Virginia, there are two sources for aircraft crash information: one may contact DOAV or one may contact each of the seven VSP Division Offices. Theoretically each VSP Division should forward a copy of the crash report form to the main VSP Central Office, but this is not always done.

Furthermore state and federal crash definitions differ. In Virginia, an aircraft crash is defined as an event where there is property damage of $500 or more or any type of injury results. The FAA defines a crash as being an event where there is severe structural damage or an injury requiring a hospital stay. Thus a crash where the nose of the plane is damaged and the pilot has to get stitches and is released from the hospital in the same day is classified as a crash by Virginia but only as an incident by FAA. Finally, FAA notes that it is not their responsibility to disseminate crash information; FAA recommends contacting the National Transportation Safety Board for national crash statistics.

(7) *Virginia International Terminals (VIT)*

Contact: Charles Thompson (804) 440-7165

Virginia International Terminals is a private organization regulated by the Virginia Port Authority. The latter, however, referred requests concerning the use of crash data to VIT. VIT requires all drivers it employs to submit a motor vehicle record and notes that "98%" of the mileage driven by its employees occurs on the grounds of the port itself in unlicensed cars. In addition, VIT has about 35 miles of railroad in the terminal. VIT keeps its own records of all incidents and these records are not available to the public.

(8) *Department of Alcoholic Beverage Control (ABC)*

Contact: Craig Vanderland (804) 367-0716

The Department uses DMV's *Crash Facts* to investigate a variety of alcohol related events. ABC cited responding to complaints from citizens about the sale of alcohol to minors as an example of one of its duties. ABC also makes decisions about how to focus resources based on the occurrence of alcohol-related crimes. (An example might be to investigate a licensee selling alcohol to intoxicated persons.) ABC noted that it would prefer to have access to data more frequently (e.g. on a quarterly rather than an annual basis).

(9) *Richmond Regional Planning District Commission*

Contact: Bob Griffith (804) 358-3684

The Richmond Regional Planning District Commission serves as staff for the Richmond Metropolitan Planning Organization (MPO).[27] One of the MPO's responsibilities is to develop a congestion management system (CMS) which involves examination of the effects of incidents, including motor vehicle crashes, on traffic flow. The CMS for

Richmond, as is the case for many MPOs, is currently in the planning stages, but already data needs for the CMS have become apparent. The MPO would like to have the ability to identify high crash locations in terms of frequency and severity, as well as the factors that caused the incident. In brief, the CMS not only needs numerical data but analytical information. For example, one application of the CMS might be to pinpoint a location on Interstate 64 Eastbound where a large number of rear end crashes were occurring as a result of drivers being blinded by sunlight. The MPO could then use the CMS to identify possible remedies, including having a tow truck on hand to remove incidents from the roadway or placing an officer near the location to smooth the flow of traffic.

Currently the MPO obtains crash information by submitting a request to VDOT's Transportation Planning Department. The MPO noted it has no formal contact with DMV or the local police department.

(10) *Central Virginia Planning District Commission*

Contact: Peggy Sublett (804) 845-3491

The Central Virginia Planning District Commission is in essence the MPO for the Lynchburg Area. The PDC notes that information pertaining to crash locations would be beneficial for identification of areas where traffic control needed to be improved. The PDC adds that in the future it should be able to identify more precisely its crash data needs.

(11) *Northern Neck Planning District Commission*

Contact: Randy Wingfield (804) 529-7400

The Northern Neck Planning District Commission indicated that it obtains crash information from VDOT which in turn obtains the information from VSP. The author surmises that this information is pulled from HTRIS by VDOT. Northern Neck noted that it stores this crash data in a DBASE file (a database program that runs on a personal computer) and that these crash data include crash severity, weather conditions, and a general description of what occurred. These data are used for various traffic studies including right-of-way acquisition, congestion analyses, and VDOT requests. For example, a VDOT residency asked the Northern Neck Planning District Commission to identify road segments which had more than two accidents per half mile over a certain period of time.

(12) *Middle Peninsula Planning District Commission*

Contact: Charles Heath (804) 758-2312

The Middle Peninsula Planning District Commission (PDC) noted that it is very interested in being able to obtain crash records information but currently does not have access to that information. For example, on Route 33 there have been four to five fatalities over the past 14 months, yet data concerning these crashes are not available except possibly through the local sheriff's office. The PDC indicated it would like to have access to the HTRIS data in either paper or electronic form, but that VDOT has been unwilling to provide even paper records to the PDC.

The planning district has several applications and decisions which would benefit from the use of crash records. These applications include the following:

- *Creation of a regional bike network.* An identification of high crash locations would suggest areas where bicyclists needed to be rerouted from primary arterial roads.
- *Display of crash data graphically.* The PDC has a geographic information system (GIS) which could, were the data available, be used to highlight areas that should be addressed by the Statewide Transportation Improvement Program (STIP).
- *Pre-allocation hearings.* Since the PDC is not served by a Metropolitan Planning Organization, these hearings are the primary mechanism through which public support is demonstrated for various transportation projects. Motor vehicle crash information would help localities evaluate the impact of various projects on transportation safety.
- *Identify areas for VDOT safety program improvements.* The PDC can provide input into VDOT safety programs, such as horizontal realignment of secondary roads and at-grade rail crossing improvements. (In the author's opinion, although VDOT may have the crash data necessary for analysis, the PDC can offer the input of the community concerning the types of improvements being considered.)

(13) *City of Richmond Traffic Engineering*

Contact: Ralph Rhudy (804) 780-6460.

A traffic engineer working for the City noted several difficulties with the current crash reporting database employed by Richmond, as well as data missing from the FR-300P. With respect to the Richmond database, problems include the referencing system and the computer software. For example, if two streets intersect twice (e.g. a linear street and a u-shaped street), then the location of a crash is not known if one simply notes that it occurred at an intersection of those two streets. A problem also arises when the data entry operator enters the wrong day of the week for a particular crash date (e.g. Monday

2/21/95 when in fact 2/21/95 is a Tuesday). An application desired by the City would be to be able to tie crash rates to particular street segments in order to assess trends.

The FR-300P also lacks information desired by Richmond. These include right-turn-on red movements, turn signal information, and differentiation between headlights being defective and brake lights being defective. For example, although the officer may mention whether or not the vehicle had defective lights, the template does not show whether or not a single headlight was missing. The suggestion was also made that the type of location be expanded to show whether the crash occurred in the middle of the block, in an alley, on private property, etc. Lastly, it was suggested that spaces for latitude and longitude coordinates be included on the FR-300P.

14. *Albemarle County*

Contacts:	Dave Shaw	(804) 972-4046	(County Police Department)
	Tex Weaver	(804) 296-5823	(County Government)
	Charles Tyger	(804) 786-8169	(Virginia Council on Information Management)

Albemarle County has been included because of its interest in using global positioning systems (GPS) and GIS technology. The police department has been trying to obtain funding to purchase GPS receivers to be used in locating crashes. Albemarle County is developing a county-wide GIS to be used as part of its enhanced 911 program, and notes that information as detailed as driveway locations are being incorporated. The statewide Council on Information Management may also be a source of additional information on other counties' GIS efforts.

(15) *Virginia Transportation Research Council*

The Virginia Transportation Research Council (VTRC) employs crash data for a wide variety of research projects. VTRC requests special runs of the CAP database from DMV as well as sanitized copies of the FR-300P and traffic counts from VDOT's Traffic Engineering Division. Data published by DMV, other states, and the Federal government (e.g. reports from the Fatal Accident Reporting System) are a source of additional information. For crashes that occurred prior to the creation of HTRIS and CAP or for studies requiring older data, VTRC refers to tapes of DMV supplied crash data. VTRC also uses both the HTRIS software and databases of localities' traffic engineering or police departments.

VTRC uses the number of crashes by severity (fatality, injury, and property damage only), locality, and vehicle type, as well as other crash related factors such as time and weather. For example, one study conducted six years ago required the selection of all crashes where the driver was drunk and between the ages of 15 years and eight months and 21 years. A second example involves obtaining, for four different urban intersections throughout the Commonwealth, the type of crash (e.g. rear-end, sideswipe, etc.), the number of crashes at the site, whether or not the driver ran the red light, and the severity. A third study used mileposts (to determine crash locations on a scenic byway), surface conditions, surface width, alignment, roadway defects, traffic control, visibility, drivers' actions, speed limits, vehicle speed, type of collision, fixed objects, the major contributing factor, the residency of the drivers, and the type of vehicles involved.

Respondents noted several data issues:

- *Crash data are not always accessible.* It was mentioned that a study conducted several years ago called for a listing of crashes organized by age of the driver, severity, and whether or not the driver was at fault. At the time, the data were not readily available and many useful cross tabulations were lacking, such as the age of the driver versus severity of crash and who was at fault. It was also noted that published crash information is dated, stating that the annual *Crash Facts* is not available until June. In response to this criticism, however, DMV notes that part of this delay is because it may take three months for all crashes to be entered into the system. Finally, it was noted that data for large trucks and any other unusual vehicles are limited.

- *Even though HTRIS is accessible, the FR-300P is often needed.* One person was not familiar with the HTRIS software, while another person noted that in a study of over fifty sites at an urban location, the crash diagram and narrative were needed since the officer paid more attention to those areas than to the rest of the FR-300P. It was also noted, however, that the problem with just using the FR-300P is that not all cases where the victim dies subsequent to the crash are shown as fatalities.

- *HTRIS crash data are not always correct.* One person noted that they used HTRIS quite frequently for crash data (e.g. crash type, severity, traffic control, weather, time, direction of travel, location, and driver action). This person indicated they had no complaints about HTRIS except that there was a high frequency of errors within the database. It is not known whether these errors result from mistakes in the way the officers complete the FR-300P or in the way the FR-300P data are entered into the CAP System.

- *FR-300P crash data are not always correct.* Several problems with the accuracy of the FR-300P were identified, such as truck types not being coded correctly and the direction not entered. Based on a study conducted in the late 1980's, the comment was made that property damage amounts were also too low. Different opinions on the crash diagram were received: one person noted that the diagram was sometimes inaccurate while another noted that the diagram was one of the most reliable descriptions. Information on pedestrians was sketchy: for example, a crash involving a pedestrian and drinking might be listed but the question of who was drinking was left unanswered. Lastly, the statement was made that the driver action category of "driver inattention" was too general to be of use.

- *The exact location of the crash is significant.* Whether the crash occurred 50 feet versus 100 feet from an intersection will affect the outcome of an analysis. One respondent noted that it is unlikely that an officer would pull out a tape measurer to obtain these exact locations, and that consequently GPS would allow an officer to obtain that location much more easily. Another person noted this is a problem with pedestrian crashes: if the specific location within the intersection is not given, one wonders whether a pedestrian was hit at the signal or 200 feet from the signal.

APPENDIX C:

HTRIS CODING OF CRASH LOCATIONS

Researchers at VTRC encountered some non-intuitive features concerning how crash locations are referenced. This Appendix outlines two of these features.

For a particular study, HTRIS reports showed that an accident had occurred in lane four while the total number of lanes was listed as being only three. The crash location in question was an Interstate highway with three mainline lanes plus an acceleration lane in the same direction. Telephone calls to different persons within VDOT's traffic engineering division revealed that the road inventory personnel would code such a location as having a total of only three lanes. VDOT operators who enter location data, however, enter the lane number in which the crash occurred based on the officer's diagram and narrative. Thus an officer might have drawn a crash location with four lanes (three regular lanes and one acceleration lane) and VDOT would have based the lane location on this diagram while the road inventory would show only three lanes.

The same study showed a possible source of confusion with the field entitled "calculated milepoint" as shown on the HTRIS straight line diagram. When a crash location is reported by HTRIS, the location is denoted by a node and a node offset. If an officer notes that a crash occurred 0.22 miles south of a ramp off an Interstate, then the crash location would be given as node X, where X is the node denoting the ramp location, with a node offset of 0.22 miles. For example, the straight line diagram shows that node number 158999 on Interstate 81 North corresponds to milepoint 148.71 on Interstate 81. Therefore a crash that occurs 0.22 miles north of this location would be coded as node 158999 with an offset of 0.22, and on the straight line diagram the crash would be shown to occur at milepoint 148.71 + 0.22 = 148.93.

The confusion arises, however, because the variable "calculated milepoint" appears not only on a straight line diagram but also on the HTRIS display for an *individual crash*. The original purpose of having this field as part of the individual accident display screen was to allow VSP to continue to use graphic logs, rather than the HTRIS link node referencing system, for the first year of HTRIS operation until VSP had received further HTRIS training. According to VDOT, since the graphic logs are no longer used by VSP, the field "calculated milepoint" as shown on the display for an individual crash serves no purpose and should be removed from the database. It should be noted, however, that in some cases, the variable "calculated milepoint" denotes the distance of the crash from a city, county, or state boundary that intersects the particular route where the crash is located. For the crash described in the preceding paragraph, the field "calculated milepoint" shows the value of 1.48 on the display screen for an individual crash. This is because this crash is located 1.48 miles north of a county boundary.

To further study this phenomenon, seventeen crashes were examined: four that had occurred on the Interstate System, two that had occurred on the U.S. System, four that had occurred on primary state routes (e.g. numbered below 600), and seven that had occurred on secondary routes. Clearly this number of crashes is not enough to verify the accuracy of the half-million crashes reported by HTRIS, but it does provide some insight into HTRIS's referencing system. For all 17 crashes, the milepoint location of the crash reflected by the straight line diagram matched the milepoint location denoted by the node and the associated offset. Thus, at the very least, the 17 crashes showed that nodes, offsets, and locations of crashes defined by the straight line diagrams were indeed consistent. Furthermore the calculated milepoint matched, within 0.01 miles, the distance from the crash to a jurisdictional boundary or end of the road for 11 of the 17 crashes. For the remaining six crashes, however, the calculated milepoint as shown on the display for an individual accident and the distance to the jurisdictional boundary or end of the road were different, although within one mile of one another. These differences are given below:

Crash Location	Difference Between Calculated Milepoint and Jurisdictional Boundary or End of Road (in miles)
I-81 North	0.80
State Route 3	0.16
State Route 3	0.66
Route 621 (Fairfax)	0.56
Route 620 (Fairfax)	0.50
Route 620 (Fairfax)	0.04

Since HTRIS reports over half a million crash records, it is impossible to use these 17 crashes to determine how often the calculated milepoint would correspond to the distance to a jurisdictional boundary. As VDOT no longer uses this field, it is not clear how changes to the roadway would be reflected by the computation of the calculated milepoint. VDOT has indicated that it has requested that DIT remove this field from the display screen for an individual crash.

APPENDIX D:

1992-1993 ALCOHOL DATA

Theoretically BAC tests are administered and recorded in CAP for all fatal crashes. Two data fields are particularly relevant: the data element "BAC" which indicates the results of the alcohol test and the data element "ppd-drinking code" which indicates the law enforcement officer's assessment of the driver's sobriety. For the years 1992 and 1993, it was possible to obtain CAP data for all crashes where the *driver* was killed. (Note that fatal crashes where the driver was not killed are not included in this analysis.) Using these data, the consistency of these two data elements was examined.

Ideally a BAC test should be administered for all fatal crashes. According to the 1992-1993 CAP Data Tape, however, sometimes a test was not administered and sometimes this field was simply left blank as shown in the following table:

Table D1: Summary of Records where a BAC Test Should Have Been Administered

Category	1992	1993	Total Records
BAC test was administered[28]	400	417	817
No BAC test was administered	82	59	141
BAC test field left blank	36	57	93
Total Records	518	533	1051

The other data element is the drinking code. The police officer assigns one of the first five drinking code values to each driver in a crash, while the sixth is assigned if the police officer leaves the field blank:[29]

1 = "not drinking"
2 = "drinking--ability not impaired"
3 = "drinking--effect on ability unknown"
4 = "drinking--ability impaired"
5 = "drinking--obviously drunk"
6 = "not stated"

The drinking code data for 1992 and 1993 are shown in Table 2.

Table D2: Drinking Codes Being Stated or Not Stated for 1992-1993

Category	1992	1993	Total
Crashes where drinking code was stated (value of 1,2,3,4, or 5)	380	411	791
Crashes where drinking code was not stated (value of 6)	138	122	260
Total	518	533	1051

The next question that arises is how do the BAC and drinking code data compare? In order to simplify the presentation of the data, the BACs have been grouped into five categories for the two year period: cases where no BAC test was administered, BAC = 0, BAC between 0 and 0.10%, BAC between 0.10% and 0.20%, and BAC over 0.20%. These groupings are shown in Table 3.

Table D3: Comparison of BACs and Drinking Codes for 1992-1993

Drinking Code	BAC not measured	BAC = 0	0 < BAC <0.10%	0.10% ≤ BAC < 0.20%	BAC≥ 0.20%
not drinking	117	347	15	13	9
drinking--ability not impaired	0	5	2	2	0
drinking--not known impaired	32	13	12	46	43
drinking--ability impaired	3	4	7	11	8
drunk	20	16	4	30	32
not stated	62	114	17	30	37

The data for the 1051 records are available.

APPENDIX E:

LIST OF ATTACHMENTS

These attachments are available separately from the author. As they constitute a four inch stack of documentation, they have not been reprinted here.

1. Charlottesville Police Department (Micro Traffic Records System)

   A. Accident Location Summary

2. Powhatan County Sheriff's Office (Micro Traffic Records System)

   A. Accident Location Summary
   B. General Traffic Accident Summary
   C. General Traffic Summons Summary
   D. Traffic Offenses by Badge Number
   E. Summary of MTRS Usage

3. Fairfax County Police Dept (Case File History Subsystem)

   A. Data Entry Screen
   B. Central Records Section Paper Flow Process Review (1992)
   C. Fairfax County Information Technology Introduction
   D. Fairfax County Pedestrian Crash Overview (1993)
   E. Annual Report CY 93
   F. Top 10 Crash Locations

4. Transportation Safety Training Center (Micro Traffic Records System)

   A. MTRS Sample Outputs
   B. MTRS Version 5.0 Accident Type Definitions
   C. MTRS Instructions for Coding Accident Locations
   D. MTRS Overview and Summary (1991)

5. Arlington County Police Department (laptop computers)

   A. Front of FR-300P Virginia Accident Report
   B. Template of FR-300P Virginia Accident Report
   C. "Pen-Based Computing for Electronic Field Reporting" from the October 1993 edition of *Law Enforcement Technology* (not shown)

6. Department of Motor Vehicles (Citizens Services System and Centralized Accident Processing System)

   A. General Accident Inquiry
   B. General Update
   C. Vehicle Update
   D. Pedestrian Update
   E. Medical Update
   F. Police Officer's Instruction Manual
   G. CAP Record Layout Sheet (2/8/91)
   H. CAP Data Dictionary (6/28/94)
   I. Additional runs from VDOT and DMV for the CAP Tape

7. Virginia Department of Transportation (Centralized Accident Processing System and Highway Traffic Records Information System)

   A. Operator Data Entry Screen
   B. Accident Record Inquiry
   C. Vehicle Record Inquiry
   D. Pedestrian Record Inquiry
   E. HTRIS Crash Record Subsystem Data Dictionary (5/1/92)
   F. User Manual for the Accident Subsystem of HTRIS
   G. HTRIS Notes
   H. "Zone of Impact" Coding Sheet

8. Department of State Police (Centralized Accident Processing System)

   A. Accident Summaries by time of day, day of the week, causative factor, and alcohol involvement
   B. Directed Patrol Locations for 1992-1993
   C. Table of Contents from Revised User's Guide
   D. CAP User's Manual (1992)

9. Department of State Police (Data Summary System and Maintaining, Producing, and Preparing Executive Reports)

   A. Selective Enforcement Directed Patrol Operations Manual (1994)

10. Department of State Police (SafetyNet)

   A. Proposed Supplemental Truck/Bus Accident Report
   B. Current Virginia Supplemental Commercial Motor Vehicle Accident Report
   C. Relevant VSP Memo

11. Virginia Alcohol Safety Action Program (INFERNO I & II)

   A. INFERNO II Data Dictionary (11/9/94)
   B. Biannual Report 1991-1992
   C. VASAP Case Management System Operations Manual (includes INFERNO 1 Data Dictionary)

12. Office of Emergency Medical Services (Trauma Registry and Pre-hospital Patient Care Report)

   A. EMS Trauma Registry Report
   B. Trauma Registry Report Form
   C. Trauma Registry Analysis Documentation
   D. Pre-Hospital Patient Care Report
   E. Trauma Registry Data Dictionary
   F. Reports produced by Q&A software
   G. Licensed EMS Agencies in Virginia

13. Department of Education (TRASER--Pupil Transportation Service)

   A. Traser Crashes Proxy Report
   B. EB-006 Bus Crash Reporting Form and Instruction Packet
   C. PTS Annual Report (1993-1994)

14. Department of Education (no system--driver training)

   A. Insurance Institute for Highway Safety Facts (1992)
   B. DMV's Virginia *Crash Facts*
   C. DOE Newsletter (Winter)
   D. DOE Newsletter (Summer)

15. Department of Corrections (assorted databases)

   A. Virginia Pre/Post Sentence Investigation Database Overview
   B. Overview of Virginia State Criminal Justice Databases
   C. National Crime Information Codes (1992)
   D. Revisions to NCIC (1994)
   E. Virginia Crime Codes

REFERENCES FOR THE APPENDICES

25. Virginia Department of Education. 1994. *Regulations Governing Pupil Transportation: Including Minimum Standards for School Buses in Virginia.* Richmond, Virginia.

26. National Safety Council. 1994. *Accident Facts.*

27. Planning District Commissions (PDCs) often serve as staff for Metropolitan Planning Organizations (MPOs). For purposes of this paper, the distinction between "MPO" and "PDC" is not significant; both represent locally-based organizations that use crash data.

28. Shown as the field "ppd-body-fluid."

29. The actual numbers corresponding to each drinking code are different: e.g. a "2" corresponds to "obviously drunk" while a 3 corresponds to "drinking--ability impaired. A reordering of these drinking codes as done in this paper allows ordinal-based statistical tests to be conducted.