COST ANALYSIS OF VIRGINIA SYSTEM FOR PROCESSING ACCIDENT DATA

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ABSTRACT

Despite over a decade of study and debate Virginia has achieved only nominal progress in developing an adequate system for keeping accident records. The principal obstacle to progress in this area has been the lack of an economic justification for system reforms.

An economic analysis of Virginia's system for processing accident records was requested by the Safety Research Advisory Committee and performed by the Virginia Highway and Transportation Research Council with assistance from the Department of Management Analysis and Systems Development. The objectives of this study were to identify present system costs and deficiencies, determine the economic feasibility of alternative system configurations, and make recommendations for improvements. The study focused on the procedures used to process data extracted from the state FR-300P police accident report form. The flow and usage of these data consume staff and/or computer resources at six agencies: the Division of Motor Vehicles (DMV), the Department of State Police (DSP), the Virginia Department of Highways and Transportation (VDH&T), the Virginia Highway and Transportation Research Council (VHTRC), the Department of Education, Office of Pupil Transportation Services (OPTS), and the Virginia Department of Transportation Safety (VDTS).

In documenting the flow of FR-300P data among the agencies the study team identified numerous operational, administrative and institutional deficiencies. Operationally, the present system is duplicative in at least nineteen areas. This results in accident data which are often incomplete, conflicting, and stale. The administrative and institutional deficiencies identified contributed to or created these operational deficiencies by fostering both interagency tension and resistance to change. These deficiencies were as follows:

Administrative
- No vesting of total system responsibility in a single agency, department, committee, or individual.

Institutional
- Systemwide resistance to change.
- Statutory division of authority for processing and analyzing accident records between the DMV, DSP, VDH&T, OPTS, and VDTS.
- Widespread skepticism that a revised accident records system could meet the informational needs of all agencies in a cost-effective manner and have a positive impact on safety.

Noting that this system cost the Commonwealth approximately $1.06 million in 1980, the study team concluded that Virginia's system for keeping accident records was needlessly inefficient and unnecessarily costly.

The study team proposed an alternative processing system for accident records which meets all of the informational requirements of the involved agencies and produces substantial cost-savings. The recommended alternative is comprised of three essential elements:

1. Consolidation of fragmented, duplicative manual processing functions.

2. Creation and maintenance of a single, fully-edited, direct-access accident file.

3. Agreement between affected agencies concerning the creation, use, and maintenance of the new system.

This alternative yields many direct benefits, including --

1. an overall net reduction of seven clerical positions,

2. a reduction in accident data processing time from 2 or 3 months to 1 week,

3. a significant increase in the quality and uniformity of FR-300P data, and

4. increased flexibility and responsiveness of the accident data processing system in meeting ever-changing informational needs.

Costs of the proposed alternative include --

1. funding for initial system implementation, and

2. loss of some agency autonomy with respect to FR-300P data processing procedures.

The implementation costs of the centralized file alternative are estimated to be $129,500. The payback period, using only personnel cost savings, is expected to be less than 2 years. System development and implementation would require 39 weeks and would not interfere with current accident data processing procedures. The entire cost for developing and implementing this new system may be met with U. S. Department of Transportation §402 highway safety monies.

The study team believes that this recommendation will not only produce more accurate and timely accident data at a significantly reduced cost, but will also provide a solid but flexible foundation upon which to quickly and efficiently integrate future improvements in Virginia's traffic records system.

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INTRODUCTION

Along with the passage of the Federal Highway Safety Act of 1966, and subsequent amendments, has come an emphasis on highway safety planning, administration, and research. In turn, this has led to many new and varied demands on the traffic safety data collected by the state. The data must be more accurate, more timely, more complete, more flexible, and more accessible than ever before. The problems in highway safety planning, administration, and research are essentially information problems. If reliable and useful data are available, then identifying problems, developing countermeasures, and evaluating programs can be accomplished with greater ease and efficiency. Thus if scarce highway safety resources are to be used to best advantage, considerable emphasis should be placed on developing the cornerstone of effective planning -- good quality information systems.

BACKGROUND

Traffic safety officials believe that access to the information maintained in a sophisticated traffic records system is necessary for identifying the array of factors that contribute to motor vehicle accidents. Accident prevention can then be achieved through the implementation of appropriate countermeasures. Thus, experts conclude

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that the development of a comprehensive traffic records data base is a prerequisite for an effective safety program.

During the early years of the national safety program, the development of sophisticated traffic records systems was not considered unrealistic; indeed, in 1967 the National Highway Safety Bureau (now the National Highway Traffic Safety Administration [NHTSA]) promulgated Highway Safety Program Standard 310, which stated in part that:

> Each state, in cooperation with its political subdivisions, shall maintain a traffic records system. The statewide system (which may consist of compatible subsystems) shall include data for the entire state. Information regarding drivers, vehicles, accidents, and highways shall be compatible for purposes of analysis and correlation. Systems maintained by local governments shall be compatible with, and capable of furnishing data to, the state system. The state system shall be capable of providing summaries, tabulations, and special analyses to local governments on request.

Faced with the possibility of losing federal highway safety funds for failure to comply with this and other federal safety standards, the states initiated activity directed toward evaluating and improving their highway safety data systems. In Virginia, this activity included the formation of a traffic records committee by the Highway Safety Division (HSD) in 1970. The committee was charged with responsibility for identifying deficiencies in Virginia's traffic records system, suggesting changes for improvements, and assessing the feasibility of implementing recommended changes. Following a review of the system by a feasibility study team, it was concluded that Virginia had the resources and expertise to develop and maintain an integrated traffic records system which would comply at least with the spirit, if not the letter, of the federal traffic records standard. However, one important element of the feasibility analysis was not satisfactorily addressed -- the economic aspects of an upgraded traffic records system. The costs of the existing system were too difficult to isolate and document at the time, thus no economic comparisons were made between the envisioned upgraded system and the extant system. Regardless, the work of the traffic records committee convinced then Secretary of Transportation Wayne Whitham that there was potential for the development of an economically efficient and productive traffic records system. Secretary Whitman initiated the Virginia traffic records information system (TRIS) project in 1974. The TRIS project, however, stalled at the conclusion of the first phase of the four-phase study when skepticism arose among project participants concerning the economic viability of an integrated traffic records system.

Although it failed to achieve its intended goals, the TRIS project did make management in the agencies involved in Virginia's traffic records system aware of the problems in the system and led to several reforms that have resulted in improvements in the system in recent years. In particular, new separate citizen and police accident report forms were introduced in January 1978 along with streamlined procedures for processing the data captured by them. The result has been a reduction in the time required for processing the crash data reported to the state and modest gains in the efficiency and timeliness of obtaining, reporting, and using accident data.

Regardless, Virginia's traffic records system is plagued today by most of the same ills identified by the traffic records committee feasibility study team almost a decade ago. Consider the findings of the December 1978 NHTSA/FHWA accident data improvement plan study of Virginia's traffic records system. Of the 12 recommendations for improvement made by the NHTSA/FHWA study team, 7 were directed toward the system per se (the other 5 pertained to recommended coding changes or changes in the report form). Each of these 7 recommendations for improvement had also been noted in one form or another in the report of the traffic records committee feasibility study team in January 1973. While it is recognized that progress has been made in Virginia's records system during the decade of the seventies, many problems remain to be addressed, including:

1. Lack of a statutory requirement for police investigation and reporting of accidents exceeding a specified severity threshold.

2. Lack of a statutory requirement for timely submission of police accident reports.

3. Lack of an adequate quality control system to detect and correct accident reports which are incomplete, improperly completed, or that contain erroneous information.

4. Lack of a centralized, automated accident records system, the results of which have been delays and inefficiencies in accident data processing.

5. Lack of an adequate statewide, uniform accident locator system.

6. Lack of adequate training of police officers in the field in accident investigation and reporting techniques.

7. Lack of a generalized, full-file capability to select, retrieve, and analyze accident statistics in a timely and efficient manner.

These deficiencies are not unique to Virginia's traffic records system. Many states have similar if not more severe problems. Yet a number of states have superior systems capable of providing timely and useful traffic records data to anyone who needs them. Although some of the more successful states may have upgraded their systems in response to federal prompting, it is more likely that their top management recognized that their mixture of traffic records system components could be merged into a single, efficient system which would have a positive impact on highway safety. It must be conceded, however, that there is as yet no documented evidence that improvements in traffic records systems have led to reductions in accidents.

In Virginia, opinion is divided on the need for the development and use of a more advanced traffic records system. Some officials believe the present system is adequate to meet the needs of the state traffic safety community. If an agency's needs are not met, the problem is attributed to the agency's underutilization of the system rather than to any deficiency within the system. More important, those in this camp believe that the safety benefits to be derived from a new system are difficult to identify and cannot be justified financially.

An important underlying deterrent to the acceptance of the need for an improved traffic records system is the present system's inherent resistance to change. This resistance is manifested by agencies which are reluctant to forfeit their control of the system or whose needs are adequately met by the present system. On the other hand, the proponents of a revamped traffic records system for Virginia represent those agencies whose needs are not being satisfied. These agencies argue that the system is "underutilized" because it is inefficient and not easily accessible. They believe the present system's apparent inefficiency is ample evidence of the need for a new system, and that tangible safety benefits will be indirectly derived through effective management use of the outputs of an improved system.

PURPOSE

Since the TRIS project became inactive in 1976, research in the traffic records area has been confined principally to the activities of the Safety Group of the Virginia Highway and Transportation Research Council (VHTRC), with oversight by the Safety Research Advisory Committee (SRAC) and the Virginia Department of Transportation Safety (VDTS). In an attempt to resurrect interest in redesigning Virginia's

traffic records system, the SRAC made the following recommendations at its meeting of May 2, 1979:

> In view of continuing uncertainty about the current costs of the state traffic records system, and further uncertainty over both the costs and benefits of alternative approaches to reform of the system, a detailed cost estimation study should be undertaken. A proposal for such a study should be prepared by the Research Council and submitted to the Director of the Department of Transportation Safety and Secretary of Transportation for review and approval.

As a result of this recommendation, a working plan for such a study was prepared in the fall of 1979 by analysts from the VHTRC and the Department of Management Analysis and Systems Development. The purpose of the study was stated in the working plan as follows:

> The major objective of this study will be to conduct a thorough economic evaluation of Virginia's system for reporting, recording, and retrieving data on highway accidents. In particular, the study will (1) compare the costs of the existing system against the costs of an alternative system, and (2) recommend modifications to the present system that will make it more cost-efficient and effective. A number of questions must be answered in the course of the study. These are:
>
> 1. What are the component parts of Virginia's system for keeping accident records?
>
> 2. How does the system operate?
>
> 3. How much does it presently cost the state to collect, code, enter, edit, process, store, maintain, and distribute accident data extracted from the FR-300P police accident report form once it is received at the state level?
>
> 4. Which processes and procedures in the current record-keeping system contribute to cost inefficiencies, inaccuracies, and delays in making available the accident data found on the FR-300P?
>
> 5. Given that some such processes and procedures will be found, what could be done to eliminate them?
>
> 6. What would be the cost of alternative methods of collecting, coding, editing, storing, maintaining, and distributing the accident data extracted from the FR-300P?

It is hoped that the results of this study, presented here, will demonstrate whether there is a need for upgrading or reorganizing the traffic records system, as well as justify any cost increase associated with proposed changes. Also it is hoped that the study will assist upper level management in determining the priority of the traffic records system among the state's transportation safety programs.

SCOPE

While the term "traffic records" denotes a far wider range of information than the data captured on the FR-300P,* for the purpose of this study traffic records is synonymous with "accident records", specifically those accident records containing data reported on the FR-300P. This redefinition of traffic records was necessary to limit the scope of the study to manageable proportions and to focus on what some believe to be the heart of Virginia's traffic records problem -- multiagency handling of the FR-300P data.

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*A state's system for keeping accident records is but a part of a larger information system commonly referred to as the traffic records system. It is generally agreed that, at a minimum, a traffic records system includes subsystems for recording, storing, retrieving, and updating driver licensing records, vehicle registration and titling information, descriptive information on reported accidents, and data describing the physical characteristics of the state's roadways. Other information systems termed "traffic records" subsystems are those that contain data on motor vehicle inspections, traffic law violations, traffic flow, and the performance of emergency medical services and driver education programs. In an ideal traffic records system all these subsystems would be linked in such a manner that information found in one system could be directly coupled with related information in another. For example, it would be possible to select an accident from the accident file and follow the chain of links to other files to find out anything about the accident, including inspection history of the involved vehicles, average traffic volume at the accident site, accident history of the involved drivers, time of arrival and departure of emergency medical services vehicles called to the scene, offenses charged to involved drivers and their disposition, etc.

This report focuses primarily on the activities of the Division of Motor Vehicles (DMV), Department of State Police (DSP), and Virginia Department of Highways and Transportation (VDH&T) related to the processing of the accident data extracted from the FR-300P. In addition, it discusses the activities of a number of smaller state agencies related to the acquisition and manipulation and distribution of accident data.

The study follows the flow of accident data among the involved agencies from receipt through their storage and distribution. The cost of using these data once they have been made available is not considered.

Inaccuracies in the data contained in state accident files is a concern only to the extent that they result from the present data entry, editing, and file-building procedures. Although it is known that problems are being experienced with the administration of the accident report form in the field because of the submission of inaccurate or incomplete forms to the state, for the purpose of this study the quality of the accident data being received at the state level is not analyzed.*

Although many Virginia localities process and maintain accident data taken from the FR-300P, the costs associated with their systems are not considered here.

In proposing an alternative accident records system configuration, it is assumed that the FR-300P will remain unchanged; thus no analysis is made of the requirements for the data recorded on it. Also, to the extent possible, the alternative accident data system proposed is respectful of current statutory requirements.

METHODOLOGY

The information gathered for this study was obtained through interviews with personnel in the following state agencies:

1. DMV
2. DSP

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*See Accuracy of Virginia Accident Data, Hargroves, B. T. and Hargroves, J. M., Virginia Highway and Transportation Research Council, September 1981, for a discussion of accuracy problems in Virginia accident data.

3. VDH&T

4. VDTS

5. VHTRC

6. Department of Education -- Office of Pupil Transportation Service (DOE-OPTS)

7. Department of Education -- Driver Education Services (DOE-DES)

8. Department of Health -- Bureau of Emergency Medical Services (DOH-BEMS)

9. State Corporation Commission (SCC)

Formal interviews were held with 17 individuals, in addition to numerous conversations with others in the course of the agency reviews.

For each agency, the information compilation process involved the following procedures:

1. Interview highest ranking supervisor with responsibility for accident processing activities. Determine scope of activities.

2. Identify processes involved in processing accident records, and their sequence. Prepare flowchart.

3. Identify personnel involved in processing accident recrods, and proportion of their time devoted to those duties.

4. Identify and prorate non-personnel resources expended on accident processing.

5. Determine costs for each of the following components:

   a. Personnel: For each job title a personnel cost was derived using the formula

      Cost = Annual salary[(a)] + fringe benefits[(b)] x no. of employees x pct. time.

(a) Annual salary = Salary of employee at step 5 in state pay classification scheme for given grade.

(b) Fringe benefits computed as 25% annual salary, except that those for DSP uniformed personnel were computed at 30% due to differences in retirement contributions and benefits.

b. Computer: Usually provided by the agency's data processing department. Estimates were made when data were not available. Costs include machine resource utilization costs and hardware lease/rental/maintenance costs.

c. Indirect: Includes light, heat, power, building maintenance, clerical, indirect supervision, etc. Calculated by taking 10% of salaries (excluding add-on for benefits). Variabilities in availability of detailed data forced use of this estimation technique.

d. Miscellaneous: Other identifiable costs not categorized by the above.

6. Compile cost components.

All costs shown in this report reflect the accident processing system as it functioned in calendar year 1980.

ORGANIZATION OF REPORT

This report is divided into two major sections. The first describes and evaluates the existing accident processing system in Virginia. It gives a generalized overview of the accident processing procedures, an agency-by-agency description of accident processing and its costs, a discussion of the deficiencies observed by the study team, and a cost summary of the activities observed. The second section describes and evaluates an alternative to the present accident processing procedures used in Virginia, including a description of the requirements to be met by the alternative proposed, a functional description of the alternative, a discussion of the sources of savings to the Commonwealth if the alternative is implemented, an estimate of the costs of developing the alternative, and final recommendations.

OVERVIEW OF ACCIDENT PROCESSING PROCEDURES USED IN VIRGINIA

Virginia's system for keeping accident records embodies the activities of public-safety-oriented agencies at both the state and local levels. Each organization has set up systems to process, record, analyze, and distribute crash data in a format consonant with its information needs.

Agencies that process crash data in Virginia include:*

1. Local police
2. Local traffic engineering offices
3. DMV
4. DSP
5. VDH&T
6. VDTS
7. DOE-OPTS
8. VHTRC

Figure 1 is a flowchart of the passage of crash data through the state accident records system. Data enter the system via two forms: the FR-300C citizen accident report form and the FR-300P police accident report form. Virginia law requires any motorist involved in a motor vehicle accident involving death, personal injury or damage to attended property to report the occurrence immediately to police authorities having jurisdiction (Va. Code §46.1-399 and §46.1-176).** Police authorities are not required by law to investigate a citizen reported accident regardless of the severity of the accident; however, it is believed that most accidents reported to the police are investigated.*** Virginia law requires every investigating police officer to complete and submit an FR-300P police accident report to the DMV for each reportable accident within 24 hours of the close of his investigation (§46.1-401). In certain cases, motorists are also required to notify the DMV of the

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*At the outset the DOH-BEMS, the DOE-DES, and the SCC were identified as potential accident processing agencies. However, interviews revealed that while these agencies do use accident statistics, none of them process FR-300 data.

**Where no death or injury results from a motor vehicle crash but unattended property is damaged, the driver must notify police authorities within 24 hours.

***Traffic records officials estimate that reports are received for 85 to 90 percent of the accidents which occur. (NHTSA/FHWA Accident Data Improvement Plan., Feb. 1980, p. 3.)

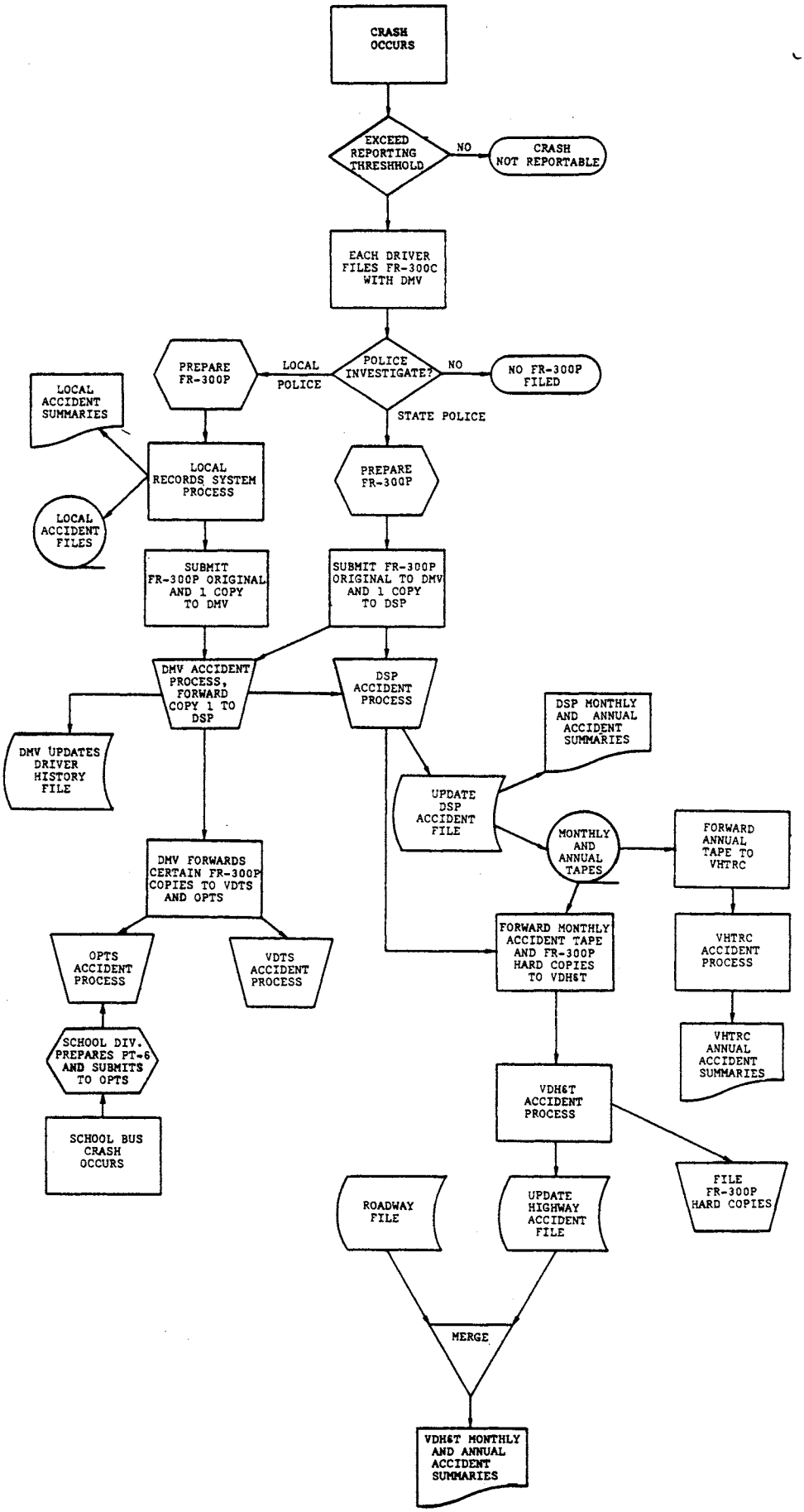

Figure 1. Flow of data through the state accident record system.

occurrence of an accident and to provide proof of financial responsibility.* This is accomplished by the completion of the FR-300C citizen accident report form, which is to be filed within 5 days following the accident.

The FR-300P is a four-part form consisting of an original and three carbons. If the investigating police officer is a state trooper, the original of the FR-300P is forwarded to the DMV, while the first copy is sent directly to the DSP for processing. All other police agencies submit both the original and the first copy to the DMV. For all reports submitted by local police agencies, the DMV forwards the first copy to the DSP for processing. The second and third copies are retained by the submitting police agency and the investigating officer, respectively, for reference. In many localities the second copy is coded and processed by the local accident records system. Usually this system is overseen by the local police agency or traffic engineer. The second copy is generally kept on file in the local police agency so that copies can be made available to the involved parties or their authorized representatives.**

At the DMV copies are made of accident reports for all fatal accidents and forwarded to the VDTS. Also, copies of police reports of accidents involving school buses are sent to the OPTS. The OPTS also receives and processes its own accident report (Form PT-6), which is similar in content to the FR-300P. PT-6s are filed by local school division superintendents for all school bus accidents regardless of the level of severity.

The DMV extracts certain items from portions of both the FR-300C's and FR-300P's and updates each motorist's driving record on the automated driver history file (DHF). The original copies of both forms are disposed of, but microfilm records of both are retained indefinitely. The processing of FR-300Cs terminates at this point.

The DSP codes, enters, edits, and processes the bulk of the data on the FR-300P and serves as the Commonwealth's center for descriptive accident statistics. For accidents occurring on state maintained

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*Va. Code 46.1-400 -- Drivers involved in a motor vehicle accident involving death, injury, or property damage to an apparent extent of $350 or more shall make a written report to the DMV.

**For more information on traffic records processing at the local level see "Traffic Records Needs of Virginia's Localities," F. N. Lisle, VHTRC, 1975.

highways, DSP coders attempt to pinpoint accident locations on a set of roadway logs furnished by the VDH&T and encode information describing the location. This information is appended to the data extracted from the FR-300P. Monthly and annual accident summaries are produced from the accident file generated at the DSP. The DSP also prepares monthly and annual crash tapes, which are sent to the VDH&T and VHTRC, respectively, for further processing.

The VDH&T restructures, edits, and processes the DSP monthly crash data and creates a subfile consisting only of highway accidents. This file is merged with certain information in the VDH&T roadway file to produce a series of monthly, quarterly, and annual reports keyed to accident locations. This information is used in traffic engineering and safety improvement studies and evaluations.

The VHTRC processes the DSP's annual crash tape to prepare accident summaries for each locality, the Virginia Alcohol Safety Action Program (VASAP), the DES, and local transportation safety commissions. This information is used by these groups in planning, administering, and evaluating local and state safety programs.

In summary, Virginia's accident record system consists of the activities of six state agencies that process crash data on four computer systems, with each agency manipulating the crash data in a manner tailored to its information needs. To more fully describe accident record keeping in Virginia, each agency's activities are detailed along with their costs in the following section of the report.

THE VIRGINIA DIVISION OF MOTOR VEHICLES' SYSTEM FOR PROCESSING ACCIDENT DATA

The major responsibility of the DMV is the administration of the state driver services and vehicle services programs. The components of the former are driver improvement, driver licensing, and financial services related to accident insurance claims. The vehicle services program maintains information on automobile titles, registrations, and dealers.

Under the Code of Virginia, the DMV is charged with the "administration of the motor vehicle license, registration and title laws, the issuance, suspension and revocation of operator's and chauffeurs' licenses, the examination of applicants (for such licenses), ... and the administration of the fuel tax laws." (§46.1-25)

The DMV is responsible for coordinating the collection of accident reports from both involved citizens and investigating police officials

(§46.1-400(a) and 46.1-401) and for the enforcement of reporting requirements (§46.1-400(b) and 46.1-405).

The DMV is also responsible, under §46.1-403, for preparing and supplying accident report forms for use in complying with §46.1-400(a) and §46.1-401.

Finally, §46.1-410 requires the DMV to furnish copies of accident report forms to certain individuals upon request.

The DMV processes approximately 130,000 FR-300Ps and 250,000 FR-300Cs each year.

Resources

The DMV's driver and vehicle data base systems, along with their administrative processing needs, are maintained in-house by a staff of 45 systems and applications programmers and engineers.

The DMV's financial responsibility unit processes all accident data at the agency. Organizationally situated within the Driver Services Administration, the accident processing section is composed of 34 clerks, 20 data entry personnel, 3 photo equipment operators, and a supervisory staff of 7 (see Figure 2).

The DMV uses the computer facilities of the Department of Computer Services' (DCS) West Broad St. Center in Richmond.

Process

To carry out its mandate, the DMV maintains a driver history file that contains information on the status of each of 3,500,000 licensed drivers in Virginia. One of the components of each driver's record is called the accident trailer. It is appended to each driver's record for each accident in which he is involved and is retained on file for 40 months for a reportable accident and 12 months for a non-reportable accident.

The accident trailer has two components for most accidents, one corresponding to the crash report submitted by the driver or vehicle owner and one corresponding to the crash report (if any) submitted by the investigating police officer. The primary functions of the police report component of the trailer are (1) to serve as a cross reference to the microfilm record of the accident report so that the associated FR-300P could be retrieved and (2) to serve as a validity check on driver reporting of motor vehicle crashes.

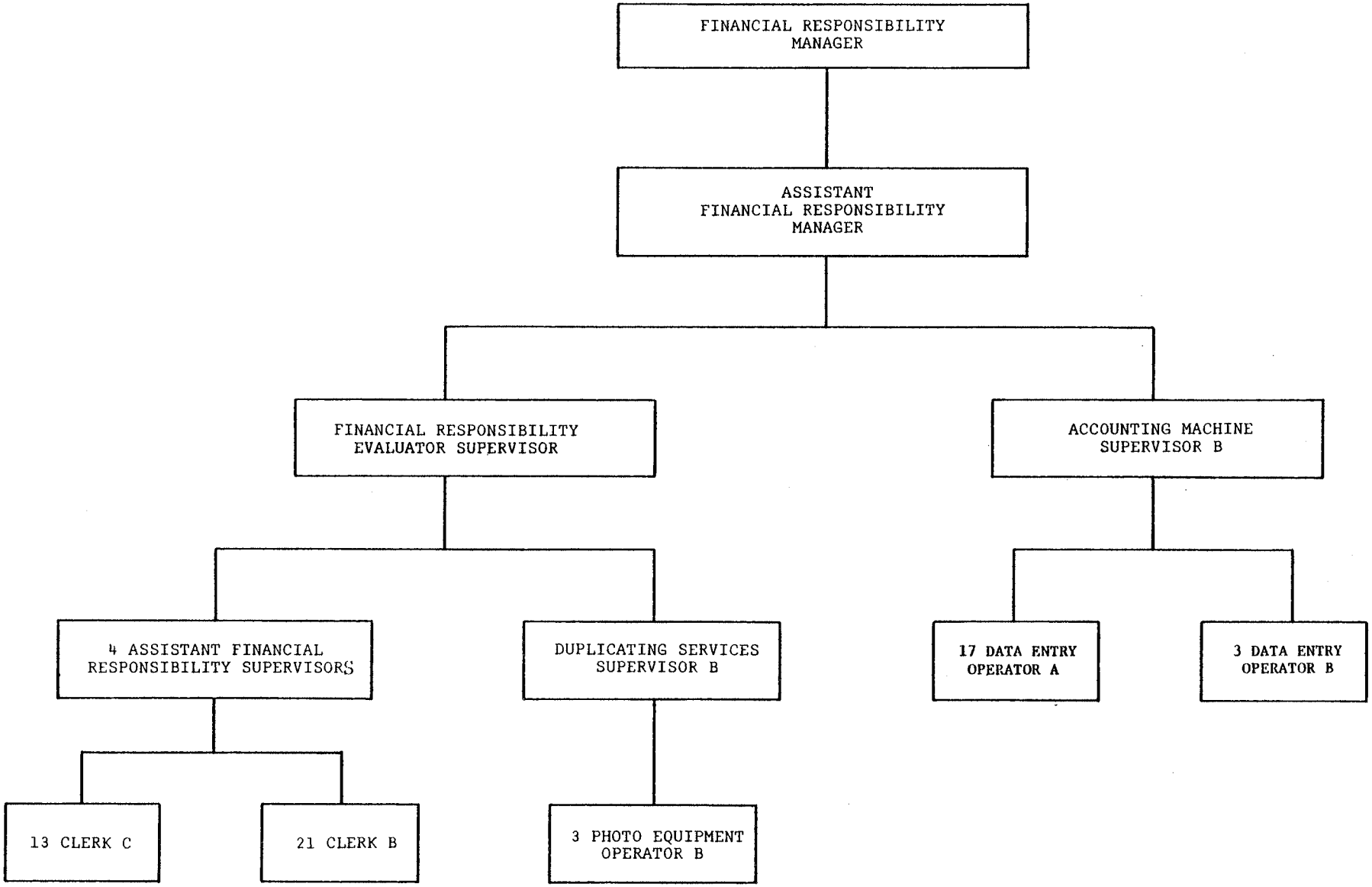

Figure 2. Department of Motor Vehicles organization chart Financial Responsibility Section.

The DMV receives FR-300Cs from citizens involved in reportable accidents and FR-300Ps from DSP field divisions and local police agencies. The reports are received at the DMV central mail room daily and forwarded to a mail clerk in the accident processing section. The accident processing section is subdivided into four regional work centers, each responsible for processing reports for accidents occurring in one of four geographic divisions. The mail clerk sorts the FR-300Cs and FR-300Ps into four groups according to the locale in which the accident occurred and delivers them to the corresponding regional work center for processing. The state police copy of all FR-300Ps received from local police agencies is separated from the original and sent to the DMV central mail room for delivery to the DSP. Photocopies are made of the original report in cases where the second copy is not submitted by the local police agency. Photocopies are also made of FR-300Ps for certain types of accidents (those involving fatalities, school buses, or certain armed services personnel) as part of cooperative arrangements with certain outside agencies and are forwarded to these agencies daily. The 34 clerks arrange reports in month and date order and review them for the presence of certain required entries. Applicable portions of reports are highlighted for accidents in which the circumstances indicate that the drivers or vehicle owners should be treated as special cases (e.g., cases involving foreign diplomats, out-of-state drivers or owners and accidents occurring on private property).

Reports which appear to be complete are forwarded to the DMV microfilm work center daily, where they are assigned document numbers and microfilmed. The microfilm records are retained indefinitely (current records date back to 1971). The report originals are returned to the regional work centers in the accident processing section. They are in turn forwarded to data entry for entry of certain data items in the DMV's automated DHF via on-line video terminals (CRTs). (Note that data from both the FR-300C and FR-300P are entered on the DHF for each driver for each accident.)

For incomplete reports, clerks attempt to correct wrong entries or supply missing required information on both the FR-300Ps and FR-300Cs by obtaining data, if possible, from the DHF. Drivers, vehicle owners, or both, whose reports cannot be completed by this procedure are notified by the DMV to submit a proper report. However, police agencies which submit incomplete reports are rarely pursued for supplemental information.

In about 2 percent of the accidents investigated by police (about 2,000 annually) a supplemental FR-300P is submitted to the DMV indicating corrections or additions to previously submitted reports. In these cases both forms are processed individually; however, the microfilm record of the supplemental report contains a reference to the document number of the initial report. The DHF shows the document

number of the supplemental report along with the most current version of the FR-300P data.

Following entry of the data on the DHF, the reports are filed in each regional work center by date and alpha order according to the driver's last name. After 25 days, the full set of reports for accidents occurring on a particular date are pulled to be matched and reviewed to determine if all drivers have filed reports as required by law. Following the matching procedure, a clerk checks the DHF to determine if the required information is correctly recorded for each driver for each accident case. Incorrect entries are deleted and the correct information is written on the file. Also, missing entries are completed if the data are known.

Accident cases for which all acceptable reports have been received are closed and are indicated as such by the entry of a special code in the accident trailer in each driver's record. The reports for these accidents are disposed of since a microfilm record already exists. If, after the matching and review process, it is determined that a driver or vehicle owner has not filed a report, he is notified by mail of his obligation and the consequences of noncompliance. If the report is not received by the tenth day from the date of notification, a second letter is mailed. In general, no efforts are made to pursue police officers for suspected missing reports. Accident cases for which reports are missing or are unacceptable remain open and are indicated as such by the entry of a special code on each driver's record. The reports for these cases are retained in an open case file pending receipt of the required reports. Approximately 55 days after a particular accident date, the open cases are pulled and reviewed to determine if an order of suspension needs to be issued. If so, the files are updated and forwarded to the order issue work center for appropriate action. Reports for those open cases are retained in a suspension file until the driver or vehicle owner restores his unencumbered status. Eventually, most of these cases are closed and the reports destroyed. However, some remain open in the suspension files indefinitely.

Timing

Most accident reports are received from the field within 15 days from the date of the accident. While the DMV may retain accident reports in its files for a number of weeks, the data from the forms are processed in a matter of days. Once received at the accident processing section, typically, an accident report is reviewed, edited, and coded in one day, microfilmed the next day, and the required data are entered on the DHF on the fourth day. Following these procedures, the form is retained on file for about 25 days awaiting the matching and case review

process. The form may be retained indefinitely afterwards, depending on the status of the accident case with which it is associated.

The flow of DMV accident data processing activities is depicted in Figure 3.

Cost Determination

Since the DMV processes both FR-300Cs and FR-300Ps similarly, it was impossible to distinguish functions and resources which could be unambiguously associated with FR-300P processing. In order to estimate FR-300P processing costs, costs for processing all forms were estimated and then prorated by the ratio of the average annual number of FR-300Ps processed divided by the average annual total number of FR-300Ps and FR-300Cs processed. This ratio amounted to a factor of 0.34, which was applied to the total cost figure to arrive at a realistic estimate.

Personnel involved in accident processing were identified along with their time commitments by DMV financial responsibility section supervisors. Personnel costs are shown in Table 1 and a summary of all costs is given in Table 2.

Computer costs were derived from monthly billing summaries of the costs associated with updating the DHF accident trailer and costs of monthly disk space rental along with the maintenance/lease costs of DMV owned/leased peripherals. Lacking data for both personnel and equipment costs for accident processing's share of system maintenance, an estimate of 10 percent of the computer charge was included as a miscellaneous item.

In all, the DMV expends approximately $299,100 processing FR-300Ps each year.

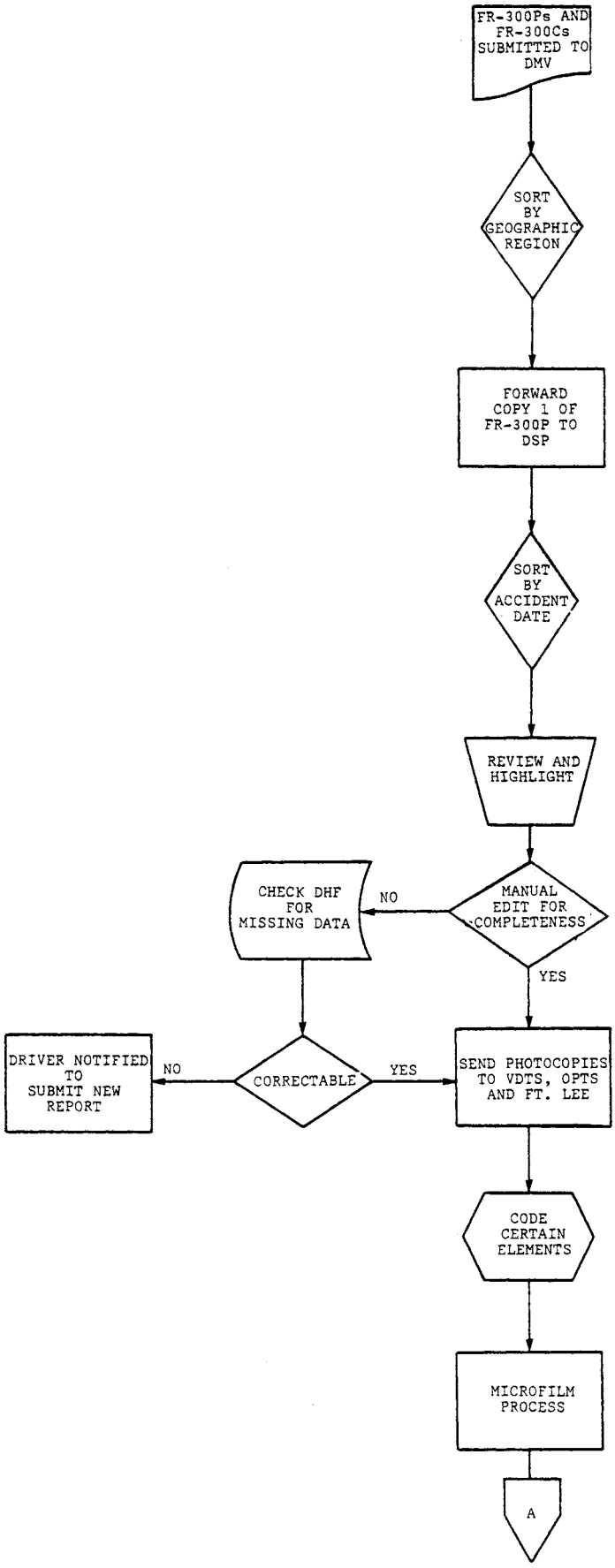

Figure 3. Department of Motor Motor Vehicles flow of accident data processing.

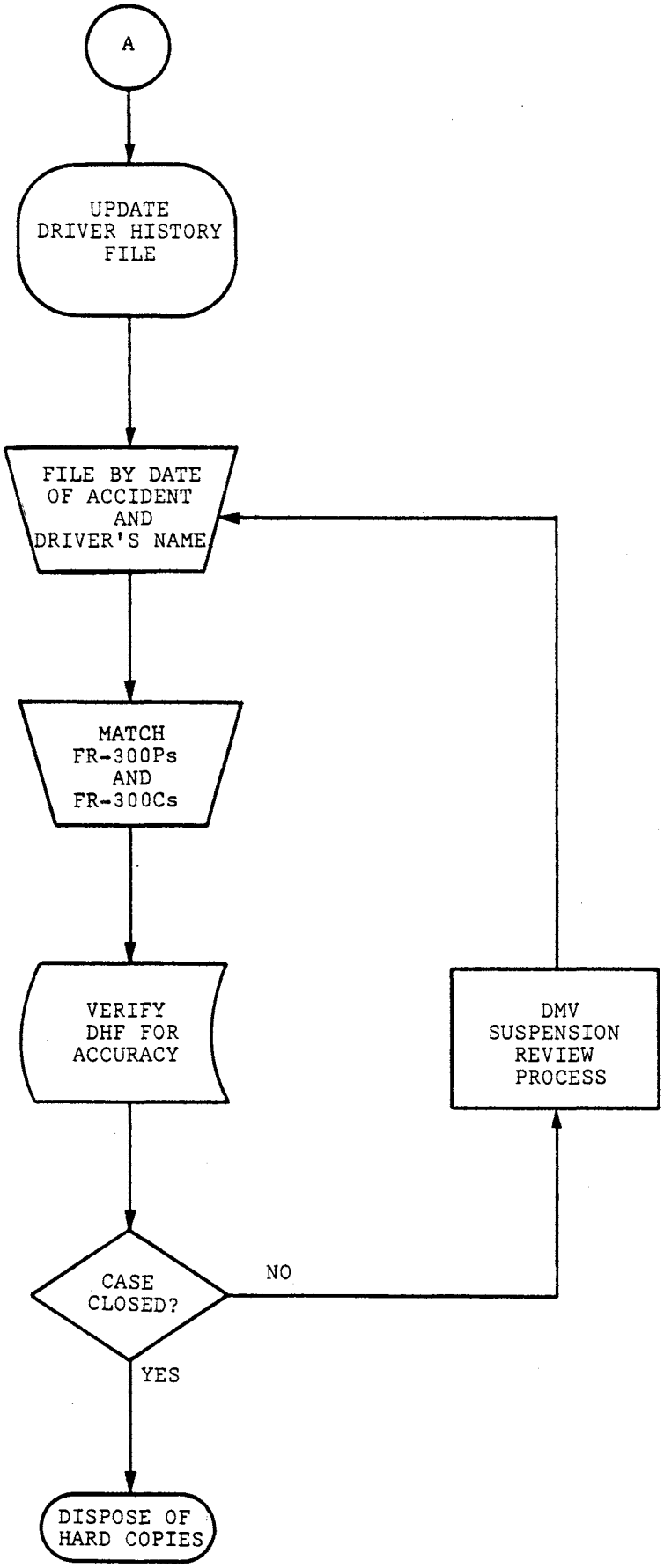

Figure 3. Continued.

Table 1

Calculation of Annual Cost of Accident Data Processing
at Virginia Division of Motor Vehicles

Personnel Costs

Position Title (Activity Type)	Grade	Annual Salary (At Step 5) Plus Fringe Benefits*	Pct. Time	No. Emp.	Total Cost
Financial Responsibility Evaluator Supervisor (Supervisory)	8	$ 18,338	100%	1	$ 18,338
Financial Responsibility Evaluator Supervisor Assistant (Supervisory)	7	16,775	100%	4	67,100
Clerk C (Clerical)	4	12,838	100%	13	166,894
Clerk B (Clerical)	2	10,750	100%	21	225,750
Duplicating Services Supervisor B (Supervisory)	6	15,350	15%	1	2,303
Photo Equipment Operator A (Clerical)	4	12,838	20%	3	7,703
Accounting Machine Supervisor B (Supervisory)	8	18,338	85%	1	15,586
Data Entry Operator B (ADP)	5	14,038	10%	1	1,404
Data Entry Operator B (ADP)	5	14,038	60%	2	16,846
Data Entry Operator A (ADP)	4	13,025	98%	17	216,996
Subtotal					$ 738,920

*Fringe benefits are 25% of annual salary.

$$\frac{\text{Avg. No. FR=300Ps}}{\text{Avg. No. Total Reports}} = \frac{137,123}{399,584} = 0.34 \times \$738,920 = \$251,232$$

Table 2

Summary of Costs

Computer Costs:

Update to DHF Accident Trailer	$58,600
Disk Usage DHF Accident Trailer	3,800
Terminal Rental/Maintenance	
12 IBM 3790 CRTs at $325/yr.	3,900
1 Communications Controller	8,000
	$74,300
x	0.34 Multiplier
	$25,262

Note: Costs of microfilming and photocopying are included within the indirect costs.

Indirect Costs:

10% of Salaries (before fringe benefits)

0.10 x $591,113 = $59,113 x 0.34 (Multiplier) = $20,098

Miscellaneous

Computer System Maintenance (personnel and equipment) $2,500.
(10% of computer costs)

Recap (rounded to the nearest hundred dollars)

Personnel	$251,200
Computer	25,300
Indirect Costs	20,100
Miscellaneous	2,500
Total	$299,100

THE VIRGINIA DEPARTMENT OF STATE POLICE'S SYSTEM FOR PROCESSING ACCIDENT DATA

The Code of Virginia invests certain responsibilities in the DSP for the collection, tabulation, and distribution of motor vehicle crash data, in effect designating the DSP as the Commonwealth's central accident data processing agency. Specifically, the Code requires the DSP to "tabulate and analyze all accident reports and ... publish annually, or more frequently, statistical information based thereon as to the number and circumstances of traffic accidents," (§52-4.2(a)). Further, "based upon its findings, after analysis the Department may conduct further necessary detailed research to determine more fully the cause, control and prevention of highway accidents" (§52-4.2(b)).

In carrying out its responsibilities under §52-4.2, the DSP maintains an accident data base derived from all FR-300Ps to meet its law enforcement and traffic safety information needs. These data are accessed by the DSP for routine purposes as well as for special studies of fatal accidents, accident locations, etc. The data are also made available by the DSP to the VDTS, VDH&T, VHTRC, and other traffic safety agencies for use in the production of a variety of accident summaries.

The Code requires the DSP to furnish copies of accident reports to certain individuals upon request (§46.1-410), but in practice these requests are satisfied by the DMV.

The DSP processes approximately 130,000 FR-300Ps each year.

Resources

Data processing services are provided by a staff of 11 systems analysts and applications programmers, 7 computer operators, and 29 data production and control personnel, all supervised by the ADP manager. Accident data preparation, coding, and logging functions are performed by a staff of 17 clerks supervised by the assistant records and statistics officer (see Figure 4).

The DSP supports its data processing needs with in-house computer facilities.

Process

When received in the DSP mail room, the FR-300Ps are delivered daily to the Records and Statistics Division's collating section. Clerks in the collating section first sort out all reports for fatal accidents so that certain statistics can be tabulated manually for

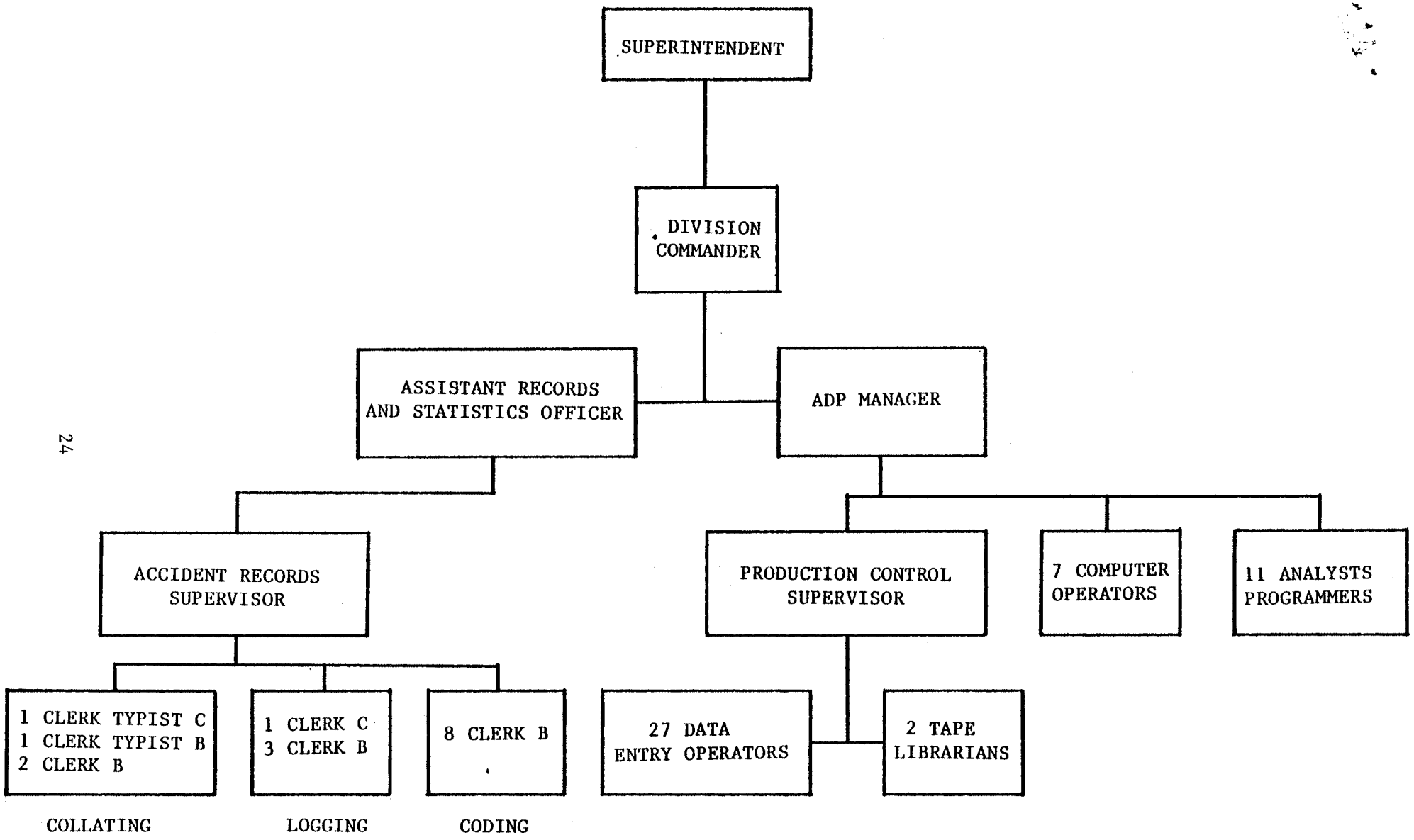

Figure 4. Department of State Police organization chart.

monitoring the state's fatal accident experience. Reports of accidents occurring in highway work zones are pulled, photocopied, and forwarded to the VDH&T as part of a cooperative arrangement to assist the VDH&T in a special safety study.

Photocopies are made of FR-300Ps for fatal crashes and forwarded to the DSP's fatal accident reporting system (FARS) analyst. The FARS analyst uses the FR-300P and other data sources to complete an NHTSA fatal crash report form. The data from the form are entered by the analyst on the FARS via a remote terminal located at the DSP.

All accidents are then sorted by location into one of four groups:

1. Rural accidents (counties only)

2. Small city (under 10,000 population) accidents

3. Large city (over 10,000 population) accidents

4. City interstate accidents

The sorted accident reports are delivered in batches to the clerks in the logging section, where the exact locations of accidents are pinpointed, where possible, on a set of paper roadway logs (graphic logs). The graphic logs cover only a portion of the state's highway network -- the interstate, arterial and primary systems, and certain of the most heavily travelled sections of the secondary roadway system -- thus a significant fraction (about 60%) of reported accidents cannot be logged. For those crashes that can be located on the logs, codes corresponding to the accident site are recorded in a data block printed on the reverse side of the FR-300P. At the same time, logging clerks indicate the location and severity type (fatal, injury, or property damage) by pencil notation along a graduated scale on the margin of each log sheet. When five or more crashes occur at one site in a calendar year, the logging clerk completes a file card indicating the location, severity, and dates of those accidents and forwards it to the DSP safety division commander for review and possible remedial police action. (This information may in some cases reach the VDH&T for safety engineering review and action.) The VDH&T updates the graphic logs and furnishes the DSP with a new set each year. Old logs are returned to the VDH&T for storage and reference. Occasionally, the graphic logs are revised at midyear; however, this practice is discouraged because of the difficulties it introduces in reconciling codes for locations of accidents occurring before and after the revision.

Following the logging operation all reports are returned to the collating section where each is stamped with a unique six-digit number corresponding to the order in which that report was received by the DSP

in the current calendar year. The 4 collators deliver the reports to the coding section where the items on the face of the report are reviewed by the 8 coders and assigned numerical codes where appropriate. All items on the report face are coded except the information shown in the investigating officer's accident diagram and personally identifying data describing the parties involved in the accident, witnesses, and owners of damaged property. Obvious errors are corrected by the coders but the investigating officer's entries are otherwise allowed to stand.

Coded reports are forwarded daily to the DSP's production control unit where the information is entered on diskettes via key-disk video terminals. At any given time, two terminals and their operators are dedicated to accident data entry. When possible, production control personnel verify 100% of the accident data prior to submission to the DSP's data processing section. Each week the diskettes are transferred to a magnetic tape that is run against an error checking program on the DSP's computer. Records which fail the edit are flagged and rejected, while records that pass are retained and stored on tape. A listing of the records in error is returned to the data entry unit for correction, rekeying, and resubmission of the data as before.

Supplemental FR-300Ps are handled slightly differently. When a supplemental report is found by a collating clerk, a search is made for the corresponding initial report. When found, the two are clipped together. In most cases, location of the initial report is simple because supplemental reports usually follow submission of the initial report by only a few days. Therefore, the initial report is still in the DSP processing pipeline and can be tracked down. The combined reports are processed as one until they reach the coding section. Clerks cut out the revised portions of the supplementary report and paste them over the corresponding portions of the initial report. After that, the now hybrid form is processed like all others. In a few instances supplemental reports are received several weeks after the corresponding initial report has been processed. In these cases, the now computerized record for that crash must be located and purged or updated. If the hard copy of the initial report is still in-house, it is located and attached to the supplemental.

At the beginning of each month a set of computer programs are run to process the data stored on the weekly tapes during the previous 30 days. First, a disk file of the monthly data is created from the weekly tapes and written over that of the previous month. From this file a monthly crash report is produced for circulation within the DSP and the VDTS. Second, a tape of all accidents processed during the month is prepared for delivery to the VDH&T. (Also sent to the VDH&T are the associated FR-300P hard copies accompanying each monthly tape.) Finally, the data for the month are written to a cumulative file of all

accidents reported to the DSP in the current calendar year and stored on magnetic tape.

Following the close of the calendar year, the cumulative accident file is processed to produce (1) the tables for the DSP's annual crash facts publication, (2) a pedestrian accident report for the American Automobile Association, (3) an annual route study report, and (4) a magnetic tape of the full accident file for the VHTRC.

Once the annual crash data have been produced in table form by the DSP data processing section (usually sometime around the first of March), the DSP accident records supervisor coordinates the compilation and updating of the charts and tables for the annual Crash Facts publication. Shortly thereafter, the prototype of the Crash Facts document is sent to an outside contractor for printing and publication of about 5,000 copies. Approximately 60 days later the document is distributed by the DSP to a variety of local, state and national safety organizations.

Timing

Usually, the FR-300Ps received at the DSP Headquarters pass through the collating, logging, and coding sections within 5 days of the DSP mail receipt. It could be up to a week or more before the data pass through the entry, verification, and edit functions in production control and are stored on the weekly magnetic tape. It could be up to 3 weeks later before the data are subjected to the monthly process (which is the point where the data can be considered usable). The goal of the DSP is to have the data for 80% of the reports for accidents occurring in a given month available for use by the 20th of the following month. The attainment of this goal is dependent upon the volume of reports received at the DSP, the level of competing computer resource demands at the DSP, and on the promptness shown by police officers in the field in completing and submitting their accident reports. In summary, it is likely to take anywhere from 2 to 6 weeks for the data for a particular accident to be processed and appear in the DSP computer files in final form. By that time the data are a minimum of 5 to 9 weeks old.

The entire flow of DSP accident data processing activities is depicted in Figure 5.

Cost Determination

Since the DSP processes only FR-300Ps, costs for all manual data preparation and entry functions were determined directly from a simple head count of involved personnel.

Computer costs, on the other hand, were extremely difficult to determine since the DSP has no accounting mechanism for allocating the costs of data processing services among their users. An estimate of $1,000/month was provided by DSP officials. An additional cost of $100/month was added to account for the lease/maintenance costs of two data entry terminals.

Total estimated annual DSP accident processing costs were $288,400. Details are given in Tables 3 and 4.

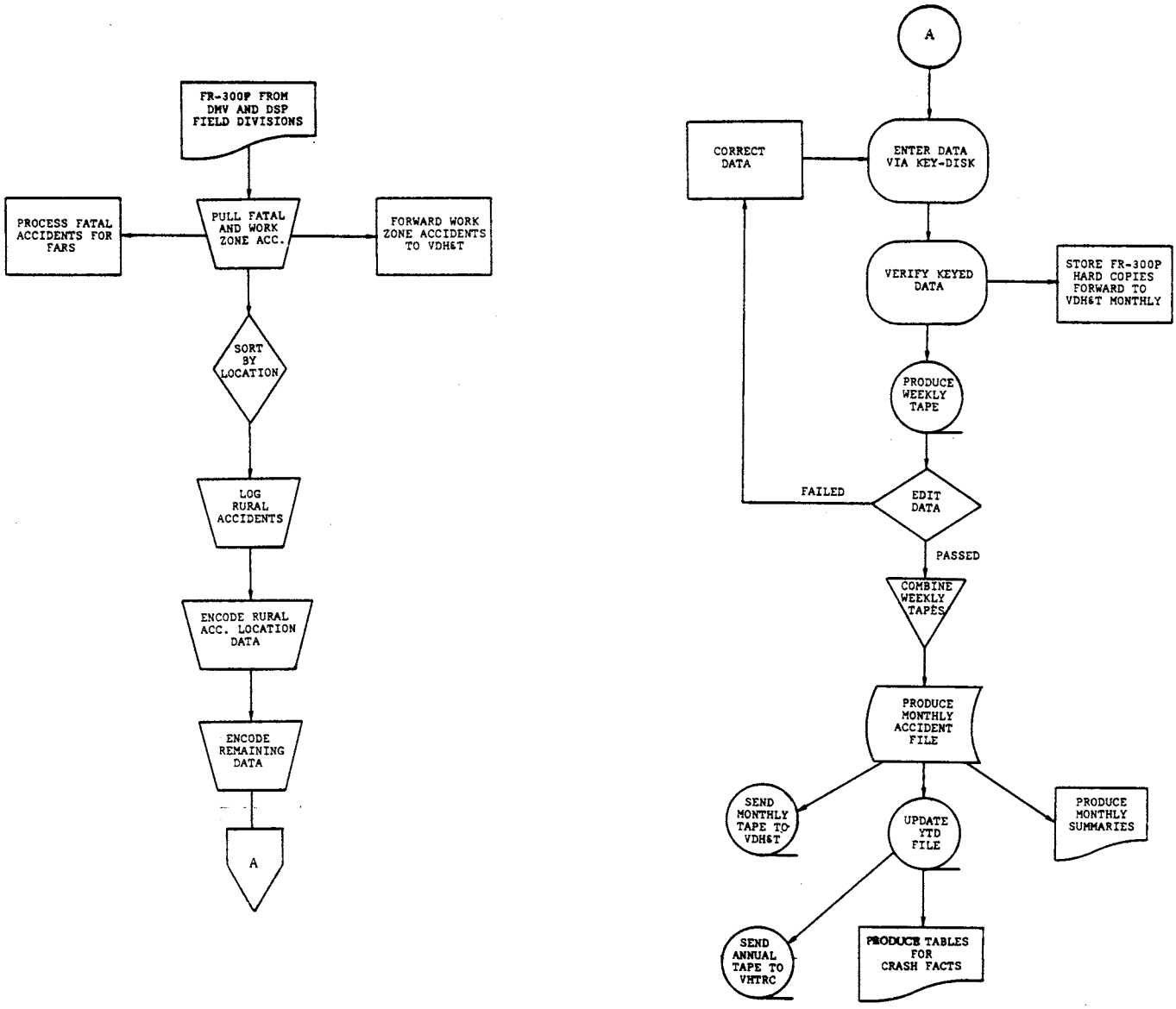

Figure 5. Accident processing flowchart -- Department of State Police.

Table 3

Calculation of Annual Cost of Accident Data Processing at Virginia Department of State Police

Personnel Costs

Position Title (Activity Type)	Grade	Annual Salary (At Step 5) Plus Fringe Benefits*	Pct. Time	No. Emp.	Total Cost
Asst. Records and Statistics Officer (Supervisory)	14	$32,565	25%	1	$ 8,141
Accident Records Supervisor (Supervisory/Clerical)	7	16,775	100%	1	16,775
Clerk Typist C (Clerical)	4	12,838	100%	1	12,838
Clerk Typist B (Clerical)	2	10,750	100%	1	10,750
Clerk C (Clerical)	4	12,838	100%	1	12,838
Clerk B (Clerical)	2	10,750	100%	13	139,750
Statistician A (FARS)	6	15,350	100%	1	15,350
Clerk C (FARS)	4	12,838	50%	1	6,419
Data Entry Operator B (ADP)	5	14,038	100%	2	28,076
ADP Manager (Supervisory)	14	31,312	5%	1	1,565
Production Control Supervisor (Supervisor)	10	21,925	2%	1	438
Computer Operator A (ADP)	6	15,350	5%	1	768
Computer Programmer B (ADP)	11	23,962	5%	1	1,198
			Subtotal		$254,906

*Fringe benefits are 25% for civilian personnel and 30% for uniformed personnel.

Table 4

Summary of Costs

Computer Costs

Processing	$12,000
Equipment Rental/Maintenance	1,200
	$13,200

Indirect Costs

10% of Salaries Before Fringe Benefits
(0.10 x $203,674 = $20,300)

Recap (rounded to nearest hundred dollars)

Personnel	$254,900
Computer	13,200
Indirect	20,300
Miscellaneous	--
Total	$288,400

VIRGINIA DEPARTMENT OF HIGHWAYS AND TRANSPORTATION'S SYSTEM FOR PROCESSING ACCIDENT DATA

The VDH&T is responsible for the design, engineering, construction, and maintenance of 52,000 miles of interstate, arterial, primary, and secondary roads in Virginia. The Department also performs long- and short-range planning studies to meet the state's transportation needs and offers financial and technical assistance to localities in support of public transportation. The VDH&T staffs eight district offices and the central office in Richmond to carry out its operations throughout the state.

The VDH&T role within the state traffic records system has resulted principally from the involvement of the federal government in traffic safety. There are no provisions in the Code of Virginia that specifically enumerate the VDH&T's responsibilities in this area. However, the NHTSA/FHWA-promulgated highway safety standards and programs which are tied to eligibility for federal money have prompted the VDH&T to develop a capability to analyze accident data for the purpose of identifying and improving hazardous roadway conditions for the benefit of the travelling public. In fact, the VDH&T's accident study section, located within the Traffic & Safety (T & S) Division, is

the Commonwealth's most active user of FR-300P Data. The accident study section maintains roadway and accident data bases and conducts analyses and evaluations of accident prone locations and fatal accidents. The Division also conducts inventories of highway/railroad grade crossings and railroad safety improvement projects, and satisfies certain federal reporting requirements.

The accident study section receives crash data in the form of magnetic tapes and FR-300P hard copies from the DSP on approximately 11,000 accidents each month. Of these, about 50% occur on state maintained roadways and are of particular interest to T & S Division engineers. These crashes are stripped from the DSP crash file, correlated with roadway statistics, and serve as the source for a variety of computer generated summaries of the traffic safety picture on the state highway system.

Resources

The VDH&T Data Processing (DP) Division has a staff of 26 programmers and systems analysts supported by 29 data control and 27 data entry personnel, supervised by 4 administrators. The T & S Division's accident study section employs a staff of 17 traffic technicians and 3 highway engineers (Figure 6) who have responsibility for preparing accident statistics for delivery to other Traffic and Safety Division units, field personnel, localities, and federal agencies.

The VDH&T uses the computer facilities of the DCS Computer Center on E. Broad St. in Richmond.

Process

Each month the accident study section of the T & S Division receives a magnetic tape from the DSP containing data from the FR-300Ps processed at the DSP in the previous month. Each month the section also obtains hard copies of the FR-300Ps which have been processed at the DSP, which are then sorted by location of accident and filed by T & S Division technicians for reference. (Theoretically, the data on the monthly tape correspond directly with the monthly batch of reports; however, no effort is made to guarantee that this is the case.) The accident study section passes the monthly crash tape to the DP Division where a series of programs are run to edit the data for completeness and accuracy and to sort, recode, and reformat the data for further processing. As a result of the edit check, a listing of erroneous accident records is returned to the accident study section. Then, T & S Division technicians pull copies of the associated FR-300Ps from the files and attempt to reconcile the errors. The corrected data are recorded and returned to the DP Division where they are keyed in for a

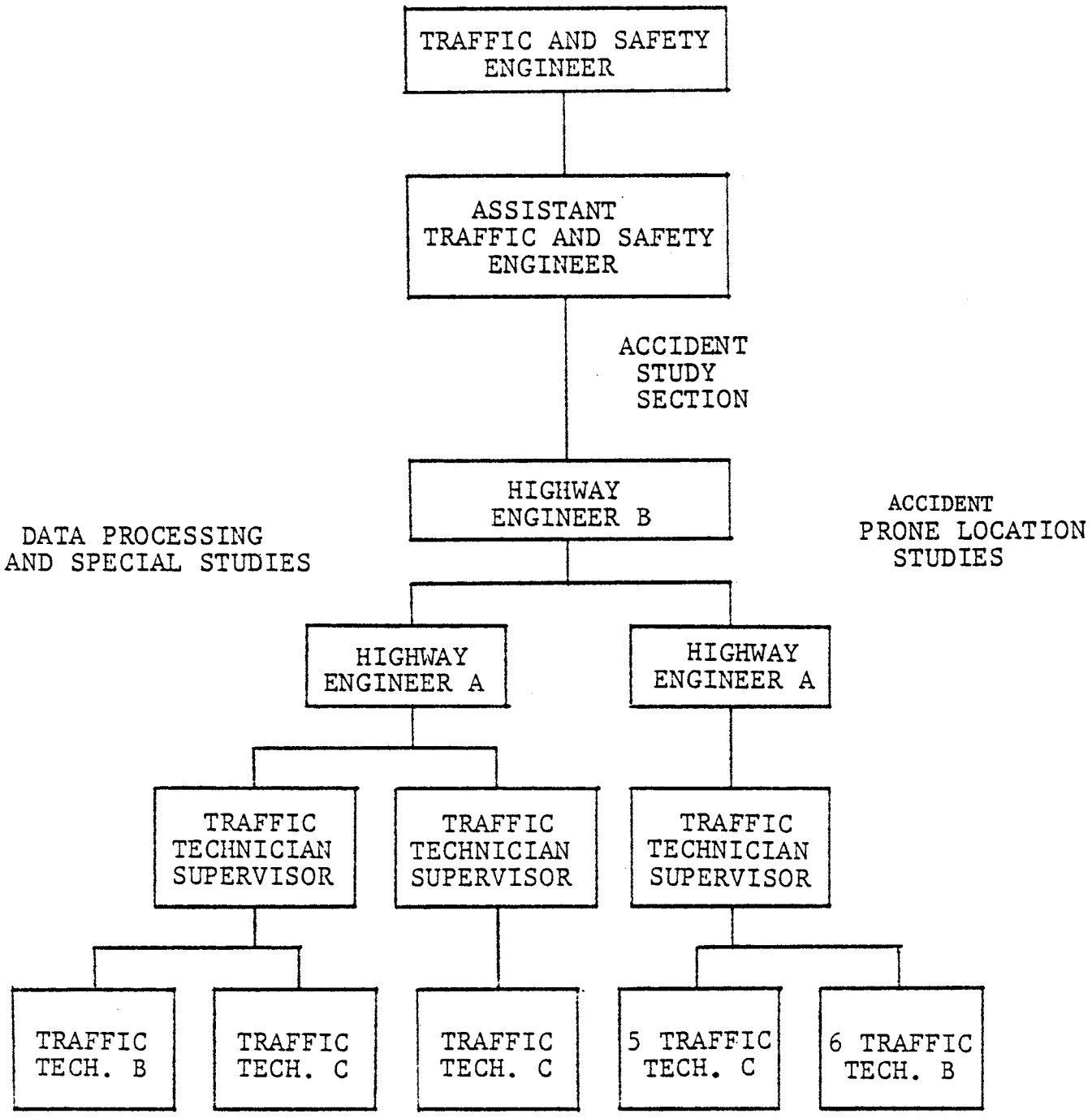

Figure 6. Organization chart for accident study section of Virginia Department of Highways and Transportation's T & S Division.

second edit check and update of the monthly file. The corrective procedure is repeated if further errors are discovered. After this, the monthly VDH&T crash file contains only "clean" data for accidents occurring on roadways under the jurisdiction of the VDH&T. (Note that accident records for crashes occurring off the state road system have been deleted from the monthly crash file.)

Each month a set of programs are run to produce two accident summaries from the monthly file:

1. "Individual Accident Report" -- A listing of data items of interest to T & S Division engineers for each accident record on file.

2. "Summary Accident Report" -- A summary of accident statistics by milepost or section for crashes occurring on roadways under the jurisdiction of the VDH&T.

Every 3 months cumulative "Individual" and "Summary" accident reports are produced using the most recent 3, 6, or 9 months of data as input. Copies of this cumulative quarterly listing are sent to each of the eight district traffic engineers and the T & S Division's safety programs section.

Following processing of the DSP December crash tape in the early spring of each year, the accident study section initiates the process of summarizing and publishing the VDH&T's annual accident statistics. The data from the monthly crash tapes which have been cumulatively compiled over the course of the year are reedited for possible errors and matched against the Department's roadway file to create a file of crash records containing accident, location, traffic volume, and roadway descriptors. This file is processed by three programs which produce a summary listing of data for --

1. interstate and primary system accidents;

2. secondary system accidents, by district, county, and route; and

3. accidents by residencies, counties, and cities by district.

A second set of programs reads the cumulative yearly accident file and produces a summary listing of accidents occurring on interstate, primary, and secondary road systems by light conditions, roadway surface width, type of collision, type of fixed object, and general location.

Another set of programs reads the cumulative yearly accident file along with certain auxiliary data and produces a summary listing of accidents by year, district, certain traffic volume categories, and route number.

All of these listings are compiled in the VDH&T annual Summary of Accident Data, which is published and distributed in the summer of each year by the T & S Division.

Annually, a set of computer programs are executed to read the cumulative yearly accident and roadway files and to compute accident rates and critical rates for roadway sections and mileposts in the state roadway system by district, county, and route number. This information is used by the T & S Division to pinpoint high accident locations on the state road system.

Finally, the cumulative yearly accident file is combined with those of the 4 previous years to produce a computerized 5-year summary of accidents occurring on Virginia's road system for use by the T & S Division's safety programs section.

The VDH&T's DP Division is also capable of producing other accident summaries and outputs on request, including automated collision diagrams for particular locations, wet pavement accident listings, and accident listings for particular years and locations.

Personnel in the accident study section perform a number of activities requiring manual manipulation of FR-300P data, including:

1. Development of accident data worksheets for certain applications.

2. Preparation of collision diagrams for engineering studies.

3. Coding of all fatal, injury, and pedestrian accidents for the FHWA's Highway Performance Monitoring System (HPMS).

4. Handling special requests from field offices and Virginia's localities.

Timing

The monthly crash tape is received from the DSP around the 20th of each month. At this point the data are a minimum of from 3 to 7 weeks old. One more week is required to submit the tape to the VDH&T's DP Division and obtain the results of the first edit check. Two more weeks pass as T & S Division technicians attempt to rectify the errors found in the first edit check. Finally, the monthly file is processed to produce monthly reports for distribution to interested parties. On the

average this takes about 1 week. In summary, the VDH&T monthly process requires about 4 weeks. By this time, the FR-300P crash data on the monthly VDH&T file are typically 9 to 13 weeks old.

The annual process begins around April 1 each year. The various computer outputs are usually produced by the early summer. The VDH&T Annual Summary of Accident Statistics is usually distributed in the late summer or early fall. Thus the data contained in this document are anywhere from 19 to 22 months old.

The entire flow of VDH&T accident data processing activities is diagrammed in Figure 7.

Cost Determination

VDH&T accident processing costs were among the most difficult to isolate, not for the lack of a mechanism for assigning costs, but rather due to difficulty in identifying those processes which fell within the scope of this study. The VDH&T is the Commonwealth's most active user of DSP supplied crash data. As such, the VDH&T manipulates crash data employing a variety of automated and manual processes for many purposes. It was often difficult to pinpoint when processing of FR-300P data ended (within the scope of the study) and where data usage began (beyond the scope of the study). Additionally, the VDH&T performs a number of ad hoc functions which introduced difficulties in determining ongoing annual costs. In the end it was decided that personnel costs for FR-300P processing would be defined by the total activities and outputs of the T & S Division's accident study section and computer costs would be defined by the machine and manpower costs associated with ongoing monthly, quarterly, and annual accident report production.

The total estimated annual expenditures made by the VDH&T on accident processing was $403,000. Details are shown in Tables 5 and 6.

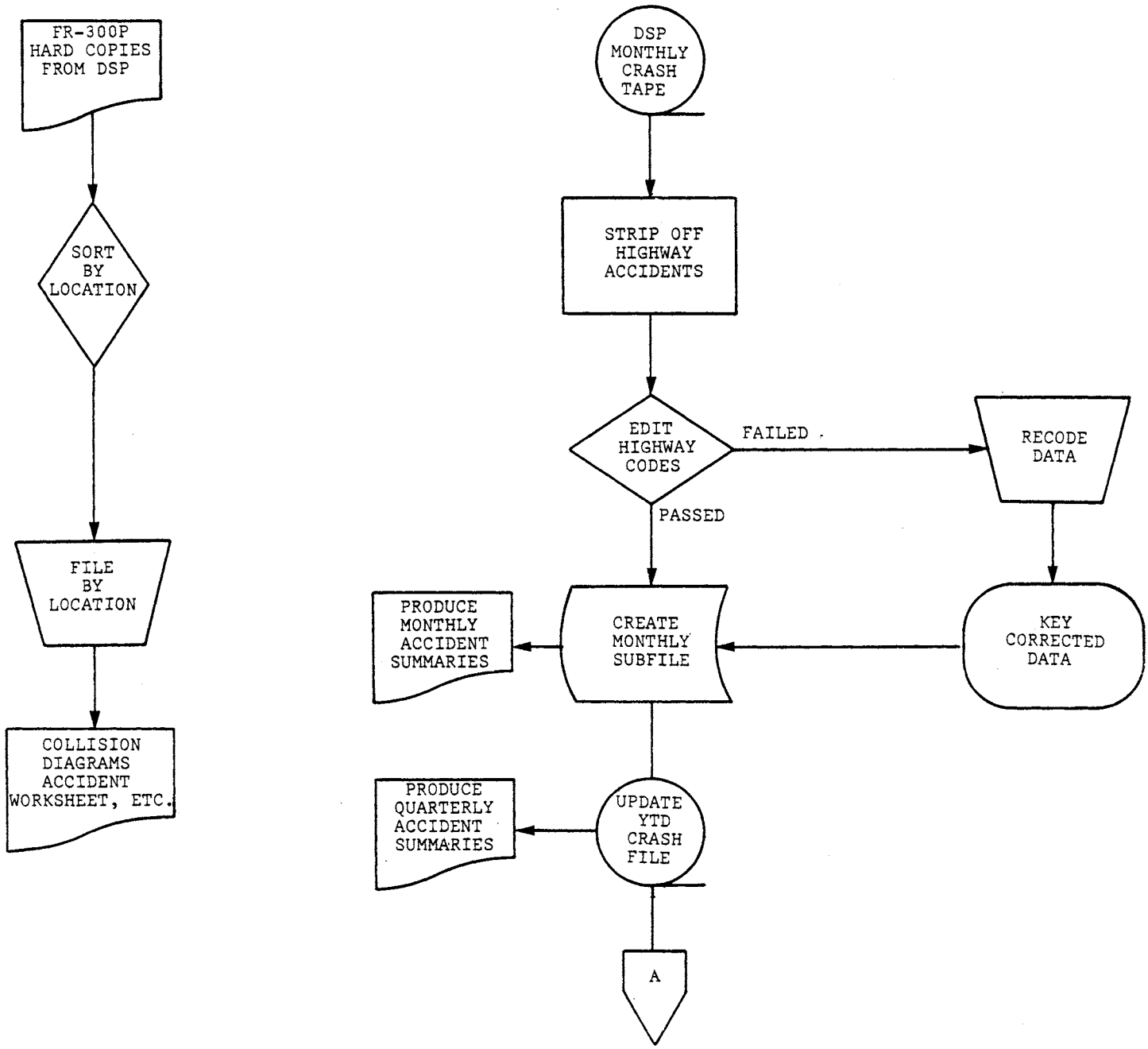

Figure 7. Flow of accident data processing -- Virginia Department of Highways and Transportation.

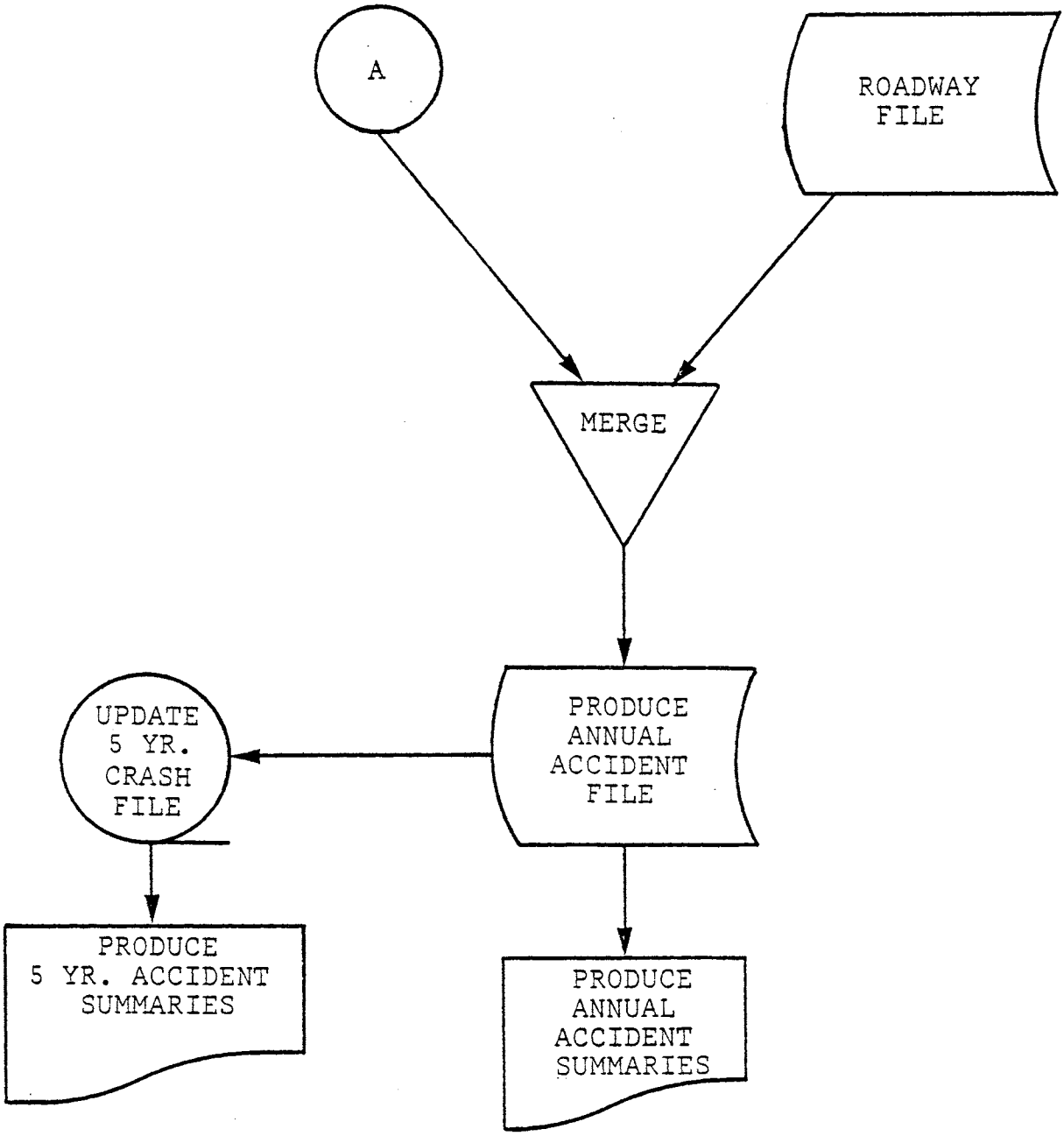

Figure 7. Continued.

Table 5

Table 5

Calculation of Annual Cost of Accident Data Processing at Virginia Department of Highways and Transportation

Personnel Costs

Position Title (Activity Type)	Grade	Annual Salary (At Step 5) Plus Fringe Benefits*	Pct. Time	No. Emp.	Total Cost
Computer Systems Analyst B (ADP)	14	$31,312	10%	1	$ 3,131
Engineer A (ADP)	11	23,962	15%	1	3,594
ADP Production Control Supervisor (ADP)	10	21,925	35%	1	7,674
ADP Production Technician B (ADP)	9	20,050	10%	1	2,005
ADP Production Technician A (ADP)	7	16,775	20%	1	3,355
Data Entry Supervisor (ADP)	8	18,337	1%	1	183
Data Entry Operator B (ADP)	6	15,350	1%	1	153
Data Entry Operator A (ADP)	5	14,038	1%	1	140
Clerk B (Clerical)	3	11,750	1%	1	117
Highway Engineer B (Accident Analysis/Supervisory)	12	26,200	70%	1	18,340
Highway Engineer A (Accident Analysis)	11	23,963	100%	2	47,926
Traffic Technician Supervisor (Accident Analysis)	9	20,050	100%	3	60,150
Traffic Technician C (Accident Analysis)	7	16,775	100%	7	117,425
Traffic Technician B (Accident Analysis)	5	14,038	100%	7	98,266
			Subtotal		$362,459

*Fringe benefits are 25% of annual salary.

Table 6

Summary of Costs

Computer Costs

Processing		$ 10,000
Disk File Usage		1,000
Magnetic Tape Storage		100
Equipment Rental/Maintenance		400
	Total	$ 11,500

Indirect Costs

10% of Salaries Before Fringe Benefits
0.10 x 289,965 = $ 28,996

Recap (rounded to nearest hundred dollars)

Personnel		$362,500
Computer		11,500
Indirect Costs		29,000
Miscellaneous		---
	Total	$403,000

VIRGINIA HIGHWAY AND TRANSPORTATION RESEARCH COUNCIL'S SYSTEM FOR PROCESSING ACCIDENT DATA

In 1969, a memorandum of understanding was adopted between the Highway Safety Division (HSD) and the VHTRC, under which a section of the VHTRC was dedicated to support the Division's safety research needs. Under the original agreement, the Safety Section of the Council (now the Safety Group) was responsible for developing and maintaining a library of traffic safety resource materials and disseminating materials to other agencies, as well as conducting research projects on an as needed basis. The 1969 memorandum covered a 4-year period, after which time the agreement was to be extended on an annual basis.

In 1978 the responsibilities of the HSD were transferred to the newly-created VDTS. The VHTRC continues to support the safety research needs of the state by providing research and analysis in highway safety problem identification, federal and state highway safety legislation, traffic records information processing, and highway safety program evaluation.

Resources

The Safety Group is comprised of 4 permanent staff members and 5 graduate and legal student assistants. The VHTRC's data section, comprised of 1 full-time and 1 part-time computer programmer, 1 ADP technician, and 1 section manager, provides technical services to the Safety Group (see Figure 8).

The VHTRC employs the computer facilities of the University of Virginia's Academic Computing Center in Charlottesville for its data processing needs.

Process

The VHTRC receives a magnetic tape containing a full calendar year's crash data from the DSP about 2 to 3 months into the following year. The tape is the source of data for a series of crash summaries distributed to Virginia's localities at midyear.

Initially, the crash tape is processed by a program which edits, extracts, and reformats selected data items. Suspected erroneous data are recoded as "other" or "unknown", since the FR-300P originals are not available for checking. An intermediate summary accident file is produced containing the data items required for four types of reports:

1. Mini-Crash Facts -- An annual summary of selected crash statistics by locality

2. VASAP Reports -- An annual summary of alcohol related crash statistics by locality

3. Youth Fact Sheets -- An annual summary of youth involved crash statistics by locality

4. Problem Identification Packets -- An annual summary of limited crash statistics and safety resource data by locality

The intermediate summary accident file is processed in turn by the programs which generate these reports. First, the 4-page Youth Fact Sheets are prepared; second, the 2-page VASAP reports are prepared; third, the 29-page Mini-Crash Facts are produced; and finally a file is prepared for later use by the program that prints the problem identification packets. All reports are reproduced, bound, and distributed to local transportation safety commissions and interested state agencies, who use these summaries for monitoring their accident experience, analyzing the crash data, and preparing local highway safety plans.

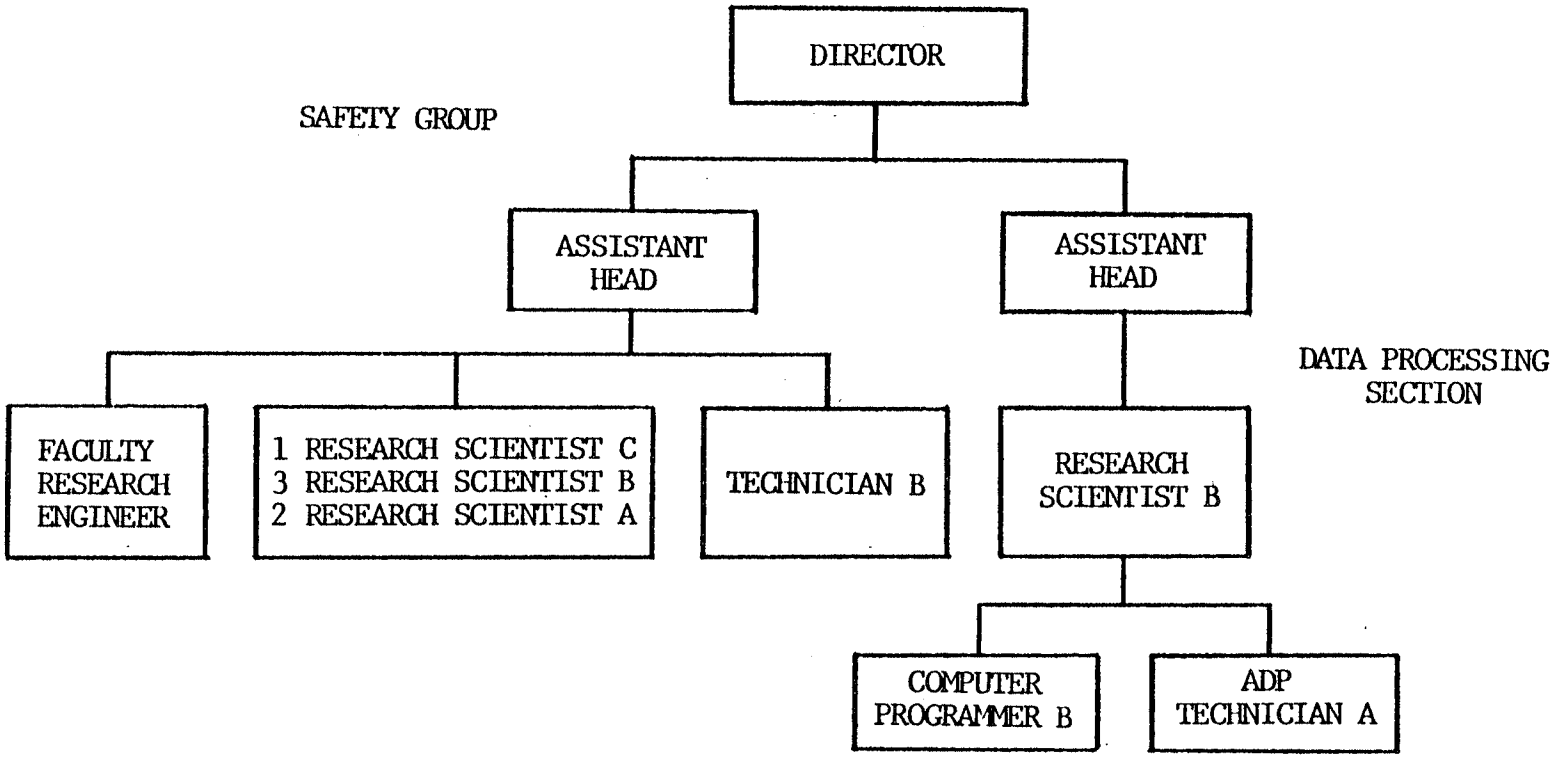

Figure 8. Virginia Highway and Transportation Research Council organization chart.

Timing

The VHTRC receives the crash tape annually in March from the DSP. The Mini-Crash Facts reports, Youth Fact Sheets, and VASAP reports are distributed within 2 to 3 month's time, usually by the end of May. Thus, the data found in these reports reflect crashes which occurred up to 18 months earlier. The master file problem identification packets are prepared in the summer months and are usually distributed in the fall. The crash data found in these reports may be up to 22 months old. The entire flow of VHTRC accident data processing is depicted in Figure 9.

Cost Determination

Since the VHTRC's data processing section services the data processing needs of all groups at the VHTRC and not exclusively those of the safety group, it was necessary to adjust the annual costs accordingly. The cost for computer time was directly derived from monthly billing summaries. The charges associated with the four projects represented 30% of the total annual machine charges. Therefore, the equipment rental and maintenance costs were multiplied by a factor of 0.30 to reflect this fact.

Personnel involved in accident processing were identified along with their time commitments and the associated personnel costs were calculated as shown in Table 7.

In all, the VHTRC expends approximately $44,800 each year for processing Virginia crash data (see Table 8).

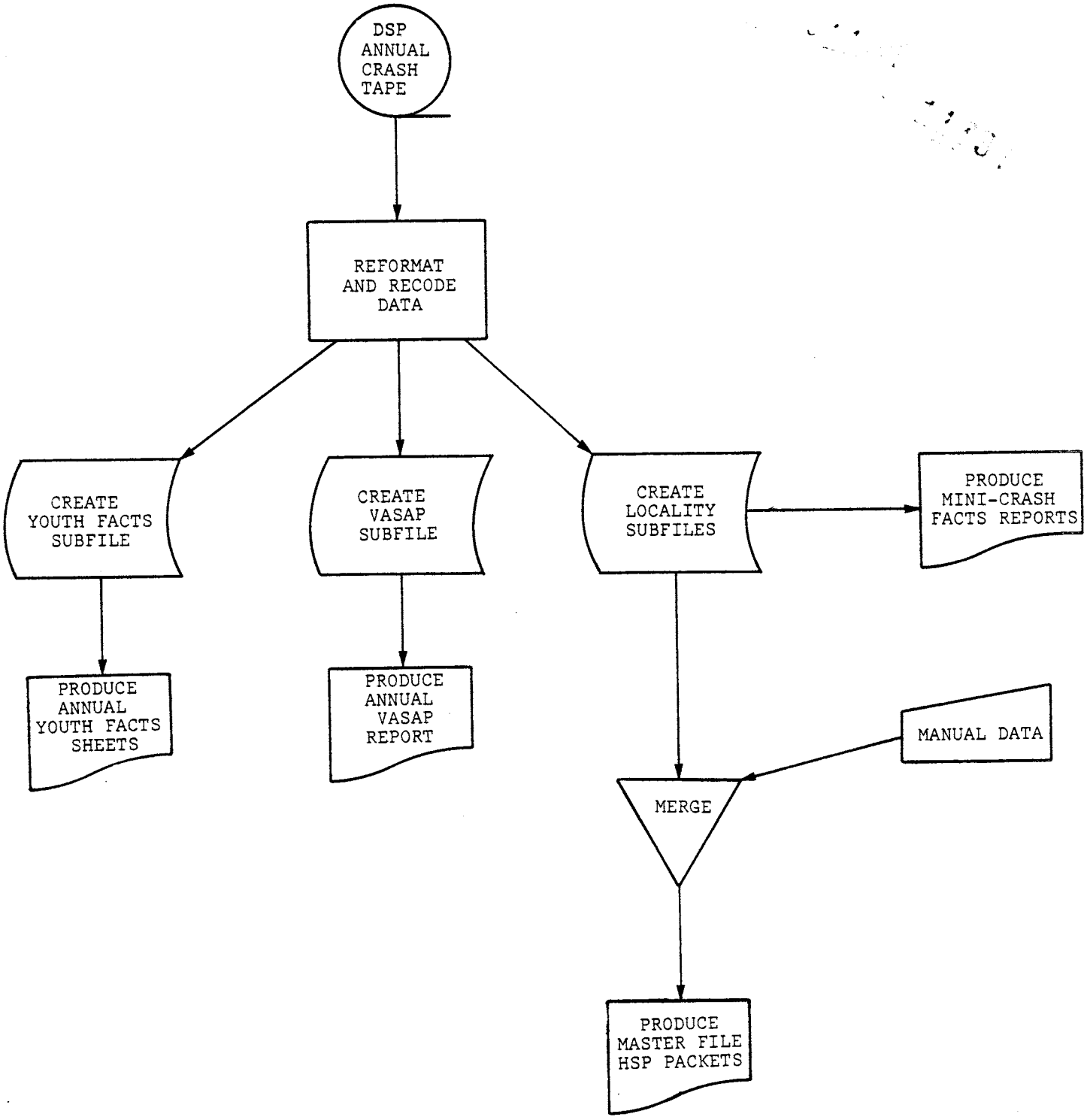

Figure 9. Flow of accident data processing -- Virginia Highway and Transportation Research Council.

Table 7

Calculation of Annual Cost of Accident Data Processing
at Virginia Highway & Transportation Research Council

Personnel Costs Position Title (Activity Type)	Grade	Annual Salary (At Step 5) Plus Fringe Benefits*	Pct. Time	No. Emp.	Total Cost
Research Scientist B (Supervisory)	13	$28,638	5	1	$ 1,432
Research Scientist B (Accident Analysis)	13	28,638	10	1	2,864
Research Scientist B (Accident Analysis)	13	28,638	30	1	8,591
Computer Programmer B (ADP)	11	23,963	30	1	7,189
ADP Production Technician A (ADP)	7	16,775	20	1	3,355
Graduate Assistant (ADP)	3	11,750	20	1	2,350
Subtotal					$25,781

*Fringe benefits are 25% of the annual salary.

Table 8

Summary of Costs

Computer Costs

Equipment Rental/Maintenance		$ 5,238*
Processing		11,670
	Total	$16,908

Indirect Costs

10% of Salaries Before Fringe Benefits
0.10 x $20,624 = $2,062

Recap (rounded to nearest hundred dollars)

Personnel		$25,800
Computer		16,900
Indirect Costs		2,100
Miscellaneous		---
	Total	$44,800

*Equipment rental charge calculated as $1,455 per month x 12 months = $17,450. This amount is reduced by 70% since the processing of the crash tape represents only 30% of the total annual processing time (0.30 x $39,330 = $11,670 total annual processing costs).

VIRGINIA DEPARTMENT OF TRANSPORTATION SAFETY'S SYSTEM FOR PROCESSING ACCIDENT DATA

In April 1978, Senate Bill 85 amended the Code of Virginia to replace the HSD with the VDTS. The policy of the newly created VDTS was "to investigate, evaluate, and promote the safe movement of people and property by all modes -- highway, railway, waterway, airway, and mass transit." The VDTS is responsible for developing, implementing, and evaluating a comprehensive highway safety program and for making policy and procedural recommendations to the Governor and the General Assembly. It also assists in the development of local highway safety programs and in training and educational activities.

Under §33.1-394, the VDTS is charged "to collect, tabulate, correlate, analyze, evaluate, and review the data gathered by various entities of the state government in regard to transportation operations, management, and accidents, especially the information gathered by the Division of Motor Vehicles, the Department of State Police, and the State Corporation Commission."

In order to carry out its duties the VDTS must keep abreast of changes in the state's traffic safety picture. Because of its relatively small staff, the Department finds it infeasible to keep current statistics on all crashes in Virginia and concentrates only on accidents involving fatalities. Analysis of traffic safety data on a larger scale is left to the VHTRC.

Resources

Although the VDTS has access, through its VASAP office, to the DCS's facilities at the Midtown Data Center it has not taken advantage of this capability to date due to staff and budgeting limitations. Instead, it relies on the VHTRC, DSP, DMV, and VDH&T for the acquisition of accident statistics and automated accident analyses and reports.

Manual analysis of fatal accident statistics is done by one half-time statistician.

Process

The VDTS receives a photocopy of an FR-300P from the DMV for all accidents involving a fatality in the Commonwealth. The manual file set up for each fatal accident contains not only the FR-300P but also the report of the state medical examiner and the toxicology report from the Bureau of Forensic Sciences for each of the fatally injured parties. These reports are filed by date of accident and are kept indefinitely (currently, records go back to 1974). Periodic reports on Virginia's fatal accident experience are prepared manually by a part-time statistician for review by the VDTS management. Also, copies of FR-300Ps for fatal accidents in which alcohol was involved are sent to certain local ASAP offices for review.

The VDTS also receives a copy of the DSP's monthly urban/rural accident report for use in monitoring accidents of all severity levels.

Timing

Accident reports for fatal crashes usually are received from the DMV within a few days of the occurrence. This, of course, is dependent on the promptness of the investigating officer in completing his report and submitting it to the DMV. Processing of a full case takes several weeks due to delays in obtaining the medical examiner's and toxicologist's reports.

Cost Determination

Only the part-time services of one research psychologist are devoted to accident processing at the VDTS.

The estimated annual costs of accident processing at the VDTS are $15,400 (see Tables 9 and 10).

Table 9

Calculation of Annual Personnel Cost of Accident Data Processing at Virginia Department of Transportation Safety

Personnel Costs	Grade	Annual Salary (At Step 5) Plus Fringe Benefits*	Pct. Time	No. Emp.	Total Cost
Position Title (Activity Type)					
Research Psychologist	13	$28,637	50	1	$14,318
				Total	$14,318

*Fringe benefits are calculated by increasing annual salary by 25%.

Table 10

Summary of Costs

Computer Costs
None

Overhead
10% of Salaries Before Fringe Benefits
0.10 x $11,455 = $1,145

Miscellaneous Costs
None

Recap of Costs (rounded to nearest hundred dollars)

Personnel	$14,300
Computer	0
Overhead	1,100
Miscellaneous	0
Total	$15,400

OFFICE OF PUPIL TRANSPORTATION SERVICES' SYSTEM FOR PROCESSING ACCIDENT DATA

The OPTS of the DOE is responsible for oversight of all phases of the transportation of students to and from public schools in Virginia. It engages in activities such as testing and certifying school bus drivers, inspecting school buses, preparing school bus design and safety standards, and investigating school bus accidents.

The State Board of Education requires each school division superintendent to report any accident, regardless of its severity, involving a school bus or passenger to the DOE's pupil transportation supervisor. Fulfillment of this requirement is accomplished by completing a PT-6 school bus accident report form and submitting it to the OPTS within 5 days of the occurrence. Upon obtaining the forms, the OPTS records, reviews, analyzes, and reports statistics on motor vehicle accidents involving school buses. The results of this activity are used in administering other phases of the OPTS program.

PT-6 school bus accident reports for approximately 1,000 crashes are received, reviewed, and processed by the OPTS each year. Of these accidents, about one-half are of sufficient severity to be investigated and reported by police officials. The OPTS obtains copies of the FR-300Ps for school bus accidents from the DMV whenever they are received at the state level.

Resources

The OPTS staff consists of 5 full-time professionals and 2 clerical personnel.

The OPTS has access to computer resources through the DOE's data processing unit; however, at present the OPTS processes all accident data manually.

Process

Following the occurrence of a school bus accident, the supervising school division superintendent completes and forwards a PT-6 to the OPTS within 5 days. Each report is reviewed by the pupil transportation supervisor and each of the assistant supervisors specializing in various aspects of school bus safety. Once the reports are reviewed, the assistant supervisor in charge of compiling accident statistics categorizes and logs each accident in one or more notebooks containing cumulative annual data by accident type and school division. Following the logging procedures, the PT-6s are filed by school division for

reference. The report files are retained for 2 years before being destroyed.

At the close of each calendar year, the logged data are used as a source for several summary reports including the pupil transportation supervisor's annual report, which contains safety activities along with other operational data.

The OPTS receives photocopies of FR-300Ps from the DMV for school bus accidents, even though the PT-6 contains much of the same information. The FR-300P is not sufficient in itself as an information source, since it does not accommodate the OPTS's need for certain data elements, it is not necessarily filed promptly, and is not completed for all school bus accidents (since some accidents are not investigated by police officials). However, the FR-300P is of significant value to the OPTS because it provides factual information supplemental to that in the PT-6 which can be useful for accident investigations and for checking the accuracy of the school division superintendent's report. The FR-300Ps obtained by the OPTS are not reviewed by the entire staff in all cases (as are the PT-6s); the form is filed, instead, with the associated PT-6 for reference.

Timing

Because the OPTS stringently enforces requirements for filing PT-6s, these reports are generally received within a few days after the occurrence of a school bus accident. On the other hand, the OPTS must rely on the DMV and investigating police officer for prompt completion and delivery of the associated FR-300P. In general, police reports are received from the DMV within a few weeks of the occurrence of a crash. Occasionally, the OPTS must contact the DMV to obtain an overdue FR-300P.

Cost Determination

Since PT-6s and FR-300Ps are processed manually, no computer costs are incurred by the OPTS.

The pupil transportation services supervisor estimates that in addition to his own commitment about 20% of the time of one staff member is involved in processing the forms.* An estimated $7,200 is spent annually by the OPTS in processing crash data (see Tables 11 and 12).

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*It should be noted that the costs described herein pertain to the processing of both forms (which is an apparent departure from the scope of this study in that the costs of only FR-300P processing were to be identified). Costs of processing both forms were compiled because they are similar in content. The argument could be made that processing PT-6s is the same as processing FR-300Ps.

Table 11

Calculation of Annual Cost of Accident Data Processing at Department of Education's Office of Pupil Transportation Services

Personnel Cost	Grade	Annual Salary (At Step 5) Plus Fringe Benefits*	Pct. Time	No. Emp.	Total Costs
Position Title (Activity Type)					
Pupil Transportation Services Supervisor (Supervisory)	13	$28,637	5	1	$1,432
Asst. Pupil Transportation Services Supervisor (Data Analysis)	12	26,200	20	1	5,240
			Total		$6,672

*Fringe benefits are 25% of annual salary.

Table 12

Summary of Costs

Computer Cost
None

Overhead 10% of Salaries (Before Fringe Benefits)
0.10 x $5,340 = $534.00

Miscellaneous
None

Recap of Costs (rounded to nearest hundred dollars)

Personnel	$6,700
Computer	0
Overhead	500
Miscellaneous	--
Total	$7,200

DEFICIENCIES OF CURRENT SYSTEM

In the judgement of the study team, Virginia's accident records processing system is replete with deficiencies. For the purposes of presentation, these deficiencies can be categorized as being operational, administrative, or institutional. Operational deficiencies are those related to the performance of the system. Included in this category are the functional inadequacies and inefficiencies in the processing system for accident data. Administrative deficiencies are those related to the management of the system. Included in this category are organizational, communication, and control deficiencies. Finally, institutional deficiencies are those related to the political and legal environment in which the system exists.

Operational Deficiencies

Four major operational deficiencies have been identified by the study team. These are (1) duplication of effort, (2) untimeliness of accident data, (3) inaccessibility of data, and (4) inaccuracies in the data. From the cost standpoint, the first of these, duplication of effort, is the most significant and is given the most treatment in this discussion. Untimeliness of the data, inaccessibility of the data, and inaccuracies in the data are interrelated deficiencies which tend to diminish the usefulness of Virginia crash data. These deficiencies contribute to the widening gap between the cost of processing accident data and the benefits which can be derived.

Duplication of Effort in Virginia's Accident Processing System

Many studies have criticized the lack of centralization in Virginia's accident records system. It was obvious at the outset of this study that the functional division (and in some cases, isolation) of the components of Virginia's system is a significant deficiency. Six agencies process FR-300P data on four different computer systems. The result is that data preparation, coding, editing, processing, and storage must be duplicated within each agency. The whole effect is to retard the flow of information among agencies and incur expenses for the required (duplicative) processing effort.

A total of 19 duplicative functions have been identified by the study team (see Table 13). Each agency performs some subset of these activities (no agency performs all 19 functions) in carrying out its accident records processing responsibilities. It should be pointed out that the identified duplications of functions are not mirrored task for task in each of the agencies. Rather, each of the agencies so identified performs essentially the same activity in kind (although that

Table 13

Duplication in System Functions by Agency

Function	Agency					
	DMV	DSP	VDH&T	VDTS	VHTRC	OPTS
Receive and manually sort FR-300s	X	X	X	X		X
Review, highlight, edit for completeness	X	X		X		X
Keep manual statistical tallies	X	X		X		X
Encode raw data	X	X				
Reproduce hard copies and/or distribute	X	X		X		
Assign report number	X	X				
Enter source data	X	X				
Edit at terminal	X	X				
Verify data	X	X				
Perform automated edit	X	X	X		X	
Correct and reenter data	X	X	X			
Update/build automated file(s)	X	X	X		X	
Produce and distribute automated reports		X	X		X	
Produce and distribute manual reports				X		X
Manually manipulate raw data. (recoding, manual analysis)			X	X	X	X
Store data on magnetic disk	X	X	X		X	
Store data on magnetic tape and/or distribute	X	X	X		X	
Store FR-300P hard copies or hard copy images	X		X	X		X
Maintain automated systems	X	X	X		X	

activity may be performed using different data elements or to provide varied output). It is argued by the study team that in an efficient statewide data processing system, the performance of each of the 19 functions would occur in only one place at one time. Thus, these 19 areas should be examined for the possibility of eliminating the duplication of effort.

To amplify Table 13, a function-by-function description of the duplicative processes among the agencies is presented below.

Duplicative Function #1: Receipt and Manual Sort of FR-300P Hard Copies

Each of the agencies reviewed, except the VHTRC, receives all or selected FR-300P hard copies at the entry point in their processing cycles. These are required by the VDTS and OPTS because the detail available from the officer's report cannot be encoded for automated processing. Similarly, hard copies are required by the VDH&T for study of individual accidents and correction of errors found in the course of its automated edit of the monthly DSP crash tape. The DMV and DSP require the hard copies to satisfy statutory reporting requirements and to serve as the data source for their encryption, tabulation, storage, and distribution systems. In all cases, personnel are required to sort FR-300Ps based on some key (date of accident, location of accident, or severity of accident) in order to place them in some sequence for processing or filing. In the cases of the OPTS and VDTS, this is a fairly easy task since the volume of reports they receive is fairly low (under 1,000 year). However, for the DMV and DSP, it is a significant effort to sort the average of 520 FR-300Ps received and processed daily. Similarly, substantial effort is required by the VDH&T to sort by location the monthly batch of 11,000 FR-300Ps it receives from the DSP.

Duplicative Function #2: FR-300P Review and Visual Edit

All of the agencies reviewed, except the VDH&T and the VHTRC, routinely review every accident report albeit for different purposes. The VDTS and OPTS review FR-300Ps for information which can be synthesized to explain the causes of accidents, while the DMV and DSP review the raw data for completeness, legibility, and consistency. It is recognized that the DMV and DSP review virtually mutually exclusive segments of the FR-300Ps; however, clerks in both agencies still perform essentially the same function.

Duplicative Function #3: Tally Manual Statistics

The DSP, DMV, VDTS, and OPTS keep manual statistical tallies of various accident statistics, principally for internal purposes. The DSP maintains an up-to-date card file of data on fatal accidents and completes and circulates a "hot spot" card for highway locations exceeding a certain number of crashes. Additionally, pencil notations of accidents by severity type are recorded along the margins of the graphic logs during the logging operation. The VDTS and OPTS also maintain running tallies of fatal and school bus accidents, respectively, so that their files reflect the state's most current status in these areas. The DMV similarly keeps a fatal accident count and manual file of fatal accident reports.

Duplicative Function #4: Data Encryption

Both the DMV and DSP encode certain data elements not already coded in the field by the investigating officer. The overlap between the DMV and DSP functions is small, however, since each agency utilizes data from different parts of the FR-300P.

Duplicative Function #5: Reproduce and Distribute Photocopies of FR-300Ps

The DMV, DSP, and VDTS each photocopy and distribute accident reports for certain classes of accidents. The DMV reproduces FR-300Ps for school bus accidents, fatal accidents, and crashes involving certain military personnel and mails them to the OPTS, VDTS, and Fort Lee, respectively (estimated number is 1,600 a year). In addition, of course, the DMV reproduces microfilm copies of FR-300Ps in response to citizen requests for accident reports (estimated number is 14,000 a year). The DSP photocopies certain accident reports (estimated number is 500) for delivery to the VDH&T, in spite of the fact the VDH&T will later receive the report originals. The VDTS photocopies FR-300Ps for alcohol related fatal accidents (estimated at 300 a year) and mails them to ASAP offices throughout the state.

Duplicative Function #6: Assign Report Number

Both the DMV and DSP assign report numbers to FR-300Ps for unique identification. The DMV's microfilming process imprints a report number on both the document and the microfilm record. The DSP stamps each FR-300P with a 6-digit identifier in the collating process. The two numbers are, of course, incompatible for obvious reasons. As a result the DSP and DMV files cannot be cross-referenced.

Duplicative Function #7: Source Data Entry

Both the DMV and DSP enter FR-300P data via automated methods. DMV data entry personnel update the DHF of the involved drivers for each accident in an on-line environment. DSP production control personnel enter FR-300P data in an off-line environment via an automated key-disk system. Magnetic tape is used to transfer crash data on a periodic basis to the DSP mainframe for further processing.

Duplicative Function #8: Source Data Edit at Terminal

Both the DMV and DSP data entry systems check certain data elements (i.e., codes out-of-range, ascending/descending keys, alphanumerical type checking) at the time of entry.

Duplicative Function #9: Data Verification

Both the DMV and DSP verify the accuracy of source data at some point in their processing cycles. DSP production control personnel rekey source data while the terminal compares it with those already entered. DMV clerks recall the accident trailer on their terminals for each driver for each accident to visually check that the data on the DHF are the same as those on the associated FR-300P.

Duplicative Function #10: Automated Edits

The DMV, DSP, VDH&T, and VHTRC all perform some sort of automated edit of the crash data at some point in their processing cycles. DMV data are edited fully at the time of data entry, DSP data are edited monthly, VDH&T data are edited both monthly and annually, and VHTRC data are edited annually. There is almost no coordination among the DSP, VDH&T, and VHTRC with respect to the compatibility of these edits. Each agency handles crash records in error in a different manner; thus each maintains a crash file which contains different data.

Duplicative Function #11: Correction and Reentry of Data

The DMV, DSP, and VDH&T automated edits reject erroneous records and either prompt the operator to reenter the data (as in the case of DMV) or print an error report indicating which records have possible errors. In all cases, the erroneous data are corrected and rekeyed by personnel in each of the three agencies for reprocessing.

Duplicative Function #12: Update/Build Automated Files

The DMV, DSP, VDH&T, and VHTRC all build/update automated crash files from the same FR-300P source data. The DMV updates its DHF, and the DSP builds monthly and year-to-date accident files for report production and distribution of crash data. Similarly, the VDH&T builds monthly and year-to-date files of crash data for accidents occurring on state maintained road systems, and the VHTRC builds a number of intermediate files from the annual crash tape in the course of producing its accident summaries.

Duplicative Function #13: Produce/Distribute Automated Crash Reports

The DSP, VDH&T, and VHTRC produce an extensive series of monthly and annual crash summaries from each of their respective crash files. Due to the varied reporting and processing features described above, often the data reported by one agency are different from those reported by another. This is one of the most undesirable results of all the foregoing duplicative processes.

Duplicative Function #14: Produce/Distribute Manual Reports

The VDTS and OPTS both produce periodic, manually derived crash summaries, although of differing scope. The reports must be produced manually because neither agency has direct automated access to the accident records system.

Duplicative Function #15: Manipulate Raw Data for Analysis

The VDTS, VDH&T, VHTRC, and OPTS all manually manipulate FR-300P data in the course of their safety related activities. The VDTS and OPTS must do all of their crash analyses manually since they have not developed access to state computer facilities. The VHTRC and VDH&T, particularly the latter, must hand analyze FR-300Ps for safety studies and certain research projects. Because of deficiencies in the accuracy of the data contained in the DSP crash file, some VDH&T automated capabilities (e.g., the production of automated collision diagrams) go unused, which forces the VDH&T to shift from the use of automated and more efficient analytical methods to manual methods.

Duplicative Function #16: Store Crash Data on Magnetic Disk

The DMV, DSP, VDH&T, and VHTRC store crash data from the same FR-300P on magnetic disk on each of their four computer systems, albeit in different formats and for different periods of time.

Duplicative Function #17: Store Crash Data on Magnetic Tape

The DMV, DSP, VDH&T, and VHTRC all maintain tape files of crash data for file backup and long-term storage. Again, these data are stored in differing formats for varying lengths of time.

Duplicative Function #18: Archival Storage of FR-300P Hard Copies

The DMV, VDH&T, VDTS, and OPTS retain hard copies of FR-300Ps on file for varying lengths of time, usually a period of several years. The DMV microfilms each FR-300P and retains the microfilm copies for an indefinite period of time. Retention of FR-300P hard copies is required by the other agencies for later reference for longitudinal studies or for requests from other organizations or private citizens.

Duplicative Function #19: Automated System Maintenance

The DMV, DSP, VDH&T, and VHTRC must periodically update their accident processing software in response to coding changes, changes in report output formats, changes in form content, or hardware/computer system modifications. The multiplicity of accident processing systems means that any elemental change in the system spawns a series of system maintenance alterations in all four agencies.

Untimeliness of Data in Virginia's Accident Processing System

A second major operational deficiency is the untimeliness of crash data. This is a direct result of the configuration of the present system. Duplicative activities make a significant contribution to delays in the availability of crash data. However, the design of the present system guarantees the untimeliness of crash data, no matter how efficiently it operates. Although there is disagreement among safety professionals on how current the state's accident file should be, there is general agreement that improvement in the timeliness of Virginia's crash data is desirable. Depending on where one chooses to look in the chain of accident processing activities and depending on the level of detail sought in the data, Virginia's crash data are at any given time anywhere from 2 weeks to at least 3 months old.

Delays in getting data from FR-300Ps into state files begin at the accident scene. Local police officers, though generally conscientious in filing FR-300Ps, can wait an indefinite time following the occurrence of a crash before submitting their report. Since there is no way to know at the state level which accidents are investigated by police and which are not, it is impossible to prod officers into submitting overdue reports. Further, local police agencies may in some cases wait to accumulate a certain threshold number of reports before they forward them to the DMV. The timeliness of FR-300P submissions by state troopers is less of a problem, since the DSP has a policy that requires troopers to complete the FR-300Ps within 48 hours of the close of their investigations. Also DSP field divisions generally review and submit FR-300Ps to headquarters without delay. In any case, most reports are completed and submitted to the DMV within 15 days following the date of an accident. Once at DMV, the FR-300Ps are processed in a few days; thus, conceivably very limited police reported crash data on individual accidents can be obtained from the DHF, or a photocopy of a particular report can be obtained from the microfilm record, within 2 to 3 weeks from the date of most crashes. However, crash data in this disaggregated format is of only limited use. Aggregate statistics are required to monitor changes in the frequency of motor vehicle crashes. Data in this format are not available at the DMV.

Another source of delay in processing FR-300Ps is the requirement that all local police agencies must submit both the original and first carbon of the FR-300P to the DMV, even though the DMV processes only the original. DMV clerks must separate the first carbon from the original and mail it to the DSP, thus adding a day or two to the processing cycle for this class of accidents (about 70% of all crashes). In contrast, DSP field division offices mail the original and first copies of their FR-300Ps directly to the appropriate agencies.

Once an FR-300P is received at the DSP, it takes anywhere from 1 week to 1 month to process the crash data, depending on the time of the month it is received. Although only a few days are required to code and log each FR-300P, the procedures employed for data entry, verification, editing, and file updating, particularly the last task, are set up to produce a crash file on a monthly basis. Since there is no daily updating of the crash file with the most recently received data, there is a quantum jump in the untimeliness of crash data from about 2 weeks at the DMV to anywhere from 5 to 9 weeks at the DSP. This is the first point in the processing cycle at which aggregate crash statistics can be produced in response to most data needs. Thus, for all practical purposes, Virginia's accident processing scheme produces crash data that are 1 month to 2 months old. This does not necessarily constitute an unacceptable delay. However, non-DSP users of the data continue to process the crash file further, adding more time to the processing cycle.

For example, the VDH&T is the state's most active user of DSP crash data. However, the DSP accident file received by the VDH&T in the form of a monthly magnetic tape is somewhat incomplete. Some data elements, particularly those associated with accident locations (entered in the DSP logging function), have not been edited for accuracy by the DSP. Also, the record structure and certain DSP codes (though edited at the DSP) are not compatible with VDH&T accident processing software. Thus, the VDH&T undertakes a process to check for erroneous crash records, reconcile codes and accident locations, and restructure the accident file each month. About 4 weeks are required to create the file VDH&T needs to analyze crash data on a locational basis. As a result, VDH&T traffic safety engineers must use data that are at least 9 to 13 weeks old.

Greater time delays are characteristic of the annual crash data reporting processes at the DSP, VDH&T, and VHTRC. In general, crash summaries prepared by these agencies are usually produced no sooner than 4 to 8 months following the close of the calendar year. Unfortunately, these are the major information sources for most of the state's traffic safety community. The data represented in these reports are up to 22 months old, which seriously undermines their usefulness as an operational or management tool.

Inaccessibility of Data

The most important measure of the value of any information system is its usefulness. In order for information to be useful, it must first be accessible. Virginia's accident data are accessible only to the agencies which house the information they process. All other users must obtain data from published statistics or gain access through special arrangements with the agency controlling the information required. The administrative obstacles which must be overcome to obtain crash information, in combination with the staleness of the data and data inadequacies, discourage all but the most urgent requests for information from Virginia's accident file. Thus, many information needs go unmet, even though the required data are contained in the system. With reference to this deficiency, an unidentified Virginia traffic records official quoted in the FHWA/NHTSA Accident Data Improvement Plan of 1980 said that "the state is maintaining data, not using it...."

Inaccuracy of Data

Another operational deficiency of significance, although not fully within the scope of this study, lies in the quality of the data in state files. Mention has already been made of the duplications involved in

performing multiple edits of the FR-300P crash data prior to further processing. While the thoroughness of the agencies in preediting their crash data is commendable, the multiplicity of edits reflects the quality of the data being entered. A great deal of time and money is spent in all of the agencies trying to correct erroneous data. The sources of the problem are difficult to pinpoint. Naturally, it can be said that source data are inaccurate because officers in the field complete the FR-300P incorrectly. However, the system contributes to the problem by failing to maintain error rates that could provide feedback to help field personnel improve their reporting skills. Further, because it is inconvenient to do so, the system fails to provide feedback to the agencies when consistent errors are found at a later stage in processing. Finally, there is no coordination among the agencies as to what items in the crash file are edited or how they are edited. The result is that there are multiple crash files with varying levels of accuracy and completeness among the traffic records agencies. Since these files are the source for each agency's crash summaries, it is not surprising that many inconsistencies can be found among them.

Administrative Deficiencies

The greatest administrative deficiency in Virginia's accident processing system is the lack of a mechanism through which it can be managed on a systemwide basis. That is to say, no single agency, department, committee, or individual is responsible for the entire system. Because of this absence of a supervising authority, the system suffers from independent, duplicative, and sometimes counterproductive activity. Most of the duplicated processes described in the operational deficiencies section can be attributed to the lack of administrative oversight. Since each agency treats the data in its possession as its own, each agency must set up an accident processing subsystem that performs one and only one function; namely, satisfaction of that agency's information needs. This dictates the existence of duplicated processes throughout the system.

Also, the lack of administrative oversight becomes problematic when attempts are made to correct systemwide deficiencies. For example, reforms in the current system are often difficult or impossible because a beneficial change in one agency may have a deleterious effect on the operations of another. There is no formal mechanism to weigh the benefits and disbenefits of a desired change, resolve differences among agencies, and implement the reform if desirable. Additionally, recognition of interagency dependence for the acquisition of accident statistics is given only minor consideration when processing reforms are made within a particular agency. For example, it is possible for one agency to unilaterally make a change in its procedures without due regard for its effect on dependent agencies. Dependent agencies have no

recourse but to accept the changes. Even worse, there are examples of changes made in the system where no notification was given to other agencies, even though the impact on other agencies was recognized by the agency initiating the reforms.

The lack of systemwide administration of Virginia's accident processing procedures promotes duplication of effort, inhibits communication among agencies, and makes uniform control of the processes which constitute the system impossible.

Institutional Deficiencies

Operational and administrative problems can often be overcome through assertive management action in any system regardless of its complexity. However, the institutional context in which Virginia's accident processing system functions causes some severe problems and provides formidable obstacles to change.

The first of the institutional deficiencies of the system is its inherent resistance to change. In Virginia, the major cause of inertia in the accident processing system is that the system has functioned virtually in the same fashion for many years. Over time systems, procedures, and individuals have become entrenched in key positions which dictate how the system operates. Principally this is because investments of manpower and equipment in the current system may be lost if existing procedures are abandoned. Further, system participants are reluctant to accept change if it means more work for them or the loss of information being obtained.

A second institutional deficiency stems from the statutory division of authority for accident processing and analysis among the DMV, DSP, VDH&T, VDH&T, and OPTS. The result is that each agency captures data from the FR-300P for slightly different purposes, although all under the umbrella of traffic safety. This justifies the existence of a separate record-keeping system in each agency, each insulated from the other in one sense by law. Additionally, the system is so fragmented that within each agency, particularly, the larger ones, accident data processing is but one small part of the total operation. As a result, the processing of accident records holds a relatively low priority, particularly in the data processing units, in each of these agencies. Other systems (payroll, accounting, etc.) probably receive more attention and better service. Since data processing resources in most agencies are scarce due to the high demand, funding and manpower allocations required for improving the accident processing system are difficult to obtain.

Interagency politics make the administration and operation of the system difficult. Suggestions for realigning responsibilities for

certain aspects of accident data processing are often rejected due to this aspect of the problem. The effect is to create an environment which is not conducive to efficient system operation or the institution of reforms. Agency protectiveness and an atmosphere of mistrust created by ten years of critical study of the accident processing system play a key role in perpetuating the status quo.

Finally, there is widespread skepticism that a revised accident records system could meet the information needs of all agencies in a cost-effective manner and have a positive impact on safety. Thus, there is little support for change in the controlling state agencies and little interest at the top levels of state government.

Summary of Virginia's Deficiencies in the Accident Processing System

The deficiencies in Virginia's accident processing system are complex and pervasive. No single agency can be found "at fault" for the difficulties. Indeed, given their mission and the resources they have to work with, taken alone Virginia's traffic records agencies probably process accident data as efficiently as possible. Paradoxically, the system, taken as a whole, is in the study team's opinion inefficient and inadequate. The system is duplicative in at least 19 areas; it produces data which are anywhere from 1 month to 2 years old; it produces statistics which are incomplete and often conflicting; it lacks any self-evaluation and correcting mechanisms; and it is locked into a pattern by inertia, statute, and agency politics which make significant change difficult to achieve.

SUMMARY OF ANNUAL ACCIDENT PROCESSING COSTS

Altogether, Virginia annually spends approximately $1.06 million to process FR-300P accident data (see Table 14), or an average of $8.15 for each report filed. In terms of percentage contribution to total processing costs the VDH&T accounts for the largest proportion (about 38%) followed by the DMV (28%) and the DSP (27%). The activities of these three agencies together account for 93% of the total costs of processing accident data in Virginia.

Of the total processing costs, personnel costs account for 86% while computer and indirect expenses contribute 6% and 7%, respectively. It is clear that the processing of accident data in Virginia is an extremely labor intensive exercise. Personnel costs related directly to manual manipulation of crash data (i.e., coding, logging, sorting, collating, and record keeping) account for the largest proportion of total personnel costs (81%).

Table 14

Comparative Summary of Annual Accident Data
Processing Costs for All Agencies

Agency	Personnel	Computer	Indirect	Miscellaneous	Total
VDH&T	$362,500	$11,500	$29,000	$ --	$ 403,000
DMV	251,200	25,300	20,100	2,500	299,100
DSP	254,900	13,200	20,300	--	288,400
VHTRC	25,800	16,900	2,100	--	44,800
VDTS	14,300	--	1,100	--	15,400
OPTS	6,700	--	500	--	7,200
TOTAL	$915,400	$66,900	$73,100	$2,500	$1,057,900

The DMV accounts for the greatest share of total computer costs (38%), followed by the VHTRC (25%), the DSP (20%), and the VDH&T (17%). When comparisons are made of computer costs and personnel costs by agency, the VHTRC has the highest computer-personnel cost ratio (.65), followed by the DMV (.11), the DSP (.06), and the VDH&T (.03). These results are not surprising since the DMV and VHTRC operations are the least labor intensive and are heavily oriented toward automated processing. Clearly, the greatest opportunity for cost reduction and productivity enhancement lie in two areas:

1. consolidation of fragmented manual accident processing functions, and

2. conversion of manual functions to automated functions.

FUNCTIONAL REQUIREMENTS OF VIRGINIA'S DATA PROCESSING SYSTEM

Up to this point the report has focused on Virginia's current system for keeping accident records, its costs, and its shortcomings. Beginning with this section of the study, the groundwork will be laid for developing alternatives to the present system and their costs. The system must provide information to a number of agencies for a variety of purposes. A detailed description of the performance requirements of the system would be very lengthy and have little application to the study. Thus, system requirements will be expressed in broad terms. For each agency the major functions in processing accident records will be stated, and this will be followed by a general statement of the data required and the mechanisms required to obtain them.

Functional Requirements of the DMV

The DMV performs four major processing functions relevant to this study:

1. Enforcement and monitoring of accident reporting.

2. Maintenance of driver accident histories.

3. Distribution of FR-300Ps to other agencies.

4. Provision of FR-300Ps to citizens.

In order to perform these four functions, the DMV must obtain and process all FR-300Cs and FR-300Ps submitted to the state. For item 3, the DMV must have a mechanism to identify, isolate, copy (if necessary), and distribute FR-300Ps to other agencies as soon after receipt as possible. For items 1, 2, and 4, the DMV must maintain the DHF which, among other items, contains an indicator of driver compliance with financial responsibility statutes, a complete history of recent accident involvement, and a cross reference to the hard copy FR-300Ps and FR-300Cs associated with each crash for each driver. Items 1, 2, and 4 also require that the record for any driver be accessible on demand; thus, interactive access to the DHF is desirable.

Functional Requirements of the DSP

The DSP performs two major processing functions relevant to this study:

1. Tabulation and compilation of statistics for police administration and distribution to other agencies.

2. Satisfaction of federal reporting requirements.

The performance of item 1 requires that the DSP have access to the data for all FR-300Ps submitted to the state. The DSP must maintain an accident file containing all non-identifying elements captured on the FR-300P and have a capability to produce periodic statistical summaries and prepare magnetic tapes of crash data for use by the other agencies. The frequency of access to the accident file is a function of the demand for information from other agencies or from within the DSP. Presently, the level of demand for accident information is probably not high enough to justify immediate access to the accident file; thus batch access capability is sufficient at the DSP.

The DSP participates in the NHTSA's FARS program. For each fatal accident a DSP FARS analyst compiles a series of data from the FR-300P and other sources and submits it to the NHTSA. The FARS analyst requires access to each of the FR-300Ps associated with fatal accidents in Virginia as quickly after the occurrence of the crash as possible. Since this is principally a manual function, automated access to the DSP accident file is not required.

Functional Requirements of the VDH&T

The VDH&T performs four major processing functions relevant to this study:

1. Production of statistical summaries of crashes occurring on state maintained roads.

2. Analysis of accidents occurring at specific locations on state maintained roads.

3. Provision of traffic safety technical assistance to Virginia localities.

4. Compliance with federal standards for reporting and analyzing crash statistics.

For items 1, 2, and 4, the VDH&T requires data from the FR-300P for all accidents occurring on state maintained roads. For item 3 it requires data for all accidents occurring on all off-system roads. Items 1, 2, and 4 require that the VDH&T have automated access to the DSP accident file. Items 2, 3, and 4 also require manual access to the FR-300P hard copy originals for detailed analysis of accident locations. Batch access to the DSP accident file is probably sufficient for the VDH&T's automated accident analysis and reporting needs.

Functional Requirements of the VHTRC

The VHTRC performs two major accident processing functions relevant to this study:

1. Production and distribution of locality-specific crash data.

2. Analysis of crash data for planning and evaluation of Virginia safety programs.

For both items the VHTRC requires automated access to the full DSP accident file. For item 1, annual batch access to the DSP crash file is sufficient. For item 2, batch access to the DSP accident file on demand is desirable.

Functional Requirements of the VDTS

The VDTS performs only one major processing function -- the compilation and summarization of fatal accident statistics. The VDTS

requires manual access to the hard copy originals of the FR-300Ps for the approximately 1,000 fatal crashes which occur each year. These data, along with associated reports from the state medical examiner and Bureau of Forensic Labs must be manually synthesized for periodic fatal accident summaries for use by the VDTS director and the VDTS crash investigation team.

Functional Requirements of the OPTS

The OPTS performs one major accident processing function -- the compilation and analysis of statistics on crashes involving school busses. While the major portion of the OPTS's need for data is satisfied by receipt of the PT-6 school bus accident report form, the agency requires manual access to the corresponding FR-300Ps as a validity check against the accuracy of the report of the local school division superintendent. Approximately 500 school bus FR-300Ps are processed by the OPTS each year.

Synthesis of Functional Requirements

By combining the foregoing functional requirements, a minimum set of system requirements which meet the needs of all agencies can be discerned. Specifically, Virginia's accident records system must provide mechanisms to --

1. receive FR-300Ps from the field;
2. match FR-300Ps with associated FR-300Cs;
3. correlate FR-300Ps with selected accident locations;
4. edit and encode selected FR-300P data elements;
5. post FR-300P data to the DHF;
6. store FR-300P data in (a) hard copy images, and (b) computerized records
7. cross reference computerized and hard copy files;
8. distribute certain subsets of FR-300Ps to other agencies; and

9. access FR-300P data in modes for:

   a. immediate inquiry to the DHF,

   b. access to any FR-300P hard copy on demand by driver or location,

   c. batch access to any single computerized record or any group of computerized records for analysis,

   d batch access to full computerized file for summary report production,

   e. batch access to full computerized file for preparation of magnetic tapes of FR-300P data for other agencies.

AN ALTERNATIVE TO VIRGINIA'S ACCIDENT DATA PROCESSING SCHEME

Virginia's current system for processing accident records operated at an annual cost of approximately $1,060,000 in 1980 and produced crash data, in an automated form, that were a minimum of 60 to 90 days old. It is the judgement of the study team that a system could be implemented that would significantly reduce both the cost and the delays associated with producing crash data and still meet the performance requirements set out above. This can be accomplished by consolidating processing functions and improving administrative controls over system components. While a number of alternative accident processing schemes were considered by the study team, only one stood out as the most promising alternative. That alternative, referred to as the centralized file alternative, how it might function, and how it will benefit the Commonwealth are discussed below.

Functional Description of the Centralized File Alternative

The centralized file alternative would (1) consolidate the currently fragmented and duplicative manual processes under one roof, and (2) create and maintain a single, fully edited, on-line, direct access accident file, any segment of which could be extracted and transmitted electronically, or by tape, to any agency in the required format.

Conceptually, this alternative corresponds to the notion of creating a central accident processing agency; however, several features

are proposed which provide for multiagency responsibility for file content and system performance.

This scheme will work as follows: The DMV will serve as the entry point for all FR-300Ps and FR-300Cs. Both local and state police units will submit the FR-300P original to the DMV in accordance with current reporting standards. Once received at the DMV, FR-300Ps and FR-300Cs will be sorted into geographical reporting regions where DMV clerks will perform highlighting, determination of reportability, and driver element completeness checking as in the present system. The DMV will also identify FR-300Ps which are of interest to other agencies (OPTS, DSP, VDTS, etc.), separate the first copy from the original, and immediately forward these reports to the appropriate place. At this point, the FR-300Cs will continue to be processed as in the current system. However, the procedures for processing FR-300Ps will deviate substantially from those used at present. DMV clerks will separate urban from rural crashes and deliver the rural FR-300Ps to the logging section where graphic logs will be employed to locate accidents occurring on state maintained roadways and to complete the codes desired by the VDH&T. Urban crashes are not logged, thus this class of FR-300Ps will bypass the logging operation. Both urban and rural crashes (once logged) will be delivered to the accident coding section, also housed within the DMV, which will review and encode non-DMV/VDH&T elements, and perform manual editing where necessary. The now fully encoded FR-300Ps will be forwarded to the DMV microfilming work center for processing and indexing. Once microfilmed and indexed, the FR-300Ps will be returned to DMV data entry personnel who will enter the data on the disk resident year-to-date accident file in an on-line environment. Screen editing will be performed on all items to catch most errors; however, overnight batch editing and file back-up procedures will be required to ensure data integrity. The study team estimates that the fully edited accident file will be current within 1 week of DMV receipt of any FR-300P. At this point, the FR-300Ps can be forwarded to the VDH&T, where they can be filed by location. DMV analysts and programmers, with DSP and VDH&T assistance, will be responsible for supporting accident file building and editing systems. Periodically, the DMV will furnish magnetic tape copies of the file to the DSP, VDH&T, and VHTRC for use in safety program analysis and reporting. The VHTRC will obtain access to a compatible accident analysis software package for generating its statistical analyses.

The consolidation of all clerical processing functions at the DMV raises issues of possible staffing configurations. The most obvious option is to turn over all manual processes to the DMV and permit it to use existing staff or hire additional personnel to perform these activities. This has the appeal of facilitating administration of the system but has the drawback of having to provide a fairly substantial training program if the system is not to falter during the conversion

from the old procedures to the new. Another alternative is to transfer DSP personnel (who are already familiar with the accident coding process) to the DMV, and either absorb them as DMV personnel or permit them to remain under the administrative control of the DSP. If this approach is taken, DSP administrative reins may be stretched but the continuity of the system will be retained. Further, if the DSP retains coders located at the DMV, there will be some assurance of continued DSP involvement in the content of the accident file. The study team has no recommendation with respect to either approach; rather it is felt that this should be resolved at a later time. The choice of personnel configuration at the central site has no significant bearing on the cost aspects of the proposed system.

Clearly, it is vital that all participating agencies recognize the need for mutual cooperation. The DMV, DSP, and VDH&T must adopt the perspective that FR-300P data are collected for the benefit of all traffic safety agencies and are not the exclusive property of one agency or another. Although for practical purposes one agency may be designated as the lead agency for direction of the system, it is important that each of the participating agencies have a strong voice in the administration of the system. To accomplish this, it is proposed that a memorandum of understanding be negotiated and agreed to by the DMV, DSP, and VDH&T to set out the responsibilities of each for the preparation of FR-300P accident data. This memorandum of understanding would include provisions for the following.

1. The formation of an active processing system review committee which would consist of representatives from the data processing, accident analysis, and management staffs of the DMV, DSP, VDH&T, VDTS, and VHTRC. In addition, the committee would include representatives from the offices of the Secretary of Transportation and the Secretary of Public Safety. The prime responsibility of this committee would be to continually evaluate Virginia's system for processing accident records. This function would include long- and short-range system planning, studying existing procedures, and making recommendations for improvements. All substantive changes in the records processing system should be initiated, reviewed, and approved by this committee.

2. The assignment of personnel from each of the participating agencies to certain accident processing functions at the DMV.

3. The development of operational priorities and mutually accepted system performance standards which must be met by each of the involved agencies. For example, certain FR-300P processing throughput requirements can be set out so that one agency is guaranteed delivery of data within a set period of time. It

will be the responsibility of the consenting agencies to provide and maintain the staff, equipment, and management support necessary to meet the agreed upon performance standards.

4. The resolution of interagency disagreements by higher level authorities.

5. The division of sharable costs among the participating agencies.

Sources of Savings in Annual Operating Costs

If the centralized file alternative is implemented, there would appear to be three major areas where savings in operating costs may be achieved. These are --

1. manual handling of FR-300Ps,

2. coding, manual edits of FR-300Ps, and

3. entry/verification of FR-300P data.

In the present system, the DMV, DSP, and VDH&T each have personnel and equipment devoted to performing each of these functions. In the judgement of the study team significant cost savings would result from consolidating these processes at the DMV, thereby making possible the elimination of certain positions in the other agencies.

Specifically, the study team believes that the existing DMV staff should absorb the function of the DSP collating unit (4 positions) merely through a slight alteration of current procedures. Following the initial review and highlighting of FR-300Ps, DMV clerks could perform the urban/rural sorting procedure prior to delivering the forms to the coding/logging sections for further processing. Also, since the FR-300Ps would be numbered by the DMV microfilm operation, the numbering process performed in the current system by DSP collators would be eliminated.

In the current system the VDH&T devotes one full-time technician to reediting and correcting errors found in the monthly DSP crash tape. If the centralized file alternative is implemented, all editing of the full crash file would be performed at the time of entry; thus, further editing procedures at the VDH&T would not be required.

Entry of all FR-300P data would be absorbed by existing DMV staff in the centralized file alternative. Thus, the DSP staff currently assigned to accident data entry and verification (2 positions) could be eliminated.

One of the optional staff configurations considered by the study team is to replace the DSP logging section with VDH&T personnel. The rationale for this suggestion is that (1) since the VDH&T is the exclusive user of the data fields encoded by DSP loggers, the VDH&T should provide the staff resources to perform this function, and (2) if the VDH&T wants to maintain a high level of quality control over the encoding of accident locations, then it should have administrative responsibility for the individuals who perform the function. If this option were elected, the DSP would be able to eliminate 4 more positions. The VDH&T may be able to reassign existing personnel to perform the logging function, in which case there would be a net cost reduction to the state. Naturally, no net cost saving would result if the VDH&T hired additional clerical help to replace the DSP logging staff.

Offsetting Annual Operating Cost Increases

The study team envisions only one source of increased annual operating costs to the Commonwealth resulting from the implementation of the centralized file alternative. The shift of the current batch oriented, automated system to an on-line environment would certainly result in increased computer costs attributable to accident data processing. However, it is believed that the cost increases would be relatively small. It is estimated that approximately $10,000 are spent annually by the DSP and VDH&T combined to build and edit their respective monthly crash files. The study team estimates that computer costs associated with parallel automated portions of the centralized file alternative would be approximately $26,000 per year,* for an increase of $16,000 annually.

Benefits and Disbenefits of the Centralized File Alternative

In the opinion of the study team, the following major benefits would accrue to the Commonwealth as a result of implementing the centralized file alternative.

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*Based on a file size of 130,000 records, two transactions per record, and $0.10 per transaction.

1. An overall net reduction in the staffing level required to process FR-300P data of at least 7 positions.

2. A reduction in the time required to produce a typical automated accident record from an FR-300P from 60 to 90 days following mail receipt at DMV to approximately 7 days.

3. An increase in the quality and uniformity of FR-300P data and the resultant automated reports due to increased agency involvement in all phases of accident processing.

4. An increase in the flexibility and responsiveness of Virginia's accident processing system to changing national, state, and local traffic safety information needs.

5. The laying of the foundation for linking state driver, vehicle, and roadway files with the accident file so that traffic safety agencies can have access to a data base with all of the components required for a complete understanding of accident causation.

6. The implementation of a formal mechanism for planning and evaluating accident processing in Virginia, defining agency responsibilities, providing a forum for resolving interagency differences, and initiating desirable reforms.

7. Improved synchronization of the availability of data with each agency's need for data.

Disbenefits of implementing the centralized file alternative include:

1. Funding would have to be acquired to defray the cost of system implementation.

2. The DMV would have to provide sufficient space for approximately 10 to 12 additional personnel.

3. DSP and VDH&T administrative oversight of DMV-based personnel and automated systems would be made slightly more difficult.

4. The DMV would experience a lag in the processing of FR-300Ps of a few days duration longer than in the current system due to the need to pass the form through coding/logging procedures prior to entry in the microfilm record.

5. All agencies would lose some degree of autonomy with respect to their control of FR-300P data processing procedures.

Development Costs of the Centralized File Alternative

Using the Department of MASD's project planning and estimating system, a one-time cost figure was derived for the development of the software to build, edit, and maintain the centralized accident data file. The proposed four-phase approach to development of the system includes a detailed system design component, a software development component, a software implementation component, and a system evaluation component. Table 15 exhibits the estimated man-hour commitments and costs for each component using Department of MASD labor rates. A team of 4 analysts and programmers would be required to develop the system.

Assuming that each phase will run consecutively, it is estimated that this system could be developed over a period of 39 weeks.

The entire costs of the development of this alternative are eligible for funding with U. S. Department of Transportation §402 highway safety monies. The funds are administered in Virginia by the VDTS.

Table 15

Development Cost for Centralized File Software System

Phase	Man-hours	Cost
Detailed Design	1,530	$ 38,250
Software Development	2,600	65,000
System Implementation	400	10,000
System Evaluation	250	6,250
	4,780	$119,500
Estimated Computer Expenses (All Phases)		10,000
		$129,500

CONCLUSIONS

Virginia's system for processing accident data is, in the opinion of the study team, inefficient and unnecessarily costly. The system is also inherently self-perpetuating since there are no formal mechanisms for identifying and implementing needed reforms. Clearly, the impetus for change will have to come from the highest levels of state government.

This report has presented a practical alternative to the present system for keeping accident records which can meet or exceed all of the current system's performance standards at a significantly reduced cost. A significant component of this proposal is the formation of a review committee that would monitor and evaluate the new system as well as provide a mechanism for resolving associated interagency problems and initiating improvements. It is the study team's opinion that this committee would be the glue which would hold the envisioned alternative system together.

The cost benefits of implementing the centralized file alternative are obvious and compelling. The intangible benefits of more accurate and timely accident data, along with increased system flexibility and tighter system control, are probably more significant, however. With the new, more responsive data processing system in place, traffic safety agencies would be better equipped to perform their primary mission of reducing traffic related casualties and property damage. It is through management use of the products of a reformed traffic records system that the greatest cost savings to the Commonwealth can be achieved.

RECOMMENDATIONS

1. The centralized file alternative as outlined in this report should be developed and implemented in Virginia. This would include formation of a system review committee consisting of representatives from involved agencies and secretariats.

2. The impetus for implementing this system should come from the Secretaries of Transportation and Public Safety following discussion with the involved agency heads.

3. The VDTS should be willing to fund the costs of developing the centralized file alternative through use of §402 highway safety grant monies.