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INTRODUCTION TO COMPREHENSIVE COMPUTERIZED SAFETY RECORDKEEPING SYSTEMS

mode
1 highway transportation

subject areas
51 transportation safety
54 operations and traffic control
55 traffic flow, capacity, and measurements

OPERATION, SAFETY, AND MAINTENANCE OF TRANSPORTATION FACILITIES

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WORKSHOP ON COMPREHENSIVE COMPUTERIZED SAFETY RECORDKEEPING SYSTEMS

Airlie, Virginia--May 6-8, 1985

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TABLE OF CONTENTS

FOREWORD

Leaders in the continuing effort to make highways safer have recognized the need for better information about traffic accidents, drivers, vehicles and highways since the early years of the twentieth century, when motor vehicle accidents first became a major cause of death in the United States. New emphasis on the need for information surfaced in the early sixties, as the number of traffic deaths rose to new highs. The Highway Safety Act of 1966, which instituted federal support for state highway safety programs, required that each state's program include safety recordkeeping. Many states have invested substantial amounts of time, effort and money in statewide traffic records systems since 1966, but the need for information to support traffic safety programs is still far from being satisfied. In 1984, Congress initiated a program of grants to the states, under the provisions of Public Law 98-363, for the establishment or improvement of "comprehensive computerized safety recordkeeping systems."

Many of the local, state and federal officials who are directly involved in the administration of the safety recordkeeping grants are not well-acquainted with computer systems or with the development of safety recordkeeping systems over the past two decades. In addition, administrative officials of agencies which have developed special-purpose data files to support their own missions are understandably concerned when the files they operate are referred to as components of a comprehensive computerized safety recordkeeping system. To assist both groups of officials, the Transportation Research Board's Committee on Traffic Records and Accident Analysis sponsored a workshop to compile introductory material on safety recordkeeping.

The Workshop on Comprehensive Computerized Safety Recordkeeping Systems was held May 6-8, 1985, at Airlie, Virginia. It was convened by Dr. Benjamin V. Chatfield, Chairman of the Committee on Traffic Records and Accident Analysis. Participants were men and women with a total of over 200 years of experience in the collection and use of traffic safety data. All of these professionals are accustomed to working under conditions where technology advances rapidly, and all look forward to substantial improvements in safety recordkeeping in the next few years. They hope the introduction they have assembled will help others to understand what safety recordkeeping is and how safety recordkeeping systems relate to other data systems operated by state and local agencies.

I. WHAT IS A CCSRS?

A comprehensive computerized safety recordkeeping system or CCSRS is a state-administered system comprised of computerized files of data on motor vehicle traffic accidents, drivers, vehicles and highways. The files, which are often administered by different agencies, are linked in a fashion that permits correlation of data from separate files. Such systems have been known among safety professionals for a number of years as state-wide integrated traffic records systems or, more often, simply as traffic records systems.

<u>How does safety recordkeeping relate to other state recordkeeping?</u>

Safety recordkeeping systems do not exist in a vacuum. Their components usually include files developed independently to support a variety of state and local programs. Traffic safety was often a secondary consideration in the development of these files, if it was considered at all. Examples include files for managing driver licensing and motor vehicle registration programs, files for managing law enforcement and public health programs, and files for managing a variety of highway planning, construction, maintenance and traffic operations activities. Components of safety recordkeeping systems also include files created primarily to support traffic safety programs.

For a number of years, it has been recognized that the value of data in special-purpose files is greater if the data can be used for more than one purpose. Closely related to this is a concern that public funds may be wasted by duplication of data collection and processing efforts. For this reason, states have linked some of their special-purpose files to permit the merging or correlation of data from related files. For example, linkage of accident and traffic volume files allows state personnel to compute accident rates for short highway segments. The key in such a case is the use of consistent location reference methods in the accident and traffic volume files. Integrated state systems formed by linking files may include files maintained by local jurisdictions as well as by state agencies.

State efforts to link or integrate their data files have been encouraged and funded by federal agencies for many years. A substantial part of the federal effort has been related to highway planning aspects of the federal-aid highway program, which is funded through the Federal Highway Administration. Since 1966, Federal funds have also been distributed to the states under the traffic records program and other safety programs administered by the National Highway Traffic Safety Administration and Federal Highway Administration. While these federally-supported programs focus on different objectives, they are highly complementary. Integrated Highway Information Systems (IHIS) have been designed to meet the needs of the state agencies primarily responsible for highway planning, construction and maintenance. While safety recordkeeping systems meet some of the same needs, they also support the programs of traffic law enforcement agencies, public health agencies, motor vehicle administrations, and others. From a state's point of view, its IHIS and its safety recordkeeping system are overlapping subsystems of an integrated state recordkeeping system that serves a wide variety of state and local needs.

<u>What makes a safety recordkeeping system comprehensive?</u>

A CCSRS may have a large number of component files. There is no upper limit. As a minimum, however, it should include driver licensing, motor vehicle registration, traffic accident, traffic volume and highway inventory files. All of the other files must be linked to the accident file. Depending on computer capacity and the need for quick response, files to be linked can be on-line and readily

accessible all the time or stored off-line when not actually in use. Linkage between files is normally achieved by including, in each file of the pair to be linked:

-- driver license number, to link accident and driver licensing files

-- vehicle registration number or vehicle identification number (VIN), to link accident and motor vehicle registration files

-- location reference, to link accident and traffic volume files

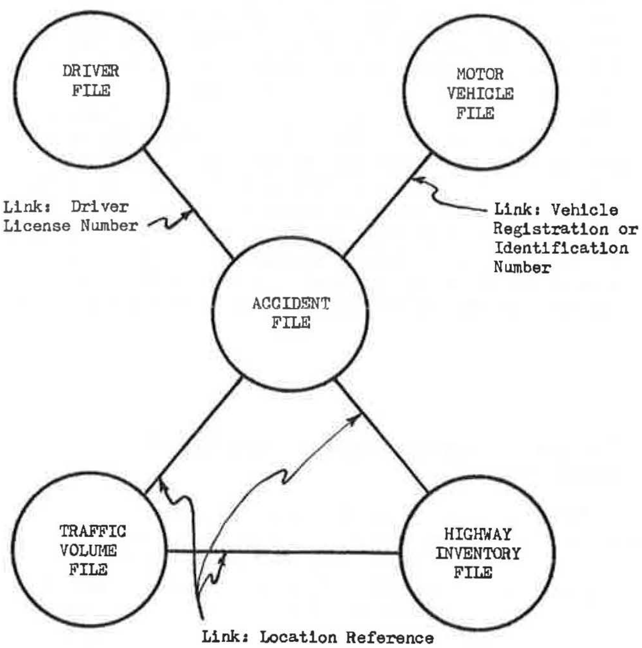
-- location reference, to link accident and highway inventory files

Location references in the traffic volume and highway inventory files should be compatible to avoid the need for multiple location references in the records in the accident file. In some states, traffic volume and highway inventory files may be combined.

A diagram of a minimum CCSRS is shown in Figure 1. All additional files must be linked, directly or indirectly, to this nucleus if they are to function as components of the comprehensive system. Linkage with the additional files may be accomplished by using any of a wide variety of links, such as:

bridge number
railway-highway crossing number
motor carrier accident system report number
Fatal Accident Reporting System report number
traffic citation number
blood alcohol test number
blood alcohol test device number
emergency vehicle run number
ICC registration number
etc.

Figure 1 -- Data files and links in a minimum CCSRS



__How is a comprehensive safety recordkeeping system "computerized"?__

For a comprehensive safety recordkeeping system to be considered "computerized", all component files must be maintained in a form permitting electronic access to the data. While punched cards may still be used occasionally to store very small files, electronic access typically involves storage of data on magnetic tapes or disks. Newer technology such as storage on laser disks may also be used.

In addition to the files themselves, the linkage among files must be electronic to be economically feasible. Links which cannot be used without manual intervention are seldom used because of the expense and special knowledge required.

The organization of CCSRS's may take several forms distinguished by the way data are stored and the way users retrieve data. Three forms are illustrated below. It is not unusual for a state to use a combination of these, basing its system design on the volume of use of various combinations of files.

In a basic system (Figure 2), users retrieve data directly from the component files. Each user is responsible for the programming necessary to correlate data from different files. In a merged system (Figure 3), the creation of merged files for various applications relieves users of some of the programming effort. This approach requires more storage capacity but, in a high volume situation, eliminates a substantial amount of duplicated effort. In a database system (Figure 4), all users retrieve their data from a single database containing data from all component files. This system makes it possible to retrieve data with a minimum investment in custom programming and is generally less costly to operate than a system with a large number of merged files.

Both the merged and database systems involve additional investment in data management to reduce user cost and inconvenience.

Figure 2 -- User access to a basic CCSRS

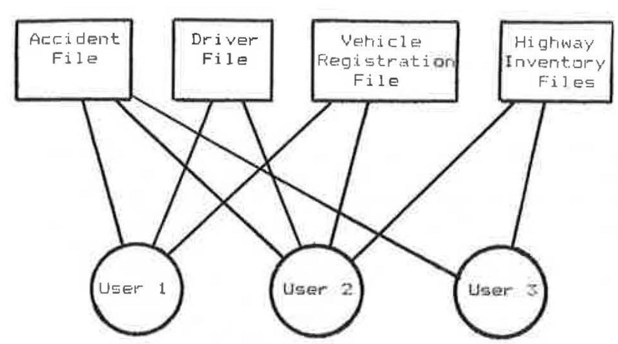


Figure 3 -- User access to a merged CCSRS

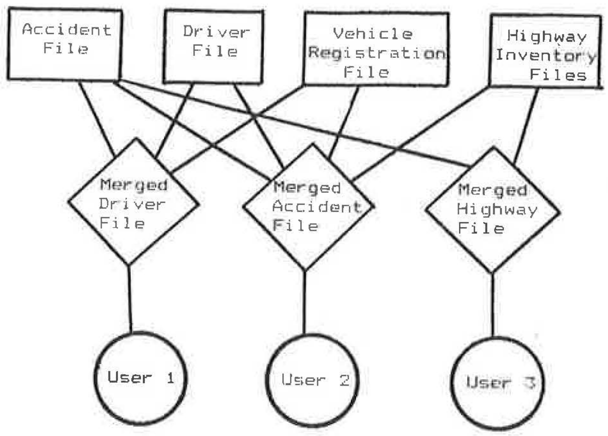
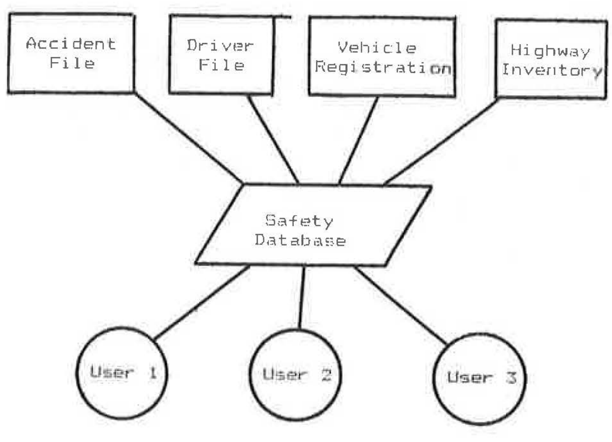


Figure 4 -- User access to a database CCSRS



II. WHAT IS A CCSRS USED FOR?

There are many examples of applications of CCSRS's that are not possible or feasible without linked files. Most of these applications can be classified in one of the following categories:

1. Enforcement
2. Engineering
3. Driver licensing
4. Motor vehicle registration
5. Research

Many applications utilize the same computerized files; what differentiates one application from another, however, is often the order in which the files are utilized and, obviously, the specific information that is generated when the files are linked.

The following examples have been selected to illustrate the range of applications of CCSRS's and are not intended to be all-inclusive.

Example 1 -- Identification of high-accident locations

A Highway Safety Improvement Program (HSIP) requires the identification of roadway sections where unusually high numbers of accidents occur or where accidents are unusually severe. These roadway sections are then studied to determine which of the available countermeasures are most likely to improve the situation at a reasonable cost. Although some agencies may use only accident frequencies in defining high-accident locations, the measures should ideally incorporate vehicle exposure for accident rate computation, and also roadway data. This will allow comparison of critically high accident rates for various highway location types (intersections, bridges, 2-lane, 4-lane divided, etc.). Automated processes for identifying high-accident locations involve merging or interfacing the accident file with the traffic volume file and roadway file. Several states currently use linked files for this purpose. Michigan, California, Ohio and North Carolina are four of these.

Example 2 -- Identification of hazardous roadway elements

State transportation departments throughout the country have a need to integrate their accident records files with highway data files containing geometric design and traffic volume data so that undesirable design features in existing roads can be detected. When a feature is found to be hazardous, a computerized recordkeeping system permits a rapid and inexpensive survey to locate similar hazards on other roads. Having determined that a feature is hazardous, steps can also be taken to avoid it in newly constructed or reconstructed roadways. An integrated system can be used to establish new policies and practices in areas of construction and maintenance. The State of Utah has successfully integrated a number of different roadway files with its accident file to form a partially integrated system. With the increased emphasis on 3R-type construction (resurfacing, restoration, and rehabilitation) this integration of data has become more important in recent years.

The current trend toward reduced police reporting of minor injury accidents and property-damage-only accidents is making it more and more difficult to use accident data to locate hazardous sections of highway. For this reason, the identification of hazardous roadway elements is expected to become increasingly more important.

Example 3 -- Use of CCSRS's to develop accident surrogates

The traditional approach to identifying the risk of traffic accidents has been to assess this risk after accidents occur. This has an obviously high cost to the public in terms of pain and suffering as well as property damage. CCSRS's can be utilized to identify high-risk locations before they manifest themselves in high-accident occurrence. The complexity of such an analysis dictates the use of a CCSRS to identify surrogates which may be used in lieu of accident data to identify hazards. For example, data on traffic speed distributions at given locations can be merged with data from enforcement and roadway inventory files to identify high-risk locations. Appropriate engineering, enforcement or other actions can then be taken to avoid high-accident occurrence.

Example 4 -- Selective traffic law enforcement

One application for information from a CCSRS computerized is in the area of selective traffic law enforcement. Traditionally, police agencies have based selective or targeted traffic enforcement measures solely on data from an accident data file. This file could identify such basic information as where, when and why an accident occurred. However, if other data files--such as enforcement (citations), traffic volume, and roadway inventory--were linked to the accident file, a police agency's ability to allocate its limited personnel would be greatly increased. This data linkage would provide a clearer understanding of accident relationships to enforcement efforts, traffic volume and roadway characteristics. The Department of Governmental Research at the University of New Mexico has developed programs for this type of application.

Example 5 -- Traffic enforcement planning

Another application of the linked data files in a CCSRS is in the problem identification area of traffic law enforcement. The linkage of accident, enforcement, roadway and traffic files better enables police agencies to identify future accident trends and analyze future accident patterns. This permits better long-range planning for deployment of enforcement personnel based on expected accident trends instead of the traditional after-the-fact approach currently used.

Example 6 -- Driver improvement programs

Drivers with accident experience or a history of traffic violations are prime candidates for driver improvement education. These drivers cause a disproportionate share of traffic accidents and receive a high percentage of traffic citations. Identification of problem drivers provides an agency a known target group from which to work. The types of files to be linked are accident, enforcement, court adjudication and driver licensing (with driver history). The output from the system is the identification of those drivers who are candidates for driver improvement training. The system can identify not only drivers who have had either accidents or traffic citations but also those who have had accidents and traffic citations and court adjudications. Two states now using such a system are California and Illinois.

Example 7 -- Court monitoring

With the increased emphasis on DUI (driving under the influence of alcohol) as a major safety problem throughout the country there is a need to know how the courts are adjudicating traffic citations for DUI. An integrated system is needed to bring together information contained in the police enforcement files with court citation dispositions for inclusion in the driver records file. A number of states are monitoring the courts using volunteers from safety organizations. New York has a system called Traffic Safety Law Enforcement & Disposition (TSLE&D) that tracks citations through the entire enforcement and judicial process.

Example 8 -- Monitoring designated truck routes

One of the most pressing questions affecting the productivity of our highway system concerns the safety characteristics of large and heavy vehicles. Decisions on a designated route system for these vehicles should be based on facts about the accident records of these vehicles in relation to their travel patterns, routes, roadway geometrics, and the travel patterns of passenger vehicles on the highways at the same time. CCSRS's are the only feasible source of data needed for the study of the multiplicity of factors contributing to accidents on the designated truck routes. Once an initial system is designated, the truck route system can be continuously modified based on accident experience and demands for service in new markets. This dynamic aspect of large vehicle monitoring argues strongly for ongoing data collection, assembly and analysis that can only be effectively accommodated with CCSRS's.

Example 9 -- Evaluation of highway safety projects and programs

The evaluation of completed safety projects and programs is essential in determining their effectiveness. Simple before-and-after studies may give misleading or erroneous results. Control sites or comparison sites should be used whenever possible to control for external threats to validity. Such proper evaluations are facilitated in several ways using data from the accident file, traffic file, roadway file and project construction file of a CCSRS. Control sites can be selected more accurately and accident data can be normalized to account for changes in traffic volume during the evaluation period.

III. COSTS AND BENEFITS OF A CCSRS

Costs

In the development and operation of a comprehensive computerized safety recordkeeping system there are many types of direct and hidden costs. Because the dollar value of these costs depends on many variables, no figure is presented in this guide. In every state, substantial components of a safety recordkeeping system are already in place. Many states have developed their systems beyond the minimum described above in Section I. The cost to expand depends heavily upon what a state is building upon. However, an agency planning the establishment or improvement of a comprehensive computerized safety recordkeeping system should consider the following areas of cost.

The first area to be considered is the amount of data that is to be manipulated. This includes the number of files and the amount of associated data within each file. A related size aspect is the number of roadway miles, accidents, motor vehicles, vehicle miles, drivers, etc., to be accounted for. In addition to the size of the system, an agency needs to assess the present level of development of its system and how much further development it is undertaking. These are the main factors in determining an overall cost of a system.

To support the cost analysis an agency must consider the availability of personnel to support the system. Data collectors, data entry and editing personnel, system analysts and programmers, technical analysts and designers are needed. All the facets of data collection, storage and use are impacted by a CCSRS. During the developmental stage, there will be a heavier reliance on data programming personnel; their costs are of a one-time or capital nature. During the operational phase personnel costs are more predictable and directly related to the data collection activity. If personnel to perform these tasks are not available within an agency they may be obtained by use of consultant services or perhaps developed within an agency. All related personnel should be committed to a successful project completion. Since a CCSRS crosses many intra- and inter-departmental boundaries, the costs of developing effective working relationships need to be included in the total project cost.

Besides the availability of qualified personnel, a vital ingredient of a CCSRS is computer availability. Systems may use mainframe, mini- and micro-computers. Costs for each vary considerably but have been dropping rapidly. Costs associated with software procurement and usage must also be taken into account. The overall size of the system and its complexities will help determine the range of alternatives available for computer hardware and software.

A fourth area in the cost analysis is the acquisition of input data. Consideration must be given to the preparation of the data and an analysis completed as to the upgrading or applicability of the input data. The costs of using and combining the existing data files needs to be determined. New developments in data entry technology (e.g., bar codes) may help to improve data quality and keep costs down.

In order to assure successful implementation of a CCSRS the agency must be committed to the program. All levels of management need to be supportive of the effort and assist in its activities. There are definite costs associated with ensuring the commitment of the agency and the related managers.

Costs involved in enhancing or developing a CCSRS can be classed as either developmental or operational. Within the developmental area there are design and programming costs. Just as in any project, enough time and effort will need to be expended to get an adequate design. This will reduce the overall programming cost and allow the operational costs to be minimized. Often the design costs and time are overlooked. This is especially true when an overall master plan is being developed for an incrementally developed system. These costs are not trivial and should be adequately budgeted, with sufficient time allocated to ensure that all users will have their unique needs met by the CCSRS.

With the implementation or enhancement of a CCSRS present operational costs should remain the same or, more likely, be reduced. With the sharing of data, duplication can be eliminated and associated data costs reduced appropriately. The CCSRS, if designed adequately, should have minimum impact on data collection procedures that are already running efficiently and improve those areas where cost savings can be implemented.

On balance, it should be recognized that a CCSRS costs a lot of money initially, but the benefits, as explained below, more than justify the expenditure of these funds.

Benefits

CCSRS's offer the opportunity for substantial benefits in a number of areas. One clear and substantial benefit is a reduction in operating costs. Data entry to each of the component data files can be substantially cut by reducing duplication. For example, driver-related information can be automatically entered in an accident or traffic citation file by merely recording the driver license number. Driver name, address, age, and other items can then be transferred automatically from the driver licensing file. This reduces editing as well as entry time. These and other improvements in manpower utilization should allow more productive use of the existing employment force.

Additional savings are also possible due to changes and simplifications in operating policies. For example, police will be able to more quickly complete an accident investigation report because details of roadway geometrics and other site characteristics will be referenced by one location reference code. Reductions in on-site investigation time should reduce delay and inconvenience to the motoring public as well as free the law enforcement officer for other duties.

CCSRS's provide the engineer, law enforcement officer and other state or local officials with powerful tools to identify, analyze and solve highway safety problems. Because the systems are automated they will provide more immediate feedback to the user. Rather than spend weeks or months tabulating and cross-referencing data on accident locations and roadway geometric conditions, for example, the engineer can quickly obtain a summary of all accidents occurring on narrow bridges, or on highways recently designated as large truck routes. Quick response to timely and important safety issues will help protect the motoring public and provide a more positive public image for the agencies involved. This quick response capability can also be used to support state executives in communication with their constituencies.

Additionally, a more comprehensive and integrated perspective on public safety issues will be available so that more informed investment and deployment decisions are made. This approach to safety records systems will help assure that scarce resources are not squandered on ineffective investments. As the highway system matures, obvious safety deficiencies will be (and are) quickly corrected. A CCSRS will be essential in the analysis and resolution of complex safety questions.

A CCSRS can also serve as a stimulus for improved communication aimed at solving common problems. Actions from diverse areas of government including engineers, enforcement officers and motor vehicle/licensing officials will be facilitated by the use of CCSRS's. While each agency will continue to pursue its own mission, cooperation on highway safety issues makes goverment more effective and efficient.

IV. OVERCOMING TECHNICAL OBSTACLES

In the development of a comprehensive computerized safety recordkeeping system many technical obstacles must be overcome. Examples are:

-- incompatible location reference systems

-- lack of "property damage only" accident data

-- obsolete or incomplete data

-- incompatible data files

-- rapidly changing technology

These five obstacles, along with possible ways of overcoming them, are discussed below.

Obstacle 1 -- Incompatible location reference systems

One of the major obstacles in developing a comprehensive computerized safety recordkeeping system is that many different reference systems have been used to develop data files. As an example, accident data may be collected by the state using a marked route and milepost location method while the roadway data collected for planning purposes is based on a link-node location reference method. At the same time maintenance files may be developed utilizing maintenance section numbers and construction cost data is collected using a construction job number. In order to integrate these data files for a comprehensive computerized safety recordkeeping system some common data base must be established or interfaces between the various files developed. It may even be necessary to restructure the existing data which could require extensive manpower efforts and costs. Various location reference methods are described in the National Cooperative Highway Research Program (NCHRP) Synthesis of Highway Practice 21, "Highway Location Reference Methods". Applications of these location reference methods are discussed in Synthesis of Highway Practice 91, "Highway Accident Analysis Systems".

Obstacle 2 -- Lack of "property damage only" accident data

One of the major problems in the use of a CCSRS in some states is the lack of information on minor accidents. The percentage of property-damage-only (PDO) accidents and minor-injury accidents reported by police has declined rapidly in the past few years. For example, much of the accident experience data is unavailable for low-speed roads (especially those in urban areas) and for typically low-severity accident types such as rear-end accidents and sideswipes. Thus, data files are incomplete and much of the safety analysis based on these files may be unreliable or give erroneous results. High-accident locations on many urban streets will not be identified if accident reporting continues to decline. When used in selecting countermeasures, incomplete accident data may not show all of the accident patterns. As a result, non-optimal countermeasures may be selected. Evaluations of completed projects may give erroneous results, since the effect of the projects on total accidents or on specific accident types will not be fully known. For research purposes, incomplete accident data is of limited value. PDO accidents should not be considered unimportant for safety analysis, since the severity of an accident (i.e. PDO, injury, fatal) is highly correlated with such factors as the size or type of vehicle (small car, truck, etc.), the use of safety belts, and other factors.

Some of the reasons for reduced PDO accident reporting are (1) police manpower limitations, (2) lack of communication among police, engineers, and others on the importance of accident reporting, (3) the low priority of accident reporting in some jurisdictions, and (4) the expense of processing a large amount of information from each accident report form.

Obstacle 3 -- Obsolete or incomplete data

Quite often when an existing data file is combined with another file in the development of a CCSRS it is found to be deficient. Additional data items may be needed or the data may not be current enough to serve the combined need. As an example, a CCSRS that utilizes the state accident data base for problem identification or high-accident location determination by local agencies is less useful if data are not entered until several months have passed. Steps should be taken to make data entry more current. This same type of updating may be necessary for other data items such as traffic volumes, citation information, etc. It may also be necessary to modify the data file to include information on recent emphasis areas such as DUI, seat belt usage, child restraint devices, or new categories of large trucks. Obstacles such as this often indicate that managers have given a low priority to the operation of a safety recordkeeping system and, consequently, have realized little benefit from it.

Obstacle 4 -- Incompatible data files

One major obstacle a state may encounter in developing a CCSRS is incompatible data files. This may occur between local and state files or between various state files. One example would be in the method of identifying a driver. One file might use the driver license number while another uses only the driver's name, which is often not unique. Another example of incompatible data files might be in the software and/or hardware of local systems which utilize personal computers or mini-computers, while their state uses only a mainframe computer. If these systems were not compatible or based on the same software they could not share data or be linked. This lack of compatibility would require a development of software bridges or complete replacement of some of the systems with compatible ones.

In developing a CCSRS, each state must study its current data files and determine the compatibility and linkage capability of these files.

Obstacle 5 -- Rapidly changing technology

Because of continuing development in computer technology and capabilities, a CCSRS should be an evolving system that is modular and highly flexible. A state may turn small obstacles into large ones if it attempts to move too quickly to expand a CCSRS. It is recommended that a building block approach be utilized. Analyze the various technical and

institutional obstacles which must be faced, then tackle them in order of importance and of the likelihood of success. There is a danger in trying an all-or-nothing approach to development of a CCSRS, since the costs could become extremely high before any offsetting benefits are realized. When this occurs it is difficult to maintain a high level of commitment to development of the system.

There is a danger that part of a newly developed system may have to be completely redone if it is not compatible with changes that are planned for some time in the future. The place of each piece in the system must be carefully considered as a CCSRS is developed.

V. OVERCOMING INSTITUTIONAL OBSTACLES

CCSRS usually includes data files administered by a number of different state and local agencies. In a situation of this kind, there are often a number of institutional obstacles to the linkage and use of the files. Some of these obstacles are:

-- lack of management recognition of the need for or value of a CCSRS

-- large investments in existing independent files

-- no comprehensive or statewide plan or structured approach to development and operation of the CCSRS

-- lack of communication and cooperation among organizational units

-- overlapping and inconsistencies in the interpretation of legislative and administrative mandates

-- no identified coordinator for a CCSRS

-- inadequate staffing and/or funding

-- limited training opportunities for potential CCSRS users

-- weakening of existing CCSRS's through the creation of competing systems by various organizational units

-- proliferation of competing activities at the local level

One way to avoid or minimize these problems is to create an interagency advisory council. Such a council should have executive and administrative commitment, with defined responsibilities and decision-making authority. It may involve representation from local as well as state agencies. The participants should represent all major users as well as the operators of components of the state's CCSRS.

Suggested responsibilities for an interagency advisory council include:

1. Development of a comprehensive, statewide approach to the CCSRS resulting in a formal traffic records plan. Such a plan should include a review of personnel staffing needs and financial resources as they relate to the accomplishment of the plan.

2. Facilitation of communications and cooperation among agencies represented on the council.

3. Supporting a policy of interagency agreements which reduce or eliminate duplication of effort.

4. Coordination of the operation of the CCSRS and its components.

VI. RESEARCH ON CCSRS DEVELOPMENT OR IMPROVEMENT

Present safety recordkeeping systems have evolved over a relatively short period from local manual systems--such as pin maps on the wall in the police station or traffic engineer's office--to large mainframe computer systems holding accident, driver, vehicle registration, and highway records in the state capitol. Most states have directed their energies toward centralization of data storage and of much of the processing. New York State, for example, has a staff of more than 80 persons in Albany who keystroke data from over 600,000 accident reports per year and prepare files for further interrogation. Such systems grew during a period in which this was, or at least appeared to be, the most efficient approach.

During the past five years, however, there has been a major revolution in computer capability. Relatively inexpensive microcomputers have memories and speeds exceeding those of the largest computers 25 or 30 years ago. Digital instrumentation techniques--bar codes, magnetic stripe credit cards, high-speed digital communication links, easy-to-use error-correcting data input devices--are now in common use in such fields as banking, telephone billing, product inventory control, and grocery checkout lines. Perhaps because of the inertia associated with the large state-centered systems, these more modern techniques have seen relatively little development in the reporting of information in the traffic records field. In other fields, the implementation of modern computerized systems has led to two outcomes: (1) major reductions in costs associated with necessary recordkeeping, and (2) discovery of undreamed of capabilities which arose in conjunction with the modernization. For example, bar code readers at cash registers speed up the checkout process and provide an accurate inventory of stock almost instantaneously. Gone is the monthly recording of stock on the shelves (along with the people who did that work). Instant inventories lead to more sensible ordering of replacement stock, shorter holding times for products in the store, and better profit margins.

While the wording of the new law which calls for CCSRSs does not address these items directly, it seems an opportune time to begin large-scale systems research of the entire traffic records process to determine whether similar gains can be made in this field.

A back-of-the-envelope computation suggests that

the accident data development process (completing paper reports in the field, transcribing them in the office, forwarding them to a central point for digital encoding, etc.) costs $20 to $25 per report. For New York, with over 600,000 accidents, this comes to roughly $15,000,000 per year; for Michigan perhaps $8,000,000. If the time per case could be halved by adding instrumentation in the system, the labor savings would be large. If the entire process from the occurrence of an accident to the availability of the data in a computer could be reduced to 24 hours (as opposed to the typical 60 to 90 days), the information might be of immediate value to police agencies for planning, for example, the next week's patrol activities.

The purpose of the Workshop on Comprehensive Computerized Safety Recordkeeping Systems was not to design such a system. Indeed, there is no guarantee that the gains would be real and of great value. We believe, however, that the time has come to begin research in this area with an understanding of the capabilities of modern instrumentation. One of the topics which arose in the Workshop discussions was how to provide information to local (city and county) users from a centralized system. (Some cities in North Carolina now have direct access to computerized state files.) The availability of microcomputers, and the possibility of downloading files from state storage facilities to local units for analysis seems to be real. But a complete design might also take into account improvements at the data input end.

While this discussion has centered on accident records, there may be similar changes possible in vehicle registration, driver licensing, roadside inventories, etc. Some of these are already being pursued--digital communication systems exist which permit instant check of records for driver license renewal, some court records are input to computers in machine-readable form, etc. Specific activities which would be in order include:

(1) Detailing of alternative system designs, showing a range of data input devices (computer terminals in police cars, bar-coded driver licenses and vehicle registration certificates to reduce time and eliminate errors from transcription of data in the field), communications links, programs developed to promote error-free data input, etc. Anticipated costs and savings for alternative designs should be computed.

(2) Small-scale experimentation with possible components for such a system--e.g., funding a small-city police agency to try an automated system, stick-on bar codes for driver licenses in a small state at the next renewal period, embedding a bar code in a license plate or on a sticker attached to the plate. Early equipment trials will likely be imperfect, and may be worse than the manual systems they replace, but it is a necessary step to find out where to go next.

(3) Development of user-friendly output programs to make the more timely data available to local users--to learn how they can use it, and to seek their feedback on the need for improvement.

(4) Refinement of the system design leading to a large-scale trial.

In a broad sense, a CCSRS program could include such a research and development component. It might turn out to be the most important activity to be undertaken.

VII. RESEARCH USES OF A CCSRS

The line between applied research and analysis of operations (in using traffic records data) may be somewhat fuzzy. Perhaps the routine listing of high-accident locations to provide highway department district engineers with a priority list for inspection should be in the latter category. But an analysis of accident and related data to discover the source of a problem related to highways (e.g., whether the accident rate is the result of wet roads, roadside furniture, or drunken drivers--or a combination of these) might fall in the research category. In both cases similar data sources might be called upon, and the label would depend on whether this was a special or routine activity.

In order to illustrate the research uses of integrated traffic records two topics have been selected from the current list of highway safety emphasis areas on the assumption that a state's highway safety program manager, or someone else in the state, must learn whether his programs have been effective. The kinds of data for this process, and their uses, are discussed below. While the effectiveness of a countermeasure may be considered simply in terms of whether things got better or not--that is, did the accident, injury or fatality rate decrease significantly?--the careful researcher should also be prepared to answer the question, "If not, why not?" Most countermeasure activities in highway safety take place in a complex environment--with many other things going on at the same time--and it is often necessary to look deeper into the data to discover "why." A CCSRS helps in taking this deeper look.

The two examples of evaluation research are (1) measurement of the efficacy of an alcohol countermeasure and (2) measurement of the efficacy of a mandatory restraint usage law. Following these examples is a discussion of a proposed research program aimed at a rather extensive redesign of a traffic records system to take advantage of digital instrumentation developments which have become available over the past five years, but which have seen relatively little use in traffic records systems to date.

Alcohol and Accidents--Evaluation of Countermeasures

There have been many programs proposed and implemented which are intended to reduce those accidents purportedly caused by alcohol. Among these are (1) laws prohibiting happy-hour (2 for the price of 1) drinking, (2) changes in the legal drinking age, (3) administrative suspensions (lifting of the driver's license at the scene), (4) sobriety check-point operations, and (5) enhanced enforcement activity. Such programs are typically initiated by legislative action, and highway safety managers are likely to be asked later how successful each program has been. As an example, consider the research approach and data requirements involved in looking at the effects of a change in the legal drinking age.

A likely model for considering this question is a time series of some desired outcome (fewer accidents, injuries, etc.) centered on the date of intervention (the passage of the law). Table 1 shows a list of data sources which may be of interest in this question, along with the kinds of information in each. Table 2 suggests possible

Table 1 -- Sources of information on effects of lower drinking age

Source	Information
Arrest records	Change in blood alcohol level (BAL) by driver age
Accident data	Change in night/day accident ratio for young drivers, change in reported drinking in accidents involving young drivers
Bar license records	Bars going out of business in college towns, license suspensions for violations of age/sales laws
Court records	No young driver convictions in the "after" period suggests the law is very effective. Inspection of conviction record by region of the state may indicate differential success by area.
Driver license records	Comparison of these with court records may confirm reliability of the record system. Driver records alone may suffice for indication of success if smaller percentage of alcohol violations for young drivers.
Roadside breath tests	Random observation of BAL on the road should indicate less drinking by young drivers, even in the absence of an accident reduction.
Medical examiner records	Change in BAL distribution of drivers killed in accidents (by age)
Hospital/trauma center records	Change in BAL distribution (where this is available)
Exposure, volume data	Used to compute rates as opposed to simple accident counts. Most useful if it could show driver exposure by age. Could include survey data, driver license file (from point of view of the number of drivers by age)

Table 2 -- Linkage of data files for evaluation of the effects of a lower drinking age

	Arrests	Accidents	Bar licenses	Courts	Driver license	Roadside tests	Medical exam	Hospital	Exposure
Arrests		S	X	S	S	S	S	S	S
Accidents			X		X		X	X	X
Bar licenses									
Courts					S				
Driver license									
Roadside tests									
Medical exam									
Hospital									
Exposure									

S: Data used to supplement findings in row item
X: Data used in linked files with that in row item

cross-references among the various data files. These are indicated in two ways. An "S" means that data from one of the files could be used in a supportive role to the other--for example, data from a roadside survey should indicate the blood alcohol level of the driving population, and this might be compared with similar data from the arrest file to learn whether arrest data are representative of the traveling population or whether there is a bias toward or against one age group in the arrests. While there may be no linking variable in these two data sets, tabular results of each may be compared with the other.

An "X" means that there may be a direct linking of the two files for this analysis. For example, if there were geographic location reference codes available in both the arrest file and the bar license file, it might be of interest to determine the arrest-age data for areas near bars which had been cited for age-sales violations. This is probably not feasible in any jurisdiction at present but is the kind of analysis which might be productive. It could be done by hand and, indeed, might be, but availability of the data in computer form would make it more likely that such analyses would be conducted routinely.

Nearly all of the X's in Table 2 appear in the accident data row. Accident locations and bar locations might be of interest for reasons such as that noted above. Driver license records might be compared with drivers identified in accident records to look at previous drunk-driving citations or to measure recidivism rates. Accident data and traffic volume data would be of value in estimating accident rates as opposed to absolute numbers of accidents.

Occupant Restraint Usage and Effectiveness

One of the leading highway safety issues of the 1980's is that of occupant restraint usage and effectiveness. In 1978, Tennessee led the way with the nation's first mandatory child-restraint law. Since that date, all 50 states have enacted child-restraint laws. On the adult side, last year New York State passed the first mandatory restraint usage law for adults. Since that time, a number of additional states have followed with similar legislation.

From the viewpoint of both the proponents and opponents of this legislation, the obvious question to be answered is how well the laws are working in terms of increasing belt usage and, ultimately, in reducing injuries and fatalities. Secondary issues involve the effectiveness of the enforcement efforts and the adjudication success in the courts, as well as public attitudes concerning the various aspects of the law. These questions will certainly need to be addressed in a timely manner using a considerable variety of data sources, most of which fall into the area of traffic records or safety recordkeeping.

This example is presented to illustrate the different data sources that must be brought to bear in examining these questions either one-at-a-time, in combination, or, as is possible with a CCSRS, by linking data from two or more sources. The data that would be needed include the following:

(1) accident report data
(2) arrest data
(3) conviction records
(4) hospital/medical examiner/in-depth accident investigation records
(5) usage surveys
(6) opinion surveys
(7) exposure (volume) data
(8) demographic data

Accident data can be used alone to address questions such as occupant restraint usage in accidents by injury severity, by age, by sex, etc. Arrest data would provide an indication of law violations by region of the state, age, sex of occupant, etc. Conviction records provide a method for conducting an evaluation of the related court performance. Usage surveys provide estimates of the usage by the population-at-risk in terms of age, sex, car size, geographic region, etc. Opinion surveys would provide the legislature with information on the political climate with respect to the law. And hospital or medical examiner data would be used to explain injury patterns with and without seat belts. (See Table 3.)

A number of these files would be used in combination to glean important additional information. For example, examination of the accident data in conjunction with good exposure data should shed light on over- or under-representation of belt-wearing in crashes by driver and vehicle characteristics. Arrest and conviction data contrasted with usage data, or exposure data contrasted with arrest, conviction and demographic data should help to clarify enforcement issues. The combination of data sources indicated by an "S" in Table 4 suggests areas in which pairs of files used together will strengthen an analysis of mandatory restraint-use laws and their ramifications. Perhaps the most important area is where the data in one file can be linked with the data in another file to answer questions that could not be addressed by either file alone. These cases are indicated by an "X" in Table 4. Thus, for example, for the court evaluation it is necessary to link the cases in the arrest file with those in the conviction file. What are the conviction rates? How do they differ by age, sex, and jurisdiction? Do they differ for accident-related and non-accident-related citations for violations of restraint laws? Are the conviction rates higher for persons previously convicted for violations of traffic laws?

Usage surveys through the vehicle registration number could link observed usage with other characteristics found in the driver history file (through driver license number of the registered vehicle owner). Many more examples could be given.

In short, CCSRS's containing the relevant data would be extremely valuable to agencies charged with responsibility for evaluating the effectiveness of mandatory restraint usage legislation.

Table 3 -- Sources of data for evaluation of seat belt laws

Source	Information
Accident data	Change in belt-wearing rates for crash occupants, change in injury and death
Arrest data	Distribution of citations by age, sex, time of day, and geographic region
Conviction records	Conviction rates by age, sex, geographic area
Hospital/medical records	Information on injury patterns and severity for belted and unbelted occupants
Usage surveys	Change in belt use rates by driver, vehicle and demographic characteristics
Opinion surveys	Feedback to legislators on public opinion trends
Exposure/volume	Needed to compute rates (per mile, per registered vehicle, etc.)
Demographic data	Driving records, other characteristics of drivers

Table 4 -- Linkage of data files for evaluation of the effects of seat belt laws

	Accidents	Arrests	Convictions	Hospital/ medical exam	Usage surveys	Opinion	Exposure	Demographic
Accidents		X	X	S	S	S	S	X
Arrests			X		S	S	S	X
Convictions					S	S	S	X
Hospital/medical exam.					S			
Usage surveys							X	X
Opinion								S
Exposure								S
Demographic								

S: Data used to supplement findings in row item
X: Data used in linked files with that in row item

VIII. CONCLUSION

"Comprehensive computerized safety recordkeeping system" (CCSRS)is a new term used by Congress in 1984 to refer to what many in the traffic safety community have known since the late sixties as statewide integrated traffic records systems. A CCSRS typically consists of a number of files maintained by various state and local agencies. The files are linked in a manner that permits correlation of data from different files.

The key to development of an effective state CCSRS is support by the state's top administrative officials. Without such support, those responsible for the administration of the data files of which the system is composed often do not recognize and accept the fact that coordination is in the best interest of the state. Generally, it is useful for a state to establish an interagency advisory council with authority to promulgate policy and coordinate CCSRS development or improvement and operation. Members of the council should represent all major collectors, processors and users of data in CCSRS files.

A state CCSRS is comprised of those data files particularly relevant to traffic safety program management. Some of the same files are included in other systems, such as those which focus on highway program management, law enforcement, or tax administration. For this reason it is rarely, if ever, desirable to consolidate all components of a CCSRS in a single state agency.

An effective CCSRS enhances state capacity to identify traffic safety problems and to evaluate safety countermeasures or programs. The primary reason for CCSRS development or improvement is to support programs that reduce the number and severity of traffic accidents. As a secondary benefit, development or improvement of a such a system may reduce the costs of operating the individual data files within it.

Without access to a CCSRS, there is little chance that a safety program manager will find the most cost-effective ways to reduce traffic deaths and injuries.

APPENDIX A

WORKSHOP PARTICIPANTS--BIOGRAPHICAL NOTES

BENJAMIN V. CHATFIELD, President of Chatfield Associates, Inc., is a professional engineer. He received his BS and MS in Civil Engineering and his Ph.D. from Stanford University. Between 1951 and 1968, Dr. Chatfield served as a highway engineer with the Alaska Road Commission, Imperial Highway Authority (Ethiopia), and the Federal Highway Administration, working primarily in highway location and design. From 1968 through 1984 he specialized in the collection and analysis of safety-related data, directing or coordinating related activities in the Federal Highway Administration. Dr. Chatfield is chairman of the Transportation Research Board Committee on Traffic Records and Accident Analysis and the National Safety Council Committee on Classification of Motor Vehicle Traffic Accidents. He is a past chairman of the NSC Traffic Records Committee and a Fellow of the American Society of Civil Engineers.

JAMES K. WILLIAMS, Transportation Safety Coordinator of the Transportation Research Board, received his BS from Dartmouth University and an MS in Public Administration from New York University. Before accepting his present position, he served as a National Safety Council Regional Director, as Executive Director of the Connecticut State Safety Commission and as Director of the Bureau of Public Roads Office of Highway Safety. He has served on several national and international traffic safety committees and has published numerous articles in professional journals over a period of 35 years.

WILLIAM T. BAKER, Chief of the Technology Development Branch, Office of Highway Safety, Federal Highway Administration, received his BS in Civil Engineering from Youngstown State University and his MS in Civil Engineering from the University of Washington. His experience includes two years in safety research with the New Jersey Department of Transportation and 18 years in the FHWA Offices of Traffic Operation and Highway Safety. Mr. Baker is responsible for the development of equipment which makes modern photologging possible and for implementation of the traffic conflicts technique in the United States and Europe. He has published about 35 articles on highway safety and related topics.

DAVID G. BLAKE, Information Management Engineer, Transportation Planning Division, Utah Department of Transportation, received his BS in Civil Engineering and his MBA from the University of Utah. He has six years of experience in safety recordkeeping and played a key role in the Utah data file linkage demonstration project sponsored by the FHWA. He has recently chaired a national committee which was formed to study the need for research related to safety recordkeeping.

THOMAS R. BOSWELL, Lieutenant, California Highway Patrol, is Project Manager of California's Statewide Integrated Traffic Records System Evaluation Project. He received his BS from San Jose State University and an MPA from Golden Gate University. He has served as traffic enforcement consultant at the University of California Institute of Transportation Studies, as a supervisor in the California Highway Patrol's Planning and Analysis Division and in other supervisory positions with the California Highway Patrol.

BARBARA A. HILGER, Head, Accident Analysis Division, Texas Transportation Institute, received her BBA from North Texas State University. She has held a variety of positions in systems analysis, database administration and management since 1972. Ms. Hilger, a member of the National Safety Council Traffic Records Committee, has published a number of articles related to traffic records, highway safety and pavement management.

PAUL P. JOVANIS, Assistant Professor of Civil Engineering and Transportation, Department of Civil Engineering, Northwestern University, received his MS in Civil Engineering from the University of Maryland and his Ph.D. from the University of California. Dr. Jovanis is active on various safety-related committees and is currently conducting research on motor carrier and urban bus transit safety. He has published papers on child pedestrian safety and on exposure to accident risk.

PHILIP P. MADONIA, Chief of the Bureau of Safety Data and Data Services, Division of Traffic Safety, Illinois Department of Transportation, is a professional engineer. He received his BS in Civil Engineering from the University of Illinois and and MS in Public Administration from Sangamon State University. He has about fifteen years experience with the Illinois Department of Transportation in traffic safety, including ten years in safety recordkeeping.

CLARENCE W. MOSHER, Director, Traffic Safety Records, New York State Department of Motor Vehicles, has guided the development of New York's integrated statewide highway safety management information system since 1971. Since 1982, he has also directed the New York State alcohol safety program. Mr. Mosher has served as a member of the National Safety Council Board of Directors and has chaired the NSC's Highway Traffic Safety Division and Traffic Records Committee. He has also been active in safety recordkeeping activities sponsored by the Transportation Research Board and other organizations.

JAMES O'DAY, Interim Director, University of Michigan Transportation Research Institute, received his AB from Gettysburg College and his MS in Physics from the University of Pittsburgh. Serving since 1951 as a research scientist at the University of Michigan, Mr. O'Day has produced numerous papers and reports related to traffic safety recordkeeping. He has been widely recognized as an authority in this field for many years.

DONALD W. REINFURT, Associate Director for Analysis Studies, University of North Carolina Highway Safety Research Center, received his BS and MA in Mathematics from the State University of New York and his Ph.D. in Statistics from North Carolina State University. He has been associated with the Highway Safety Research Center since 1970 and has worked in the safety recordkeeping field during that period. He is a past chairman of the National Safety Council Traffic Records Committee and has been active on other national committees. Dr. Reinfurt is the author of numerous publications and has made substantial contributions to the development of traffic records systems in the United States.

FRED F. SMALL, Highway and Traffic Safety Coordinator, Virginia Department of Highways and Transportation, received his BS in Traffic and Transportation Safety from Virginia Commonwealth University. He has been active in the highway safety field for 18 years and in safety recordkeeping for 12 years. Mr. Small has served on the Executive Board of the National Safety Council Traffic Records Committee for several years and is currently vice chairman of that committee.

CHARLES J. VENTURI, Highway Safety Manager, Office of State Program Assistance, National Highway Traffic Safety Administration, received his BS and MS from the Universities of Wisconsin and Maryland. He has 15 years of experience in highway safety. Mr. Venturi was a member of the team that designed NHTSA's Fatal Accident Reporting System in the early seventies.

PHYLLIS E. YOUNG, Chief of the Performance Evaluation Branch, Office of Highway Safety, Federal Highway Administration, received her BS and MS in Mathematics and Statistics from Howard University. After serving with the Massachusetts Institute of Technology Operations Evaluation Group and the FHWA's Office of Research, she accepted a supervisory position in the Office of Highway Safety in 1976. Since that time, Ms. Young has been responsible for a wide variety of safety recordkeeping projects, many of which involved coordination with the states, NHTSA and other organizations.

CHARLES V. ZEGEER, Vice President, Goodell-Grivas, Inc., received his BS in Civil Engineering from Virginia Tech (VPI) and his MS in Civil Engineering from the University of Kentucky. He became associated with Goodell-Grivas after seven years as a research engineer with the Kentucky Department of Transportation. During his 12 years of experience in the safety recordkeeping field he has published about 30 papers and articles. Mr. Zegeer is also the principal author of a number of major research reports and safety manuals. He is Chairman of the Transportation Research Board Committee on Pedestrians.

APPENDIX B

LOCAL USE OF THE NORTH CAROLINA "MERGE" SYSTEM

Traffic engineers, city planners and city police departments are making more and more use of various traffic records data in problem identification. This has been made possible by increasingly available and powerful computer systems and corresponding software packages. However, in the past each city that wanted to upgrade its capabilities has had to develop its own system at the outset (including keying the data into the computer) as the software and much of the data for these applications was not available. Obviously, this is an expensive proposition in these days of dwindling resources.

A viable alternative is being explored in North Carolina. This would involve using the statewide Merge System at the local level. Briefly, the Merge System is a computerized database management system used primarily by the North Carolina Department of Transportation to study the effects that certain roadway features and characteristics have on accidents. It provides the capability of automatically merging mileposted accident data with roadway features (e.g., bridges, intersections, railroad crossings) data and with roadway characteristics (e.g., shoulder type and width, number of lanes, traffic volume) data. This, in turn, allows the traffic engineer to carry out a variety of highway-oriented accident data analyses that were previously next to impossible to do.

These same statewide files contain accident, features and characteristics data for state-inventoried roads of all municipalities in North Carolina. Why shouldn't the same system be modified so that traffic engineers at the local level would be able to use it for their own analyses? The answer, indeed, appears to be that the same general system should be usable by city traffic engineers.

During the past year, the police and traffic engineering departments of Winston-Salem and Wilmington have been experimenting with the use of the statewide Merge System for their local applications. Through individual projects with the Governor's Highway Safety Program, they have secured the necessary computer hardware to be able to access the Merge System data. High Point and Durham expect to join this program in 1985. Some of the required software has been modified by the University of North Carolina Highway Safety Research Center (HSRC) and communications packages have been provided so that the users in these cities have been able to retrieve their local accident and highway data from the state file located at the Triangle Universities Computer Center in Research Triangle Park. Training on the use of the system has been provided at local workshops by programmers from HSRC. Initial indications are most positive and the potential for future exploration and use seems most promising. A variety of accident problems have already been identified (particularly high-accident locations in Wilmington) and certain solutions implemented.

APPENDIX C

SAFETY RECORDKEEPING IN NEW YORK

New York State has one of the most complete and comprehensive traffic records systems in the nation. This integratable system was developed to address the highway safety and analysis needs of users within the Department of Motor Vehicles and other state, local and federal agencies, and to provide better, faster, quality services.

Although it was possible for New York State to develop and implement each of the seven data subsystems recommended by the National Highway Traffic Safety Administration (NHTSA) in its Design Manual for State Traffic Records Systems, the technology to easily and fully integrate the data in those files with allied highway safety data and to distribute that information to the several families of users was not available when the files were created. At that time, the availability and cost of the resources prohibited the state from accomplishing an easily accessible comprehensive traffic records database. Today, the technology is available to complete the task.

Initially, the main thrust of the Department of Motor Vehicles (DMV) was the issuance and control of driver licenses and vehicle registrations and the receipt and distribution of fees from those activities. The system was designed to meet the operational needs of these and other operational programs. Eight areas included in the traffic records system are driver licensing, vehicle registration, accident records, traffic law enforcement and adjudication, roadway environment, educational services and emergency medical services.

The DMV very effectively meets these operations needs; however, it has an equally important corollary need to meet the administrative, analytical, planning and research needs of the local, state, and federal highway safety community-at-large.

Although the basic data elements are present in New York's traffic records system, the ability is lacking to effectively and efficiently produce this information in a timely manner to make it more meaningful and of value to the ultimate users.

The proposed plans in our comprehensive computerized safety recordkeeping system (Integrated Traffic Safety Information Network Improvement Program--ITSINIP) are designed as a solution to that problem. They include the ability for current and future improvements, with little if any adverse effect upon the ongoing operational system. The goal of the Office of Traffic Safety (OTS) is to provide the highway safety community with appropriate data in a time frame consistent with the needs and requirements of the several constituencies.

There are six overall objectives:

1. Develop strategies and a system to further increase the effectiveness of accident reporting and recordkeeping.

2. Implement the state-funded Traffic Safety Law Enforcement and Disposition (TSLE&D) program at an accelerated pace to have more and better quality arrest and disposition data for the entire state.

3. Provide the appropriate resources to integrate the various files into a comprehensive database.

4. Provide communication links to tie together the highway safety community (counties, other state agencies and OTS central office and field staff).

5. Provide data and rapid delivery of reports to counties and other agencies (possibly through the communication links).

6. Provide the OTS with the computer resources to build highway safety applications interactively.

The goals and objectives will be achieved through a unified effort of all potential users, including, but not limited to:

a) Governor's Traffic Safety Committee
b) Department of Motor Vehicles
c) Department of Transportation
d) Division of State Police
e) Division of Criminal Justice Services
f) Education Department
g) Department of Health
h) Division of Alcohol and Alcohol Abuse
i) New York State Association of Chiefs of Police
j) New York State Association of Sheriffs
k) New York State Magistrates Association
l) New York State STOP-DWI Coordinator
m) New York State Association of Traffic Safety Boards

Each has an integral part in the processing, flow and distribution of traffic records data. Each will participate in the decision-making process as ITSINIP is developed and implemented.

The goal of the Office of Traffic Safety is to develop a comprehensive integrated traffic records system which can be shared and used as a common resource by local, state and federal users to:

a) Analyze data
b) Monitor programs
c) Evaluate effectiveness

This cooperative local/state effort, utilizing currently available computer and communications technology, should:

a) Decrease costs at both the state and local levels

b) Increase the availability of data

c) Decrease the processing time

d) Allow the localities to become a full partner in the creation of and access to the data in the system in a time frame consistent with their needs.

APPENDIX D

UTAH'S HIGHWAY INFORMATION SYSTEM

In 1978 Utah began linking files for safety analysis when the Accident File was tied to the Geographic and Traffic files using the Mark IV sequential file manager/report writer system. Accident rate data could be generated for the statewide highway network, discrete systems, and specific locations, for a variety of analyses. Reports could be generated to meet standard reporting needs, or to produce individual ad-hoc analyses for special studies. With data drawn from the files and processed electronically as needed, both the time needed to produce analytical reports and the probability of coding errors were reduced.

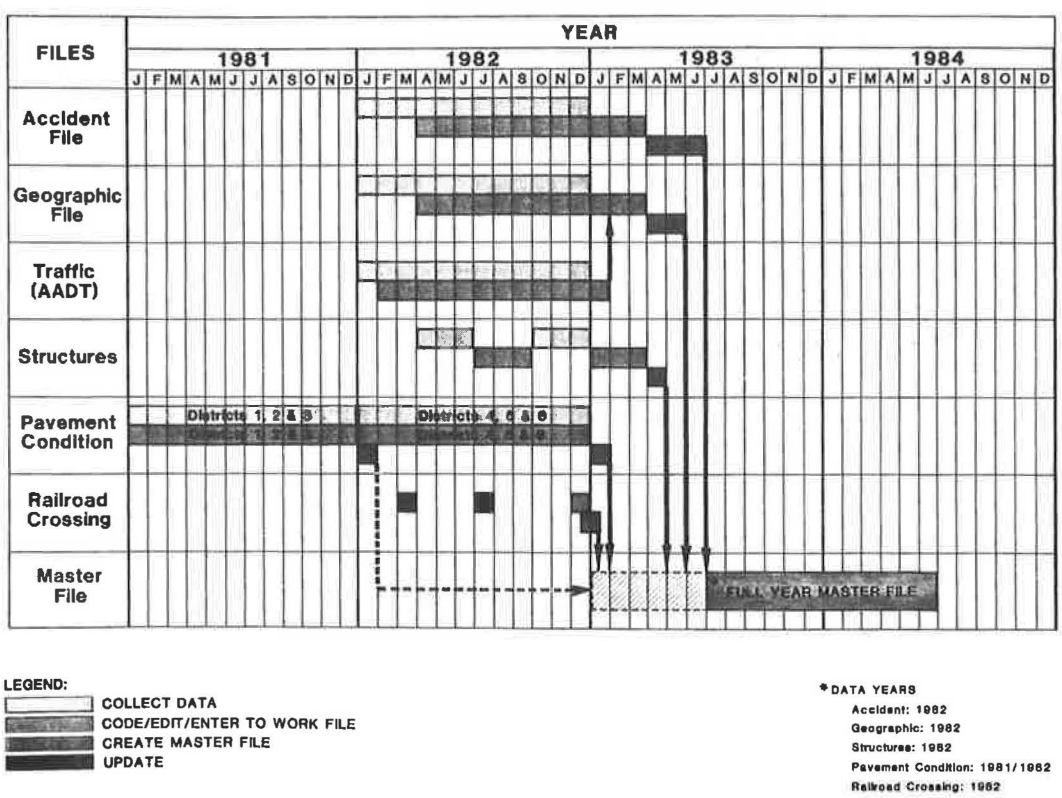
In 1982 we began a two-year project to link additional files with the Accident, Geographic and Traffic files to form the basis for an Integrated Highway Information System. After evaluating available files we selected the Structures (bridge), Pavement Condition, and Railroad Crossing files for our initial effort. We chose a data base management system - ADABAS - operated by the State of Utah, which required a conversion for some of the files as they were maintained in different host systems. Files were established within ADABAS beginning with data for 1982.

Each unit responsible for a specific file within the linked system retains management of its own file. Data are available for use by others through the system, but file inputs, edits and updates remain the responsibility of the "original owner".

A word here about file development. Our current system is designed around a "Full-Year" file concept, with the "most current" full-year data becoming available by July 1st of the following year (see figure 1). Active files in the system will consist of the most current year data and data from the preceding four years, with earlier data removed from the system and maintained on tape as historical files.

Figure D-1

Data Collection and File Development Cycle



While this approach offers many advantages as a highway information and planning tool it does not allow the system to be responsive in such areas as planning for next week's enforcement activity. However, each responsible agency maintains a working file through the year with data entered as received. Access to this current data in each file is available through the individual file managers.

Utah's system is designed for three user levels: Executives/Managers, Technicians, and Data Processing trained personnel. In the Management Reporting system report areas are pre-programmed, with menus requesting user inputs to identify the year, specific route or area to be reported upon, and, in some cases, the sorted format for the report.

Currently we have reports set up covering wet-weather accident/pavement condition combinations, truck accident rate development in rural areas, accidents at narrow bridges, and an AADT update program for railroad crossings. As the need for additional reporting areas develops it will be relatively simple to expand the pre-programmed reports which are available to include whatever is needed.

At the Technician level a Dynamic Report Generator program allows a user to select up to three of the files, up to seven elements from any of the selected files, and up to 14 total data elements for a single report. This flexibility allows specific reports to be developed and lets technicians experiment with various combinations of data. Finally, Data Processing trained personnel can write programs to solve specific, often one-time problems and produce reports on an individual basis.

Our system development plan calls for including at least selected elements of driver license, vehicle registration, maintenance, and construction (road log) files as the system progresses. We also plan to carefully review data uses to evaluate our data collection program and to be sure that we collect only the data we need.

Currently counties and cities do not access our files directly. When they want specific information they can request what they wish to have and get it in hard-copy report form. As the system progresses expanded use through direct system access can be provided.