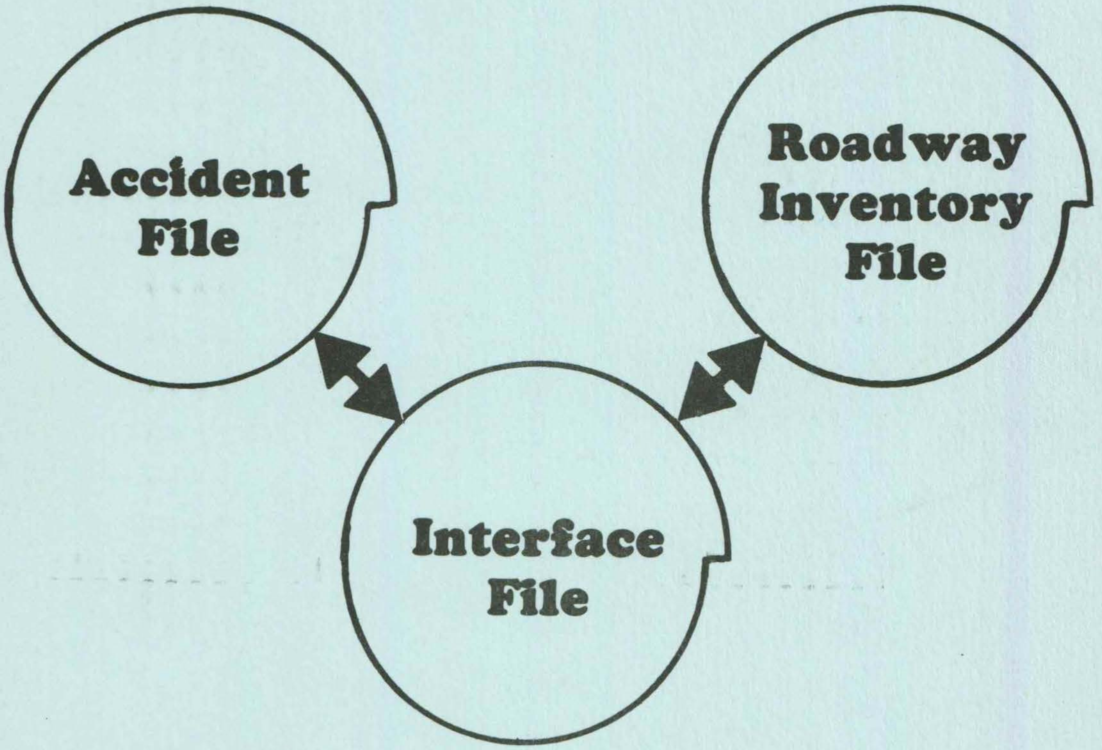
ALAS-BASE RECORD INTERFACE



DEPARTMENT OF TRANSPORTATION
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NOTICE

ALAS-BASE RECORD INTERFACE

FINAL STATUS REPORT

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Prepared by
Office of Transportation Research
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PREFACE

This report was written to document the investigation of alternative concepts of interfacing the Accident Location and Analysis System (ALAS) file with the Base Record roadway inventory file. It is intended that the recommendations made in this report be adopted by the Iowa Department of Transportation.

The ALAS system and the Base Record system both contain data which is valuable in safety related analysis. Interfacing the two systems will enhance the usefulness of the data contained in the two files. Federal funding is available for the development of the recommended interface system.

ALAS-BASE RECORD INTERFACE

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SUMMARY

The Highway Base Record and the Accident Location and Analysis System files both contain extensive data. Interfacing the two files would provide safety related information that would be very useful in the identification and correction of accident problem locations, roadway features and design types.

Three types of interface concepts were evaluated:

(1) Link-node concept;
(2) Grid-coordinate concept; and
(3) Route-mile-reference concept.

Of the three, the route-mile-reference concept provides the most potential for an effective and efficient interface system.

It is estimated that interfacing only the more heavily traveled roads, such as the federal-aid system, would provide coverage of over 80 percent of the accidents and travel. This coverage could be accomplished by interfacing only 23 percent of the statewide mileage.

A pilot study, in which interface compatibility was developed for a portion of federal-aid mileage in Story County, was conducted. It was concluded from the pilot study that the route-mile-reference concept is a feasible approach to interfacing the two files.

I. INTRODUCTION

The Iowa Department of Transportation maintains a computerized highway base record file for highways on the primary, secondary and municipal systems. Identifying information such as route number, county, state and federal functional class, federal-aid status, etc., are included on each record. The base record format varies for each highway system but does include basic information such as length, traffic, roadway width and surface type.

The Iowa Department of Transportation also has developed an Accident Location Analysis System (ALAS) for identifying accident locations on all three road systems. The locations currently identified by the unique ALAS node numbering system are intersections, interchanges, bridges, railroad grade crossings, county lines, road ends, etc. This system has all relevant accident data on computer tape.

Development of interface capability between these two records will provide the Iowa Department of Transportation and other state, federal and local offices with valuable information on the analysis of accidents relative to roadway features.

The purpose of this study is to develop an interface capability file between the Base Record file and the ALAS accident file. This will enable selected data from these two files to be merged for various accident analysis programs designed to meet the needs of the user. Typical uses would be development of the annual TA-1 Table for the FHWA, evaluation of safety improvement projects, the L.I.F.E. Program, analysis of high accident locations, computation of accident rates and correlation analysis between accident data and roadway characteristics.

II. INTERFACE CAPABILITIES OF OTHER STATES

A survey conducted in 1978 by the Transportation Research Office indicated that 22 states have at least partial interface capability. The majority of those states indicating interface capability were interfacing only the state maintained and/or the federal-aid road systems.

Seventeen of the 22 states use a milepoint or milepoint-related location system in both the roadway inventory file and the accident file. Other location systems being used are coordinate systems, link-node systems and combinations of these systems. A few states are using commercial computerized data base management systems. Only four of the twenty-two states were using different location systems in the roadway inventory and accident files.

The current status of interface compatibility development and data utilization was obtained from a selected number of states.

1. Minnesota

Minnesota has approximately 128,000 total miles of roadway. Both their accident and inventory records are identified by a milepoint (true mileage) reference. They utilize existing route numbers where available and a route number is assigned to the accident inventory record data for those highways not marked. They maintain total accident coverage for the entire state and all roadway mileages. Six full-time personnel are assigned to coding accident identification data, with an additional 20-25 summer employees supplementing this coding effort. They feel the system is working and does provide data for highway safety improvement programs. Major problems with the system are maintaining accurate route identification record changes and accuracy in location reporting of accidents.

2. Louisiana

Louisiana has developed interface compatibility on their state highway system which is approximately 15,000 miles. Accidents are coded to a route-milepost reference system, with the base record identified by a route-milepoint (true mileage) distance. They have developed a third record, or compatibility record, that identifies the exact milepoint (true mileage) of each milepost. This compatibility file allows them to interface the accident and inventory data. They have approximately four persons working full-time on coding identification control for accidents. Their system has worked satisfactorily for them and their problems have been in accurate field identification of accident locations and coding errors.

3. Oklahoma

Oklahoma has a route milepoint reference system for interfacing accidents and roadway inventory features of their state highway system which comprises 15,000 miles. They feel their system is working satisfactorily and they are in the process of developing computer plotting programs to map some of their accident analysis data. They have four full-time employees working on the coding of accident location identification. They have had no major problems with their system, but do stress centralized control on accident identification for maintaining accurate records.

4. California

California has a route milepoint identification system for both their accident data and their inventory data. They have interfaced only their state primary system which includes approximately 26,000 miles. An estimated 100,000 accidents per year occur on this system. Approximately 10-12 full-time employees are involved in coding location data on the accident record. Their system works very well and they have developed several accident-inventory correlation analysis programs that are utilized in prioritizing highway safety improvement programs.

5. Tennessee

Tennessee has recently completed a new Highway Data Management System (TRIMS) to identify all roadway features and accident data on their highway systems. The new system will cover all 120,000 miles of roads and streets in Tennessee. Their system will utilize a route-mile point concept with federal-aid and assigned route numbers for identifiable systems and assigned route numbers for non-federal aid routes. They employ approximately six full-time persons in coding the location identification for all accidents.

6. Georgia

Georgia has approximately 103,000 miles of total highways in their state. They have developed interface compatibility on their 14,000 mile state highway system only and utilize the route-mile point concept for making the accident-inventory record compatible. Their traffic and safety section maintains the interface compatibility between the road inventory, accident location and the detailed accident data. They have approximately 10 persons assigned to the task in their traffic and safety section. They feel their system works quite well and strongly recommend the central control for all data reporting and coding.

7. Ohio

Their current system utilizes the route log-milepoint concept, but is limited to their state highway system only (16,000 miles). They have not had central control on coding of accident identification data and have had numerous problems in maintaining route and milepoint identification accuracy on accident data.

They are under contract with M & S Computing Services of Huntsville, Alabama to develop a computer graphics system for digitizing all accident and highway inventory data on computer based maps. Plans are to have this digital mapping system installed during 1980. They will digitize their entire state (111,000 miles) and interface all accident and highway inventory data involving railroad crossings, etc., to this computerized data base. They have indicated that the initial cost of all hardware and development of software will cost approximately $800,000.

8. New York

New York's past system was a route log milepoint concept for their state highway system only (approximately 15,000 miles). Problems they experienced with this system included improper location of accident by field personnel, coding errors in office and maintenance problems in keeping route-mile information current. They have recently developed a Centralized Local Accident Surveillance System (CLASS) that will digitize all highway mileage (107,000 miles) in the state and interface this mileage data with accident data and roadway inventory features. The major elements of the CLASS system are:

1. A digitized accident site location map, using interactive graphic techniques to develop accident inventory nodes, the nodes being a point of intersection along the highway such as intersections, bridges, railroad crossings, etc.
2. A highway information data base bank and an accident information data base bank both interactively interfaced with the digitized maps.
3. A software system which allows the data base files to be assessed, summarized, analyzed with graphical or non-graphical evaluation tables for identification and promoting safety improvement programs.

New York has financed this computer mapping data base (CLASS) program in cooperation with Federal Government using 402 Highway Safety funds. To date they have obligated approximately $750,000 in highway safety funds for this project. They estimate that the total system, when developed will cost approximately $2,000,000. System design and components were provided by M & S Computing, Inc., of Huntsville, Alabama. It is anticipated that all maps will be digitized and software programs operational by late 1981. Currently, sixteen full-time staff personnel are assigned to the CLASS project. It is anticipated that approximately seven full-time employees will be needed for maintenance of the system.

9. Michigan

The Michigan Accident Location Index (MALI) was developed jointly by the Michigan Department of State Highways and Transportation (MDSHT) and the Michigan Department of State Police. MALI was financed by a Section 402 Federal Safety Grant.

The prerequisite to the MALI computerized accident system was the coding of the entire state highway network (120,000 miles). The coding was done on a county by county basis and this network record is referred to as the street index. The street index identifies, by specific codes, all highways in the state and includes specific features of the highways such as pavement width, surface type, and shoulders. The main control for entering the roadway data was the street mile, where every roadway in the state was identified by a name and mileage assigned to that route. Much of that basic coding effort had been initiated earlier on the state trunk highway system by the MDSHT.

The coding of the network was unique in that function codes were assured to all information points along the route. For example, "IR" indicates intersecting ramp, "IS" means intersecting street, "IT" is railroad grade crossing, etc. These function codes can then be used to evaluate accidents by features on the highways.

A very elaborate data processing and editing program was developed to check the inventory data that was coded and entered. To minimize the coding effort, interactive terminals were used to enter the data for processing. By using a line edit program much of the data was checked and corrected before it became a part of the permanent record. This proved to be a very effective way of developing the street index data base.

The MALI System has only been developed by the MDSHT since early 1979. To date it has been a very effective system providing basic accident-roadway data for analysis of accidents throughout the state and the evaluation of such accident data in programming highway improvements. The unique feature of the MALI System is that neither the highway file nor the accident file were tied to existing computerized systems but the MALI System provided a common basis for both records.

III. ACCIDENT LOCATION AND ANALYSIS SYSTEM (ALAS)

The ALAS system was developed from 1972-1974 by the consulting firm of Wilbur Smith and Associates. After reviewing several alternatives, a link-node accident locationing system was adopted for statewide use in Iowa. The system is based on the six-mile square Congressional Townships using eight digit node numbers as follows:

Node - 85 120196

where 85 = County Number
12 = Congressional Township Number
1 - South to North Tier
2 - West to East Range
01 = South to North Coordinates
96 = West to East Coordinates

The composition of the node number is more fully described in Appendix "A".

Within each Congressional Township there are 96 possible coordinates in each direction, or one available node every 330 feet. As shown in Appendix "A", node coordinates on section lines are numbered 01, 17, 33, 49, 65, 81 and 97 on north and east county lines. The following are typical locations where ALAS node numbers are assigned:

1. Intersections
2. Bridges
3. Railroad crossings
4. Ramp Exits
5. Ramp Entrances

6. County Boundaries
7. Road Termini
8. 90 degree turns
9. Grade Separation Structures

Maps have been prepared for every incorporated city in Iowa and each county identifying the ALAS node number assigned to each of the above mentioned locations. These maps are now being updated by the Transportation Inventory Office to reflect highway conditions as of January 1, 1980.

Accident location coding and data entry is accomplished in the Office of Safety Programs. Once ALAS nodes have been identified on the accident form they are entered into a computer file via terminals along with other pertinent accident data. The following is a brief description of ALAS location data fields and how they are coded:

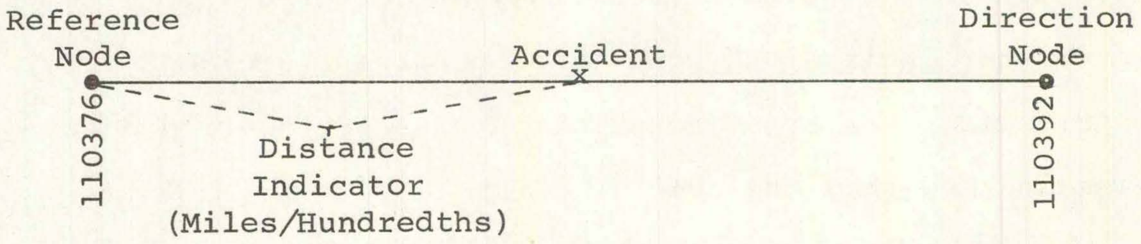
(1) Intersection Identifier - All "intersection" or "intersection related" accidents are coded to either the single node for normal intersections or the designated intersection identifier node for interchanges and other multiple node intersections. Non-intersection accidents are coded 999999 to indicate the field is not applicable.

(2) Reference Node - The reference node is either the node at which the accident occurred or the node from which the distance is measured, usually the closest node. In the case of single-node intersection accidents the Intersection Identifier node is repeated.

(3) Distance Indicator - This field indicates the distance in miles and hundredths-of-a-mile from the Reference Node toward the Direction Node to the point of the accident. If the accident occurred at a node the field is coded 999 to indicate the field is not applicable.

(4) Direction Node - The location of a non-node accident is tied to a specific link by coding the first node along the route from the Reference Node beyond the point of the accident as illustrated in Figure 1.

FIGURE 1: ACCIDENT LOCATION CODING



If the Direction Node field is not applicable, 999999 is coded.

Any of the above fields that cannot be determined from the accident reports are coded with zeros. In some cases the specific location may be unknown but the accident can be tied to the appropriate Congressional Township followed by zeros. Accidents that occur on new roads that do not appear on the node maps are coded to the appropriate Congressional Township followed by 9898. These accidents can then be identified and recoded when updated node maps become available.

Table 1 illustrates the approximate number of nodes by highway system mileage in the State of Iowa.

TABLE 1

MILEAGE AND ESTIMATED ALAS NODES BY ROAD SYSTEM

Road System	Mileage	Estimated Number of ALAS Nodes	ALAS Nodes Per Mile
Primary	10,153	32,000	3.2
Secondary	89,562	80,000	0.2
Municipal	12,007	70,000	5.8
Totals	*111,722	182,000	1.6

* Excludes 305 miles of State Parks and Institutional Roads and 284 miles of non-mainline ramps and connections.

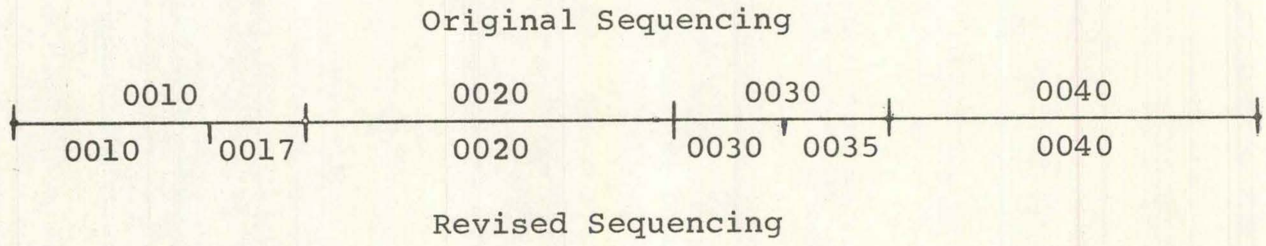
IV. BASE RECORD

The Base Record was developed in the 1960's for the documentation of Iowa's highway inventory data, the development of highway needs studies, and is utilized in determining sufficiency ratings on Iowa's primary highways. Base records were developed for the primary, secondary, and municipal highway systems. Each highway system has a unique method of control identification. These controls are central to the sequence breaks (roadway segments possessing homogeneous geometric, classification, political and locational characterizations).

PRIMARY SYSTEM

The major identification controls for the primary system are county number, route number and sequence number. The four digit sequence numbers start at the south or west limits of the route within each county. For the original sequencing of routes the numbers increase by tens (i.e. 0010, 0020, 0030, etc.) north or east across the county. When new control breaks occur, splitting the existing record, the last digit is changed as illustrated in Figure 2.

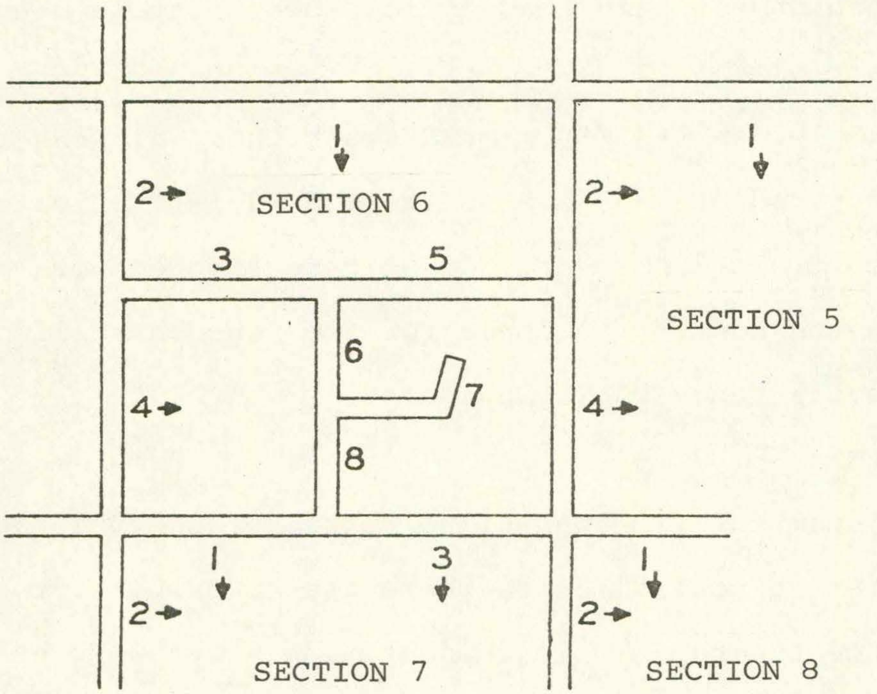
FIGURE 2: PRIMARY ROAD SEQUENCE NUMBERING



SECONDARY SYSTEM

The basic controls for roads on the secondary system are county number, township, range, section and road number. Roads bounding the north and west sides of a section are assigned to that section. Road numbers are assigned as shown in Figure 3. Roads running west to east are assigned odd numbers proceeding east and south from the northwest corner of the section. Roads running south to north are assigned even numbers proceeding south and east from the northwest corner.

FIGURE 3: SECONDARY ROAD NUMBERING



MUNICIPAL SYSTEM

The identification controls for the municipal system are county number, city number, street number and sequence number. Street numbers are assigned in a grid pattern within each city and sequencing is similar to that used for the primary road system. A literal description file describes the limits of each street sequence.

FEDERAL-AID ROUTE CONTROLS

Secondary roads and municipal streets in the federal-aid system are further identified by a federal-aid route number and sequence number. This sequencing is similar to the primary road sequencing.

DUPLICATE ROUTE CONTROLS

Where duplicate routes occur, the following order is used to establish the primary control route:

(1) When on different system, the higher system controls.

(2) When on the same road system lower route number controls.

For example, on I-35/80 around Des Moines, all base record data will be found on I-35 and where Iowa 38 is duplicate with I-80, I-80 controls. However, a duplicate file can be made available on the control sequence for the non-controlling routes for sufficiency rating purposes.

CONTROL BREAKS

Each system has its own unique method of control identification. Within the control unit, there are numerous factors that cause sequence breaks. Table 2 identifies sequence breaks for all systems. Also illustrated are the breaks for ALAS nodes. This comparison identifies those ALAS node and Base Record breaks that are compatible. Figures 4, 5 and 6 illustrate how the ALAS Record and the Base Record compare by highway system. Appendix "B" shows the Base Record format for the Primary, Secondary and Municipal street files.

TABLE 2

COMPARISON OF ALAS AND BASE RECORD BREAKS

SEQUENCE BREAKS	BASE RECORD			ALAS
	P	S	M	N
1. County boundary	X	X	X	X
2. Change in functional classification	X	X	X	
3. Change in federal aid route number & control section	X	X	X	
4. Present Urban area line	X	X	X	
5. Change in surface type, surface width or roadway width	X	X	X	
6. Intersection with corporation lines	X	X	X	
7. Traffic volume changes	X	X	X	
8. Junction with a primary road	X	X	X	X
9. Change in condition ratings	X	X	X	
10. Intersections with higher priority streets	X	X	X	X
11. Road or street termini	X	X	X	X
12. Intersection with local road (rural-rural and rural-urban only)	X	X		X
13. Interchange ramp connections	X	X		X
14. Section line	X	X		
15. Change in type section	X		X	
16. Change in type area	X		X	
17. Change in function code	X			
18. Changes in maintenance contract area	X			
19. Point of intersection at interchange	X			X
20. Bridges				X
21. Railroad grade crossings				X
22. All local city street intersections				X
23. Grade separations				X
24. Ninety degree road turns				X

P = Primary; S = Secondary; M = Municipal; N = Node; X = Break

FIGURE 4

ALAS - BASE RECORD - PRIMARY ROAD COMPARISON

COUNTY:
ROUTE:
SEQUENCE NO: (AS SHOWN)

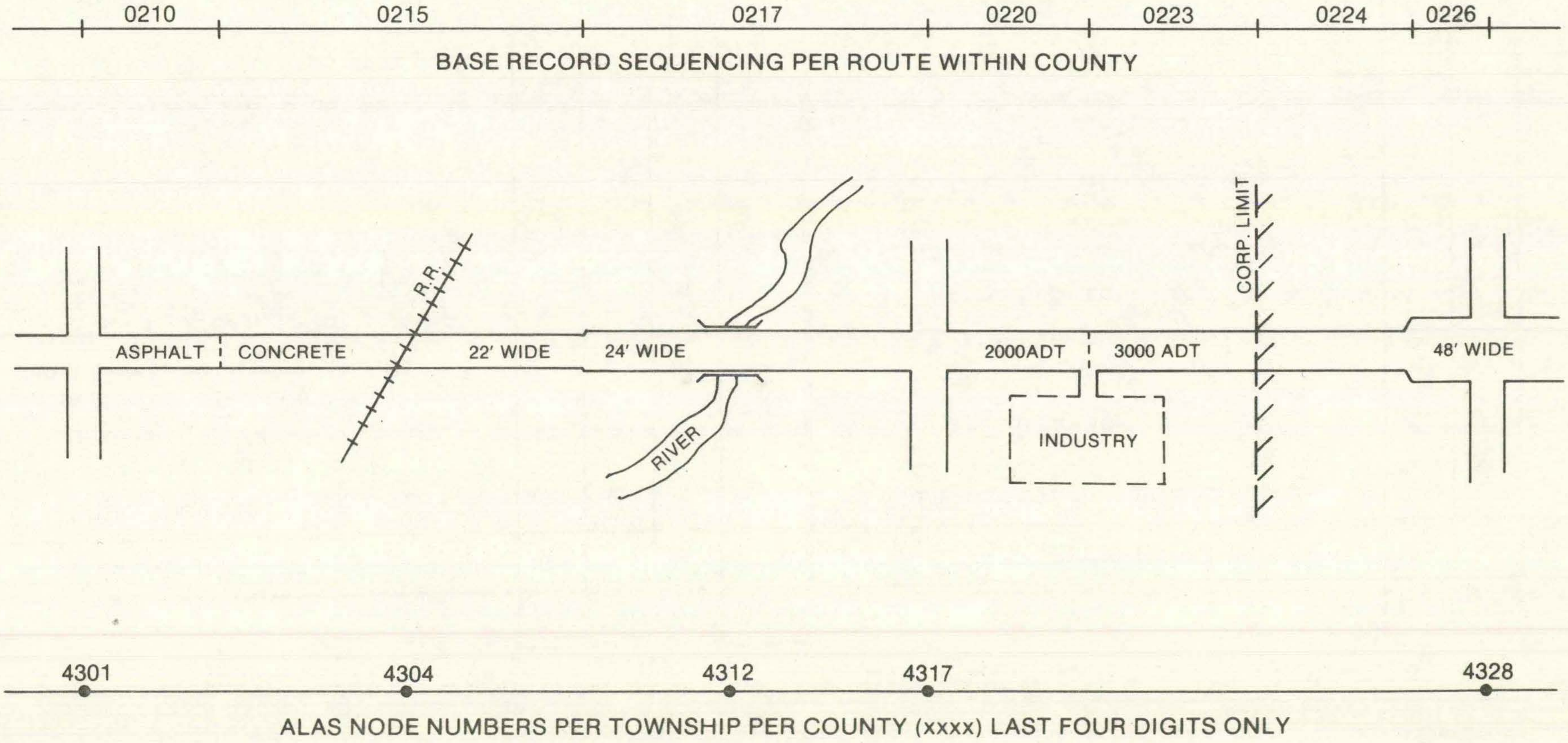


FIGURE 5

ALAS - BASE RECORD - SECONDARY ROAD COMPARISON

COUNTY:
TIER:
RANGE:
SECTION:
ROAD NO: (AS SHOWN)

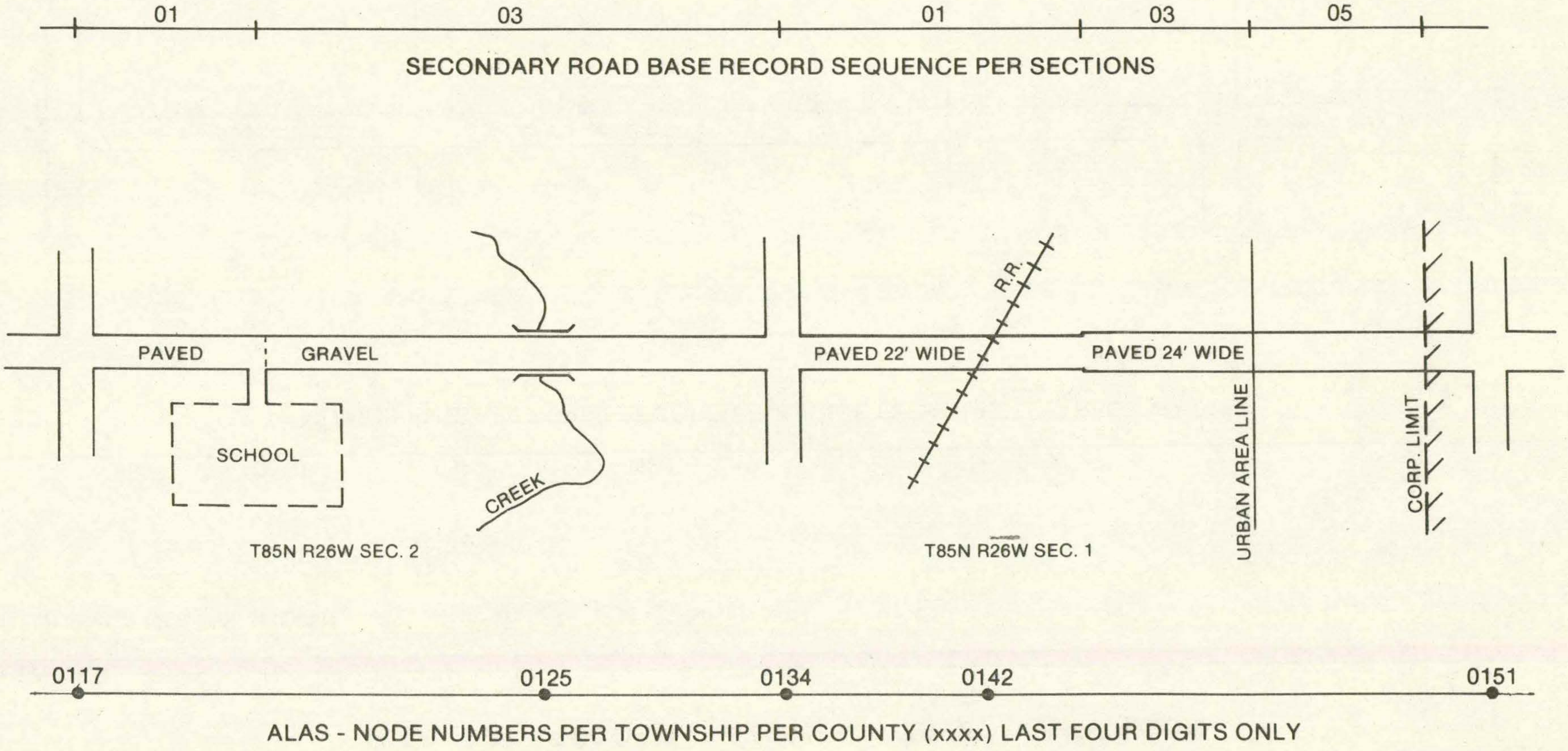


FIGURE 6

ALAS - BASE RECORD - MUNICIPAL STREET COMPARISON

CITY NO:
STREET NO:
SEQUENCE NO: (AS SHOWN)

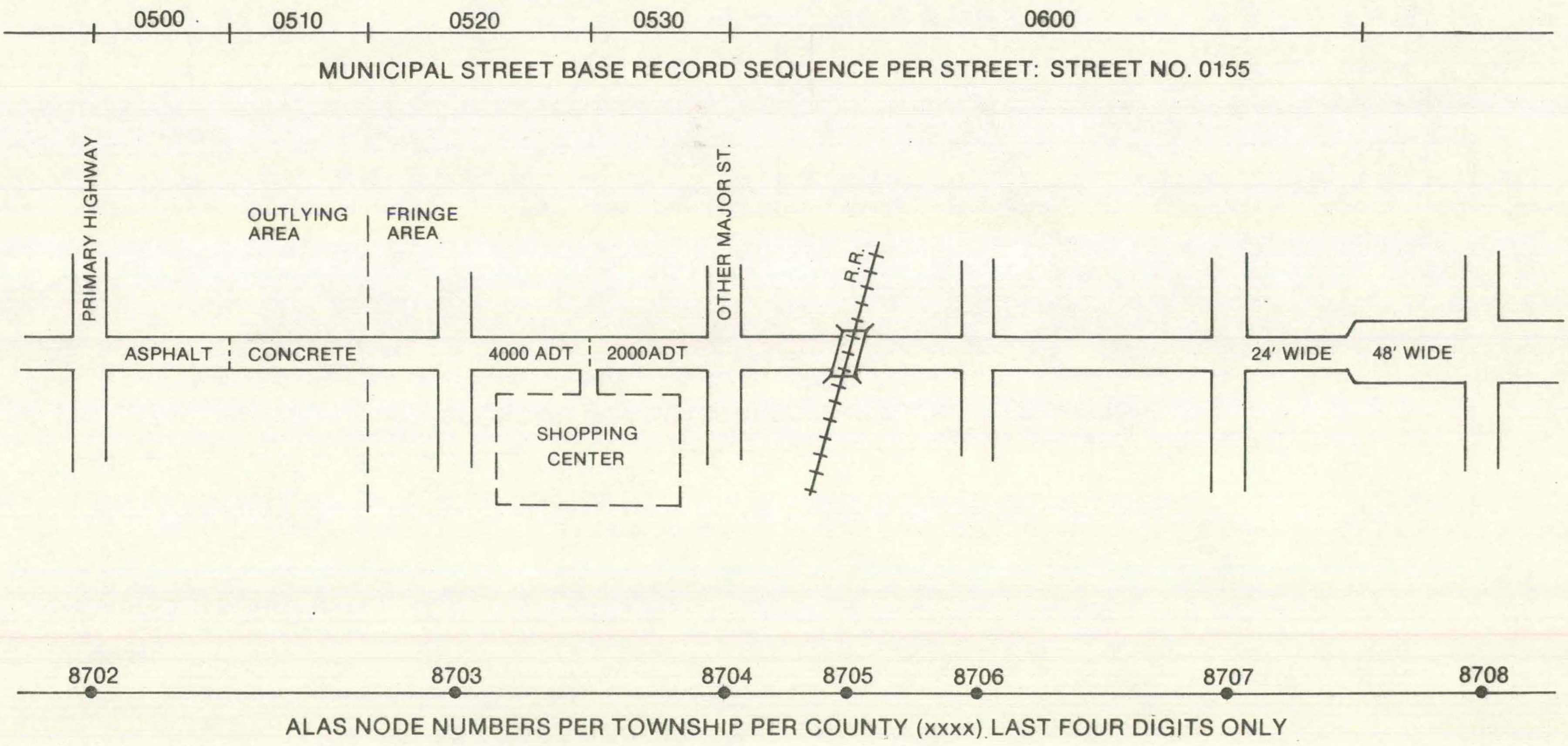


Table 3 illustrates the total number of Base Records and the records per mile for each road system. The growth of the Base Record, in terms of number of records, has been slow. The Primary System has increased from 25,000 records in 1972 to 30,000 records in 1978. The Municipal System has increased from 75,000 to 81,000 in the same time period. The Secondary System has stayed stable at 150,000 records.

TABLE 3

MILEAGE AND BASE RECORDS BY ROAD SYSTEM

Road System	Mileage	Number of ALAS Nodes	Base Records Per Mile
Primary	10,153	30,000	2.9
Secondary	89,562	151,000	1.7
Municipal	12,007	81,000	6.8
Totals	*111,722	262,000	2.3

* Excludes 305 miles of State Parks and Institutional Roads and 284 miles of non-mainline ramps and connections.

V. ALTERNATE INTERFACE CONCEPTS

There are various ways the Base Record and ALAS files can be made compatible, some of which are more adaptable to one road system or another. The following three interface concepts have been reviewed and evaluated in this study:

(1) Link-node

(2) Grid-coordinate

(3) Route-mile-reference

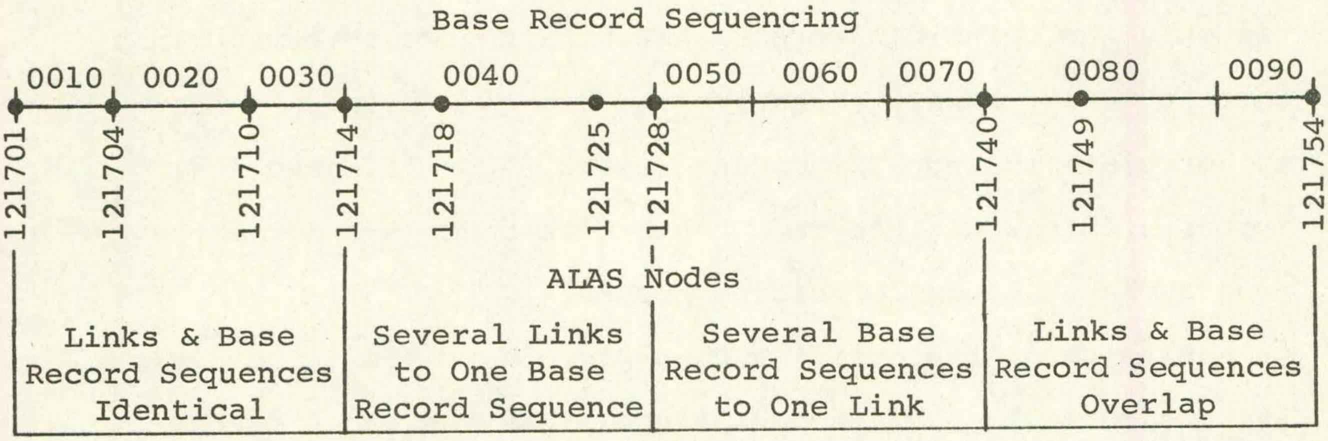
LINK-NODE INTERFACE CONCEPT

Under a link-node concept, breaks in the Base Record and nodes in the ALAS system would be matched. This would involve additional Base Record breaks at nodes, and conversely, additional nodes at Base Record breaks. It is estimated that this would create at least 50 percent more nodes and 30 percent more Base Record segments.

This interface concept could be accomplished in one of two ways; (1) Attach to the Base Record a leading node for each segment break or (2) develop a separate compatibility file correlating the ALAS nodes to the Base Record segments. Attaching the nodes directly to the Base Record file would provide the most direct tie between the files.

Figure 7 illustrates a section of roadway in which some nodes coincide with Base Record breaks, others are more finely spaced and still others are more coarsely spaced. Sections where the ALAS links and Base Record sequences overlap as shown, are also quite common. In rural areas nodes are usually more coarsely spaced. In municipal areas, with nodes at all the intersections, there are normally more ALAS links than Base Record sequences. However, in both areas there will be sections where the links and sequences overlap.

FIGURE 7: CORRELATION OF ALAS LINKS AND BASE RECORD SEQUENCES



The additional breaks created by a link-node interface would cause problems for both systems. Except for the addition of a leading node for each sequence, the Base Record System would not be altered drastically. However, the additional records created by the new breaks for nodes would significantly increase the size of the file. This fact would compound the maintenance problem and also increase computer costs.

The development of the link-node interface would require a basic system change in the ALAS system. At the present time, nodes are assigned only to static road features. Assigning nodes to non-static breaks in the Base Record such as corporation lines, urban area lines, classification changes, surface width and/or type changes, etc. would alter the basic design of the ALAS system.

Maintenance problems for the ALAS system would be compounded by the additional nodes required and the annual shifting of non-static breaks. Accident data from one year to the next would be difficult to correlate because of the shifting nodes. At the present time this occurs only for new construction or corrections to the existing system.

A modified link-node concept could be developed that would tie only the coinciding breaks between the two systems. This concept would, however, require the use of a mileage factor to correlate the non-coinciding breaks. For all practical purposes this would become a route-mile concept complicated by node numbers at the coinciding breaks.

Stretching the modified concept, one of the two present systems could be used as a base and break the other system to match up with the base system. These alternatives would have the same major drawback as mentioned above, in that a mileage factor would be required.

The following are some advantages and disadvantages of the link-node interface concept.

Link-Node Advantages

1. Can directly be used since ALAS nodes are tied directly to Base Record segments.
2. Can be used universally for all systems.

Link-Node Disadvantages

1. Requires an extensive change and addition of record segments to the Base Record System.
2. Requires additional node numbers for breaks in the Base Record.
3. Constant and continual maintenance of system each year.
4. Records very susceptible to changes.

5. Additional distance - direction parameters may have to be developed to identify accident locations occuring on those segments not having a direct interface relationship.
6. Additional ALAS nodes for base record breaks would make accident location coding cumbersome and more difficult.

GRID-COORDINATE SYSTEM

The grid-coordinate interface could be accomplished on a manual basis or through a digitized mapping system. The manual method would not provide for practical retention and retrieval of coordinate data. A manual application would create a third identification system, separate and unique from the current ALAS and Base Record identification systems.

The grid-coordinate concept can best be utilized through a computer mapping and graphics system. Basic equipment for a computer graphics system consists of a digitizer, micro-processer, host computer and a plotter. The computer graphics system would be more accurate, provide for a retention of all digitized data and allow for digitized data to be interchanged automatically with other computer data such as roadway inventory features, accidents, etc. The system, if properly developed, would be the most user responsive of all systems. Graphic terminals could be located in the ALAS accident location section where CRT displays of the accident area would allow for accurate assignment of ALAS node identifiers and entry of accident data.

A computer graphics system can cost anywhere from $100,000 to $500,000 for equipment only, depending upon the complexity of the system. There would also be additional costs for software and supportive personnel. It would be difficult to justify a computer graphics system for the sole purpose of accident identification and interfacing with inventory features or other related roadway data. Multi-purpose use with other Iowa DOT or state agencies mapping and data analysis programs may provide justification for a computer mapping program.

With multi-use, it is desirable to have as accurate a base map for digitizing as possible. Most states such as New York, Indiana, Michigan, etc., that have initiated a digitized computer mapping program have utilized as base maps the 7½ minute quadrangle map developed by the U.S.Geological Survey. These maps are developed from high resolution aerial photography and ground control survey. At the present time, Iowa is approximately seventy percent covered with 7½ minute quad maps with the remaining thirty percent to be completed on or before January, 1984.

The grid-coordinate concept through a statewide multi-purpose mapping program has distinct advantages and benefits. However, such a program would take two to four years to fully develop depending upon detail of desired data, base maps, funding for equipment and manpower, and space allocation. Following are advantages and disadvantages of the digitized grid-coordinate concept.

<u>Grid-Coordinate Advantages</u>

1. System has universal application, any point in the state can be defined by coordinates.
2. Editing of location coding can be accomplished quickly and efficiently through the use of terminal CRT graphic displays.

3. Maps defining high accident locations, accident rates per road features, etc., can be generated through computer plotting equipment.
4. System can be utilized for numerous mapping purposes both in the Iowa DOT and in other state agencies.
5. Accident analysis programs and accident reduction highway improvement programs can be analyzed on a graphics CRT display terminal and program adjustments made by the user.
6. With the CRT display terminals and the ability to enter, process, and edit data, it is very user-responsive.

ROUTE-MILE-REFERENCE CONCEPT

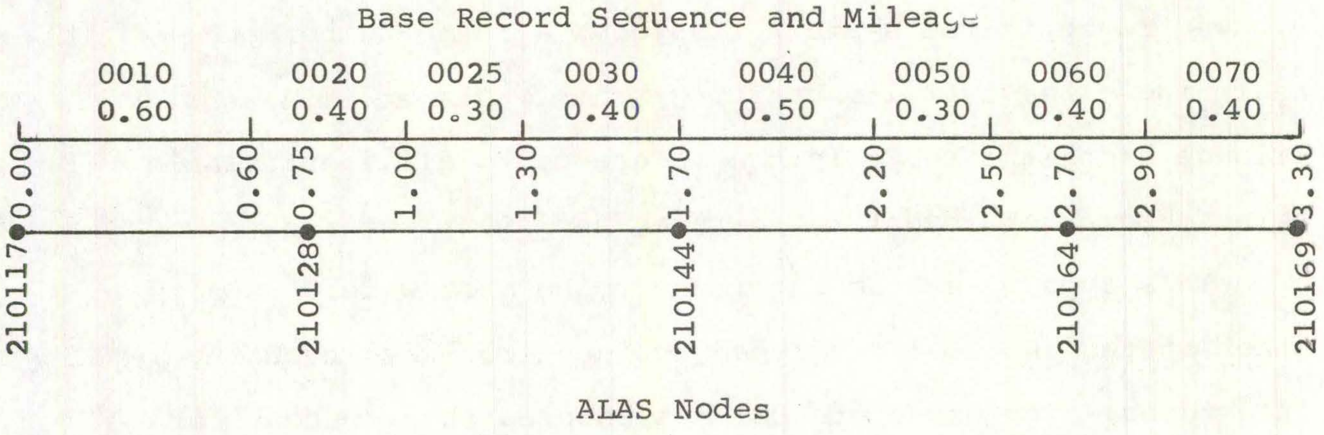
The route-mile-reference concept utilizes a reference mileage along predetermined routes. Under this concept, each highway route in the state is assigned a route number and a beginning mileage at its starting point. The accumulated mileage along the route is the reference to all identifiable points, both for inventory features and ALAS features.

This type of system was found to be most widely used by other states who have developed accident-roadway inventory interfaces. The Minnesota DOT has adopted this concept for all of their highways, state, county, and local. They use the existing route numbers on each road for route identification and reference all data, both accident and inventory, to a mile-point along the route. For those roadways not having regular route numbers, they assign a special route number for the accident-inventory compatibility. They have found this system very workable, requiring only minimal updates.

The basic identification for both the Minnesota data sources, accident and inventory, is the mile reference. All accidents along a route are coded to the specific mile reference (0.01 mile) as well as having all inventory data referenced in the same fashion.

Iowa's two systems are somewhat different since each system has its own unique identification, i.e., ALAS nodes and Base Record sequence breaks. They do, however, have a common identification that can be tied to features on either system, i.e., a distance along a route, or a mile-reference. Figure 8 illustrates this mile-reference as applied to the two systems.

FIGURE 8: ROUTE-MILE-REFERENCE INTERFACE CONCEPT



Using this method, a compatibility file can be developed by having each node number assigned a mile-reference along the route. This mile-reference can be correlated with a corresponding mile-reference on the Base Record. This type of concept would require the following major work efforts to our existing ALAS and Highway Inventory Base Records.

1. All roads and streets in the primary, municipal, and secondary systems to be interfaced would have an assigned route number. This number could be unique for the ALAS/Base Record interface only, or it could be the existing Iowa, U.S., Federal Aid, or county route number.
2. All Base Record segments on each route must be sequenced in order from west to east and south to north and reference mileage assigned to the beginning of each segment.
3. All ALAS nodes along assigned routes would have to be sequenced in the same west to east and south to north pattern with reference mileage assigned to each node number along the route.
4. The beginning mile-reference for multi-county routes should break at county boundaries with a separate mile-reference for each county along the route.

By using the county as a control unit, accident rates, comparison by system mileages and travel, etc., can be made on a summary basis, providing illustrative information on counties with high accident rates per inventory feature. The county control unit would also limit the effect of reconstruction realignment, mileage changes on multi-county routes to that county in which the changes occurred.

Following are some of the advantages and disadvantages of the route mile-reference system.

Advantages

1. Method is simple, easily understood and recognized by users.
2. Many of Iowa's roadways are already sequenced on the Base Record and the mile-reference would require minimal changes to the existing record.
3. Mile-referencing of routes will provide a general location reference of data along a route.
4. There is a relatively high incidence of existing compatibility since many Base Record breaks are at the same location as ALAS node numbers.
5. The reference mileage could be assigned to all sequenced route segments with very little manual efforts. Major manual efforts would be concentrated in developing node strings for each route and sequencing route segments on the Base Record for interfacing the entire system.
6. Concept does not require a one-on-one ALAS - node Base Record break, since data can be referenced to any location with an existing mile-reference and a directional distance.
7. Readily adaptable to a floating section for determination of high accident locations. (i.e., a 0.3 mile floating section along a route).

Disadvantages

1. Frequent Base Record breaks not needed in ALAS analysis would require a reference mile.
2. The majority of the county roads would have to be assigned a route number and all inventory data

sequenced.

3. The local city street Base Record is not broken at every city street intersection, and the mile-references would have to be computed or scaled for many intersections.
4. Also, the majority of all bridges and railroad crossings are not location identified on the Base Record and their mile-reference would have to be computed or scaled.
5. The system would require the creation and maintenance of a third record file, the mile-reference compatibility file.

SUMMARY OF ALTERNATE INTERFACE CONCEPTS

Of the three interface concepts evaluated, the route-mile-reference concept appears to have the most potential for development of an ALAS-Base Record interface file. Much of the compatibility data can be generated by utilization of existing data bases, i.e., Base Record data from sequenced routes and ALAS node strings for selected routes. Once established and working, it appears to be the least cumbersome system to maintain. With accurate and current documentation of any roadway mileage changes and or ALAS node changes, the compatibility file can be maintained with minimal effort.

The initial and major effort in this type of interface would be the selection and identification of route numbers, the proper sequencing of all Base Record data on these routes, and the development of ALAS node strings for all routes. With approximately 112,000 miles of streets and highways in Iowa and over

10,000 potential route numbers for all streets, the amount of effort required to make every mile of roadway compatible may not return comparable benefits in accident safety analysis.

The next section of this report evaluates the travel and accidents in Iowa by various highway systems. It looks at those highway systems and mileages that would involve the least amount of effort in development of an interface and provide the highest benefit in return for accident analysis highway improvement programs.

VI. EVALUATION OF ACCIDENT, MILEAGE AND TRAVEL DATA

On Iowa's 112,000 miles of roadway, there were 19.5 billion vehicle miles of travel and 91,213 accidents during 1978. Since travel and mileage vary significantly by the various highway systems and classes, an evaluation was made on a system basis to determine those highway systems with the highest accident frequencies and rates. Table 4 summarizes the mileage, travel and accident data by highway system.

TABLE 4
MILEAGE, TRAVEL AND ACCIDENTS BY ROAD SYSTEM (1978)

Road System	Mileage		Vehicle Miles		Accidents					
	Miles	Per cent	Millions	Per cent	Fatal	Per cent	Non Fatal	Per cent	Total	Per cent
Primary	10,153	9	11,698	60	298	53	34,361	38	34,659	38
Secondary	89,562	80	3,452	18	183	32	11,550	13	11,733	13
Municipal	12,007	11	4,317	22	82	15	44,739	49	44,821	49
Totals	*111,722	100	19,467	100	563	100	90,650	100	91,213	100

* Excludes 305 miles of State Parks and Institutional Roads and 284 miles of non-mainline ramps and connections.

As indicated, the Primary System comprises only nine percent of the statewide mileage but carries 60 percent of the travel and accounts for 53 percent of the fatal accidents and 38 percent of all accidents.

Looking at the statewide picture, the mileage can be divided into the higher volume roads on the federal-aid systems and the low volume roads on the non-federal-aid roads. This is illustrated in Table 5.

TABLE 5
MILEAGE, TRAVEL AND ACCIDENTS BY FEDERAL AID STATUS (1978)

Federal Aid Status	Mileage		Vehicle Miles		Average Daily Traffic	Accidents					
	Miles	Per cent	Millions	Per cent		Fatal	Per cent	Non Fatal	Per cent	Total	Per cent
Federal Aid	25,281	23	16,316	84	1,768	459	82	74,861	83	75,320	83
Non-Federal Aid	86,441	77	3,151	16	100	104	18	15,789	17	15,893	17
Totals	*111,722	100	19,467	100	477	563	100	90,650	100	91,213	100

* Excludes 305 miles of State Parks and Institutional Roads and 284 miles of non-mainline ramps and connections.

As shown, the federal-aid systems include only about 23 percent of the statewide mileage but carry almost 84 percent of the traffic and account for about 83 percent of the accidents. The average daily traffic (ADT) on the federal-aid routes is 1,768 vehicles per day compared to only 100 for the Non-Federal routes.

Appendix "C" identifies in more detail the 1978 mileage, travel and accident data by federal-aid and non-federal-aid highways by jurisdiction. Data in this table identifies the disparity of accidents and travel related to the mileage in each category. Referring to this appendix table, 64 percent of the state-wide mileage is on the secondary road non-federal-aid category, but only carries eight percent of the total travel. The ADT on this road system is only 54 vehicles per day. This road system had only eight percent of the total travel.

DATA BASE COMPATIBILITY ANALYSIS

As shown in the previous tables and Appendix "C", not all highway systems have the same mileage, travel or accident rates. In addition to this data, other factors to be considered in making an ALAS-BASE Record compatibility file are the number of ALAS nodes, number of base record breaks and a relative index of the difficulty in making these two records compatible. Appendix "D" illustrates this basic data relative to constructing an interface file for the two records. The data is identified by federal-aid status within the primary, municipal or secondary highway system. Shown in this table are the mileages of each system, number of inventory records, estimated number of ALAS nodes and the estimated number of compatibility records required under the route-mile interface concept. Table 6 provides a summary of the data in Appendix "D".

The adjusted compatibility records (shown in Table 6) illustrates the estimated number of compatibility records multiplied by the relative time required per record for interfacing. The ratio of adjusted records per annual accident indicates the effort involved in developing the compatibility record per accident experience. As illustrated by this ratio, interfacing the state-wide federal-aid systems would involve about 15 percent of the compatibility coding effort. This work effort would result in interface capability on 23 percent of the mileage, 84 percent of the travel, and 83 percent of the accident experience.

One of the main uses of the interface system on non-federal-aid systems would be to meet the FHWA requirements in reporting fatal and injury accident data on the TA-1 Table (Statewide Mileage, Travel and Non-Fatal and Fatal Injury Accidents). The fatal and injury accidents on the low-volume non-federal-aid routes could be manually coded to meet the federal requirements.

TABLE 6

SUMMARY OF MILEAGE, RECORDS AND ACCIDENT COMPATIBILITY BY HIGHWAY SYSTEM

Road System	Mileage	Adjusted Compatibility Records Per 100 Miles	1978 Fatal and Injury Accidents Per 100 Miles	Ratio: Compatibility Records Per Fatal and Injury Accidents
PRIMARY				
All	10,153	345	93	4
SECONDARY				
Federal Aid	12,626	151	21	7
Non Federal Aid	76,936	289	2	152
Totals	89,562	269	5	51
MUNICIPAL				
Federal Aid	2,502	2,398	268	9
Non Federal Aid	9,505	4,625	21	222
Totals	12,007	4,165	72	58
STATE				
Federal Aid	25,281	451	74	6
Non Federal Aid	86,441	766	4	192
Totals	*111,722	695	20	35

* Excludes 305 miles of State Parks and Institutional Roads and 284 miles of non-mainline ramps and connections.

Referring back to Appendix "D", column (11) is a ratio of the number of adjusted compatibility records per mile over the annual number of fatal and injury accidents per mile. Assuming that it would take about five times as long to manually code each compatibility record, the manual accident coding could be done for almost 40 years before the number of man-hours would equal the compatibility work effort.

The results of this data comparison reflects the effort that would be required to develop a compatibility table for all highway systems. The ratio of adjusted compatibility records per fatal-injury accidents for each system provides an indication of the potential work effort per analyzed accident.

The results of this comparison indicate that the time and effort involved in developing a compatibility file for non-federal-aid systems would not provide sufficient dividends in accident roadway feature analysis for these lower volume roadways.

VII. RECOMMENDED INTERFACE CONCEPT

Based on the previous evaluations, of the Base Record, the ALAS Record, various interface concepts, the miles of roadway, travel, accidents, etc., the most feasible interface proposal is the route-mile-reference system. While the federal-aid system was used in our evaluation to determine a select sub-grouping of mileage to be interfaced, the actual mileage to be interfaced could be based on other selected functional classes of highways. The main point of the selected system is to interface those routes that have the highest amount of travel and accidents and can be interfaced with the least amount of cost. The federal-aid systems provide that potential.

Assuming the federal-aid systems were to be route-mile interfaced, approximately 83 percent of the accidents each year can be interfaced on approximately 25,000 miles of highway. It will provide the highest return in accident analysis for the effort invested. The route-mile-reference system can be accomplished with little or no modification to the identification portion of the Base Record format. This can be accomplished through Data Processing programming since the segment lengths are already on the Base Record.

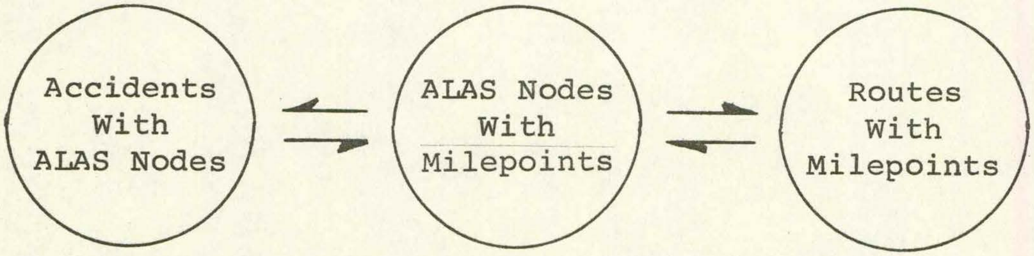
As previously mentioned in the ALAS/Base Record comparison, there already exists compatibility between many of the ALAS and Base Record breaks. On those breaks where no compatibility exists, a county route-mile-reference point will have to be scaled or otherwise established for each ALAS feature. By having the mileage referenced within each county, any changes to the length of a route on multi-county routes can be limited to that county in which the changes occurred. This will keep annual maintenance work on the interface file at a minimum.

To eliminate the need for equations in the route-mile reference system it is recommended that interface updating be done on an annual basis. Relocations and route changes would be handled by revising the entire route compatibility file within the county effected. Annually, accidents would be interfaced with the Base Record File for that year.

Since we already have a railroad grade crossing record and a structure inventory record, the additional feature of a route-mile-reference point for these items will also allow for interface capability between the railroad grade crossing and bridge inventory records with highway inventory records. This will provide more complete updating and evaluation capability of all transportation data along a given route. The interface will also allow for the utilization of accident and roadway inventory data in the pavement management program.

The route-mile interface does require the development and maintenance of a third file. That file will provide the compatibility between the ALAS and Base Record Files or other such files with identification records common to the ALAS or Base Record File. The basic concept of this interface file is illustrated in Figure 9.

FIGURE 9: ROUTE-MILE-REFERENCE INTERFACE FLOW CHART



To help in the evaluation of the interface development, the next section of this report covers a Story County Pilot Project. Selected routes were interfaced and the location data on ALAS and Base Record was reviewed for problems and difficulties in interface compatibility.

VIII. STORY COUNTY PILOT STUDY

The Office of Transportation Research has developed a compatibility file between ALAS and Base Record files for selected Federal-Aid routes in Story County. The purpose of the pilot study was to test the feasibility of the recommended route-mile-reference interface concept and to identify problems that will require special consideration. From the information gained through this pilot study a detailed methodology for interfacing the files on a statewide basis will be developed.

DEVELOPMENT OF COMPATIBILITY FILE

The computer operations of the pilot study were conducted on the remote terminal (CRT) in the Transportation Research Office through the use of SAS (Statistical Analysis System). A number of data files were used by pulling the Story County portion of the master files onto the Transportation Research disc file as follows:

1. Base Record Data - selected data fields from the Primary, Secondary and Municipal Street data files.
2. ALAS Literal Description File.
3. 1977 Accident File - selected data fields.
4. 1978 Accident File - selected data fields.

The compilation of the Interface Compatibility File involves three steps as follows:

1. Computer assignment of accumulated mileage at the beginning of each Base Record sequence.

2. Assignment of milepoints to each ALAS node along the route to create the "Nodemile" file.
3. Merging the Base Record control data with the Nodemile file to create an Interface Compatibility File.

Step 1 - Computer Assignment of Base Record Milepoints

This step is a computer accumulation of the Base Record mileage for each segment and the assignment of a milepoint to the beginning of each sequence. The compilation of FAS routes, that extend into or through a city, or FAU routes that extend beyond the corporate limits of a city involves the merging of data from both the Secondary and Municipal Base Record Files.

The example in Figure 10 from the U.S. 69 file illustrates the listing format used in this pilot study.

FIGURE 10: BASE RECORD MILEPOINTING (U.S. 69)

```
SEQROAD   SEQCNTY   TOWNSHIP   RANGE   SECTION   CITYNUMB   FUNCTION   LENGTH   MILEPT

   10        5         82        24       36          0         0        0.91     0.00
   20        5         82        24       36          0         0        0.05     0.91
   30        5         82        24       36          0         0        0.05     0.96
   40        5         82        24       25          0         0        0.05     1.01
   50        5         82        24       25          0         0        0.04     1.06
   60        5         82        24       25          0         0        0.83     1.10
   80        5          0         0        0       3630         0        0.03     1.93
   90        5          0         0        0       3630         0        0.15     1.96
  100        5          0         0        0       3630         0        0.84     2.11
  110        5         82        24       23          0         0        0.16     2.95
  120        5         82        24       23          0         0        0.10     3.11
  130        5         82        24       14          0         0        0.28     3.21
  140        5         82        24       14          0         0        0.70     3.49
  150        5         82        24       11          0         0        1.01     4.19
  160        5         82        24        2          0         0        0.76     5.20
  170        5         82        24        2          0         0        0.13     5.96
  180        5         82        24        2          0         0        0.10     6.09
  190        5         83        24       35          0         0        1.00     6.19
  200        5         83        24       26          0         0        0.50     7.19
  210        5         83        24       26          0         0        0.52     7.69
  220        5         83        24       23          0         0        0.48     8.21
  230        5         83        24       23        155         0        0.48     8.69
  240        5         83        24       14        155         0        0.21     9.17
  250        5          0         0        0        155         0        0.06     9.38
```

Step 2 - Manual Assignment of Milepoints to ALAS Nodes

Using the listings from Step 1 along with ALAS node maps, milepoints were manually assigned to each node along the routes. First, milepoints for nodes that coincide with Base Record breaks were directly assigned.

It was found during this step that more Base Record data was needed to efficiently match nodes with coincidental Base Record breaks. This was expecially true in municipal areas where very short Base Record segments are quite common. Ideally, what is needed is a generated data item that would indicate the reasons, or at least the primary reason, for the Base Record break. If this is not practical it may be necessary to print out more of the data fields and also include the literal descriptions from the Primary and Municipal files.

Second, milepoints were scaled from appropriate maps for nodes that did not coincide with Base Record breaks. The scaling of milepoints had minimal effect on accuracy since lengths were adjusted at the next node with a coinciding Base Record break. The milepoint assignments were then entered onto the disc file through the CRT to create the Nodemile file shown in Figure 11.

Step 3 - Merging Base Record File With Nodemile File

The Interface Compatibility File was then generated by merging the Nodemile File with location control data from the Base Record File. The ALAS Literal Description File was also merged for this study to assist the user in reading the file. A portion of the U.S. 69 file is shown in Figure 12.

FIGURE 11: NODEMILE FILE (U.S. 69)

OBS	NODE	MILEPT	DESCRIP
124	110181	0.00	US 69 AT POLK CO LINE
125	111781	1.01	JCT US 69 & IA 210
126	113281	1.93	N US 69 AT C M STP & P RY
127	113381	2.01	
128	113581	2.14	INT US 69 & E 3RD ST
129	113781	2.23	INT US 69 & E 4TH ST
130	113780	2.25	INT US 69 & TIMBERLANE
131	113880	2.30	INT US 69 & E 5TH ST
132	114277	2.64	INT US 69 & N MAIN AVE
133	114474	2.91	
134	115473	3.60	
135	115474	3.80	
136	116577	4.19	
137	118173	5.20	
138	119473	5.96	
139	119673	6.09	S-INT US 69 & CO E57
140	210373	6.30	
141	212573	7.69	N-INT US 69 & CO E57
142	214173	8.69	
143	214473	8.93	INT US 69 & GARDEN DR
144	214973	9.18	INT US 69 & JEWEL DR
145	215773	9.69	INT DUFF AVE & AIRPORT RD
146	215973	9.79	
147	216075	9.87	
148	216173	9.93	GR SEP EB US 30 OVER US 69(DUFF)
149	216274	9.98	
150	216375	10.05	
151	216573	10.19	INT S DUFF AVE & S 16TH ST
152	217073	10.53	
153	217573	10.83	INT S 5TH ST & DUFF AVE
154	217873	11.02	INT DUFF AVE & S 3RD ST
155	217973	11.11	INT DUFF AVE & S 2ND ST
156	218173	11.19	INT DUFF AVE & LINCOLN WAY
157	218171	11.28	INT SHERMAN AVE & LINCOLN WAY
158	218169	11.36	INT LINCOLN WAY & KELLOGG
159	218168	11.44	INT WASHINGTON AVE & LINCOLN WAY
160	218167	11.53	INT CLARK AVE & LINCOLN WAY
161	218166	11.57	
162	218164	11.66	LINCOLN WAY AT C & NW RY
163	218163	11.69	INT GRAND AVE & LINCOLN WAY
164	218264	11.73	GRAND AVE AT C & NW RY OVERPASS
165	218365	11.79	GRAND AVE AT C & NW RY OVERPASS
166	218465	11.85	GRADE SEP GRAND AVE & MAIN ST
167	218565	11.90	INT GRAND AVE & 5TH ST
168	218665	11.97	INT GRAND AVE & 6TH ST
169	218765	12.07	INT GRAND AVE & 7TH ST
170	218865	12.11	INT GRAND AVE & 8TH ST

FIGURE 12: INTERFACE COMPATIBILITY FILE (U.S. 69)

OBS	CITY	MILEPT	SEQUENCE	BASELENG	NODE	LINKLENG	DESCRIP
175	0	0.00	10	0.91	110181	1.01	US 69 AT POLK CO LINE
176	0	0.91	20	0.05	.	.	
177	0	0.96	30	0.05	.	.	
178	0	1.01	40	0.05	111781	0.92	JCT US 69 & IA 210
179	0	1.06	50	0.04	.	.	
180	0	1.10	60	0.83	.	.	
181	3630	1.93	80	0.03	113281	0.08	N US 69 AT C M STP & P RY
182	3630	1.96	90	0.15	.	.	
183	.	2.01	.	.	113381	0.13	
184	3630	2.11	100	0.84	.	.	
185	.	2.14	.	.	113581	0.09	INT US 69 & E 3RD ST
186	.	2.23	.	.	113781	0.02	INT US 69 & E 4TH ST
187	.	2.25	.	.	113780	0.05	INT US 69 & TIMBERLANE
188	.	2.30	.	.	113880	0.34	INT US 69 & E 5TH ST
189	.	2.64	.	.	114277	0.27	INT US 69 & N MAIN AVE
190	.	2.91	.	.	114474	0.69	
191	0	2.95	110	0.16	.	.	
192	0	3.11	120	0.10	.	.	
193	0	3.21	130	0.28	.	.	
194	0	3.49	140	0.70	.	.	
195	.	3.60	.	.	115473	0.20	
196	.	3.80	.	.	115474	0.39	
197	0	4.19	150	1.01	116577	1.01	
198	0	5.20	160	0.76	118173	0.76	
199	0	5.96	170	0.13	119473	0.13	
200	0	6.09	180	0.10	119673	0.21	S-INT US 69 & CO E57
201	0	6.19	190	1.00	.	.	
202	.	6.30	.	.	210373	1.39	
203	0	7.19	200	0.50	.	.	
204	0	7.69	210	0.52	212573	1.00	N-INT US 69 & CO E57
205	0	8.21	220	0.48	.	.	
206	155	8.69	230	0.48	214173	0.24	
207	.	8.93	.	.	214473	0.25	INT US 69 & GARDEN DR
208	155	9.17	240	0.21	.	.	
209	.	9.18	.	.	214973	0.51	INT US 69 & JEWEL DR
210	155	9.38	250	0.06	.	.	
211	155	9.44	260	0.09	.	.	
212	155	9.53	270	0.05	.	.	
213	155	9.58	280	0.11	.	.	

The development of interface compatibility for I-35 involved the coding of dual roadways for each direction of travel. Even though dual roadways were coded, the milepointing was tied to the overall "control" mileage of the route. This handling of divided highways allows for directional analysis of accidents as well as providing for overall route analysis capabilities.

On I-35 many nodes were unique to only one direction of travel and some were common to both lanes. Portions of the interface compatibility files for northbound and southbound I-35 are shown in Figure 13. As shown in (A) and (B) of Figure 13, nodes 121708, 124108 and 128111 are common to both directions of travel.

Interchange ramps were handled as short separate routes in the compatibility file. Within the Base Record, each ramp is described by a sequence number or series of sequence numbers. Tying accidents to these sequence numbers through the compatibility file will provide for inclusion of ramp accidents in route analysis if desired. The I-35 and Ia. 210 interchange ramp compatibility files are illustrated in Figure 13 (C).

FIGURE 13: INTERSTATE INTERFACE COMPATIBILITY

(A) NORTHBOUND I-35

CITY	MILEPT	SEQUENCE	BASELENG	NODE	DESCRIP
0	0.00	10	0.61	120110	NB I-35 AT POLK CO LINE
0	0.61	20	0.04	.	
0	0.65	30	0.08	.	
0	0.73	40	0.28	121410	I-35 NB AT EX RAMP TO IA-210
0	1.01	50	0.28	121708	GR SEP IA 210 OVER I-35
0	1.29	100	0.08	122110	I-35 NB AT ENT RAMP FROM IA-210
0	1.37	110	0.04	.	
0	1.41	120	0.60	.	
0	2.01	130	1.00	.	
.	2.04	.	.	123409	GR SEP NB I-35 OVER CMSTP&P RR
.	2.50	.	.	124108	GR SEP CO RD E63 OVER I-35
0	3.01	140	1.00	.	
.	3.94	.	.	126411	I-35 NB EX RAMP TO WGH STA
0	4.01	150	1.01	.	
.	4.25	.	.	126912	I-35 NB ENT RAMP FROM WGH STA
0	5.02	160	1.00	.	
.	5.03	.	.	128111	GR SEP CO RD OVER I-35(MP106.8)

(B) SOUTHBOUND I-35

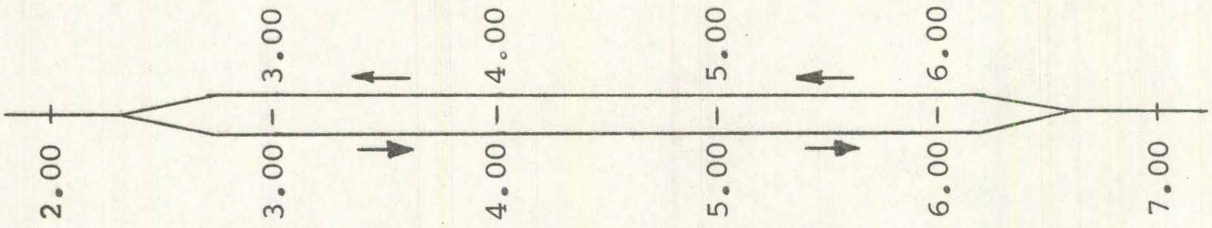
CITY	MILEPT	SEQUENCE	BASELENG	NODE	DESCRIP
0	0.00	10	0.61	120109	SB I-35 AT POLK CO LINE
0	0.61	20	0.04	.	
0	0.65	30	0.08	.	
0	0.73	40	0.28	121408	I-35 SB AT ENT RAMP FROM IA-210
0	1.01	50	0.28	121708	GR SEP IA 210 OVER I-35
0	1.29	100	0.08	122108	I-35 SB AT EX RAMP TO IA-210
0	1.37	110	0.04	.	
0	1.41	120	0.60	.	
0	2.01	130	1.00	.	
.	2.04	.	.	123408	GR SEP SB I-35 OVER CMSTP&P RR
.	2.50	.	.	124108	GR SEP CO RD E63 OVER I-35
0	3.01	140	1.00	.	
.	3.72	.	.	126009	I-35 SB ENT RAMP FROM WGH STA
0	4.01	150	1.01	.	
.	4.07	.	.	126610	I-35 SB EX RAMP TO WGH STA
0	5.02	160	1.00	.	
.	5.03	.	.	128111	GR SEP CO RD OVER I-35(MP106.8)

(C) I-35 & IA. 210 RAMPS

MILEPT	SEQUENCE	BASELENG	NODE	LINKLENG	DESCRIP
0.00	60	0.30	121711	0.30	IA-210 AT I-35 NB RAMPS
0.33	.	.	122110	.	I-35 NB AT ENT RAMP FROM IA-210
0.00	70	0.28	121410	0.28	I-35 NB AT EX RAMP TO IA-210
0.28	.	.	121711	.	IA-210 AT I-35 NB RAMPS
0.00	80	0.30	121707	0.30	IA-210 AT I-35 SB RAMPS
0.30	.	.	121408	.	I-35 SB AT ENT RAMP FROM IA-210
0.00	90	0.28	122108	0.28	I-35 SB AT EX RAMP TO IA-210
0.28	.	.	121707	.	IA-210 AT I-35 SB RAMPS

Non-interstate divided highway sections can be interfaced in the same manner as I-35 was done. Many divided sections will not continue through a complete county. In these cases shorter supplemental routes will be developed for the southbound/ westbound roadways, with milepointing tied to the "control" mileage. The sketch in Figure 14 illustrates this concept.

FIGURE 14: NON-INTERSTATE DIVIDED SECTIONS



Milepoints

MILEPOINTING ACCIDENTS

A SAS program was developed to illustrate how accidents can be milepointed through the Interface Compatibility File. The resulting printout illustrating a portion of the U.S. 69 data is shown in Figure 15. Accident data for 1977 and 1978 have been used in this pilot study.

As shown in Figure 15, several accidents could not be milepointed because of coding errors or insufficient location data on the accident report form. Coding errors can be minimized in the future by using the node strings developed under the Interface project for more stringent edit checking of accident data. Incomplete accident reporting is a universal problem in the accident analysis field and is difficult to correct.

FIGURE 15: ACCIDENT INTERFACE (U.S. 69)

```
  CITY  MILEPT  SEQUENCE  BASELENG       NODE  LINKLENG    DESCRIP                             ACCNO   ROUTE  SEVERITY        DATE
     .    .          .        .            .     .                                      80093767    0069      PI       112178
     .    .          .        .            .     .                                      80097112    0069      PDO      120578
     .    .          .        .            .     .                                      80101316    0069      PDO      121578
     .    .          .        .            .     .                                      80102035    0069      PDO      121678
     .    .          .        .            .     .                                      80102311    0069      PDO      121878
     .    .          .        .            .     .                                      80104483    0069      PI       122278
     .    .          .        .            .     .                                      80104742    0069      PDO      122378
     .    .          .        .            .     .                                      80104998    0069      PDO      122678
     .    .          .        .            .     .                                      80105443    0069      PDO      122378
     0   0.00       10       0.91     110181    1.01    US 69 AT POLK CO LINE                  .                            .
     .   0.00        .        .            .     .                                      80103702    0069      PDO      122578
     .   0.06        .        .            .     .                                      70019960    0069      PDO       22677
     .   0.71        .        .            .     .                                      80072882    0069      PDO       91278
     0   0.91       20       0.05          .     .                                             .                            .
     0   0.96       30       0.05          .     .                                             .                            .
     0   1.01       40       0.05     111781    0.92    JCT US 69 & IA 210                     .                            .
     .   1.01        .        .            .     .                                      70021392    0069      PDO       30777
     .   1.01        .        .            .     .                                      70047074    0069      PI        61777
     .   1.01        .        .            .     .                                      70052304    0069      PI        70677
     .   1.01        .        .            .     .                                      80037579    0069      PI        43078
     .   1.01        .        .            .     .                                      80058920    0069      PI        72378
     .   1.01        .        .            .     .                                      80072724    0069      PI        90878
     .   1.01        .        .            .     .                                      80081533    0069      PDO      101378
     .   1.01        .        .            .     .                                      90000855    0069      PDO      122978
     0   1.06       50       0.04          .     .                                             .                            .
     0   1.10       60       0.83          .     .                                             .                            .
  3630   1.93       80       0.03     113281    0.08    N US 69 AT C M STP & P RY              .                            .
     .   1.93        .        .            .     .                                      80023871    0069      PDO       30578
  3630   1.96       90       0.15          .     .                                             .                            .
     .   2.00        .        .            .     .                                      70045131    0069      PI        60977
     .   2.01        .        .       113381    0.13                                           .                            .
     .   2.01        .        .            .     .                                      80082681    0069      PDO      101878
     .   2.01        .        .            .     .                                      80083706    0069      PDO      102178
     .   2.05        .        .            .     .                                      70045075    0069      PI        60877
  3630   2.11      100       0.84          .     .                                             .                            .
     .   2.14        .        .       113581    0.09    INT US 69 & E 3RD ST                   .                            .
     .   2.14        .        .            .     .                                      70076036    0069      PDO      101077
     .   2.14        .        .            .     .                                      80009617    0069      PDO       12078
     .   2.14        .        .            .     .                                      80070625    0069      PDO       90878
     .   2.23        .        .       113781    0.02    INT US 69 & E 4TH ST                   .                            .
     .   2.23        .        .            .     .                                      70011103    0069      PDO       12377
     .   2.23        .        .            .     .                                      70056545    0069      PI        72677
     .   2.23        .        .            .     .                                      70059018    0069      PDO       72977
     .   2.25        .        .       113780    0.05    INT US 69 & TIMBERLANE                 .                            .
     .   2.25        .        .            .     .                                      80021489    0069      PDO       22578
     .   2.30        .        .       113880    0.34    INT US 69 & E 5TH ST                   .                            .
     .   2.30        .        .            .     .                                      70039300    0069      PDO       52077
     .   2.33        .        .            .     .                                      70033826    0069      PI        42777
     .   2.64        .        .       114277    0.27    INT JS 69 & N MAIN AVE                 .                            .
```

Once accidents have been assigned route-milepoints, they can be tied to the appropriate Base Record sequence for computation of accident rates and correlation analysis with roadway inventory data. This will greatly enhance the analysis capabilities of the ALAS system.

PROBLEMS REQUIRING SPECIAL CONSIDERATION

In addition to divided highways and interchange ramps which were discussed earlier, a few other types of roads will require special consideration in developing the Interface Compatibility File. These are:

(1) One-way pairs of streets carrying Primary Road or other FA system traffic; and

(2) County-line roads.

One-Way Pairs

One-way pairs of streets carrying Primary Road Traffic are handled differently in the Base Record than normal divided highways. The control mileage is carried on the northbound or eastbound sections as in other types of highways. However, the southbound and westbound roadways are given different sequence numbers with zero "control mileage". The actual mileage of each of these sequences is carried in the southbound/westbound mileage column.

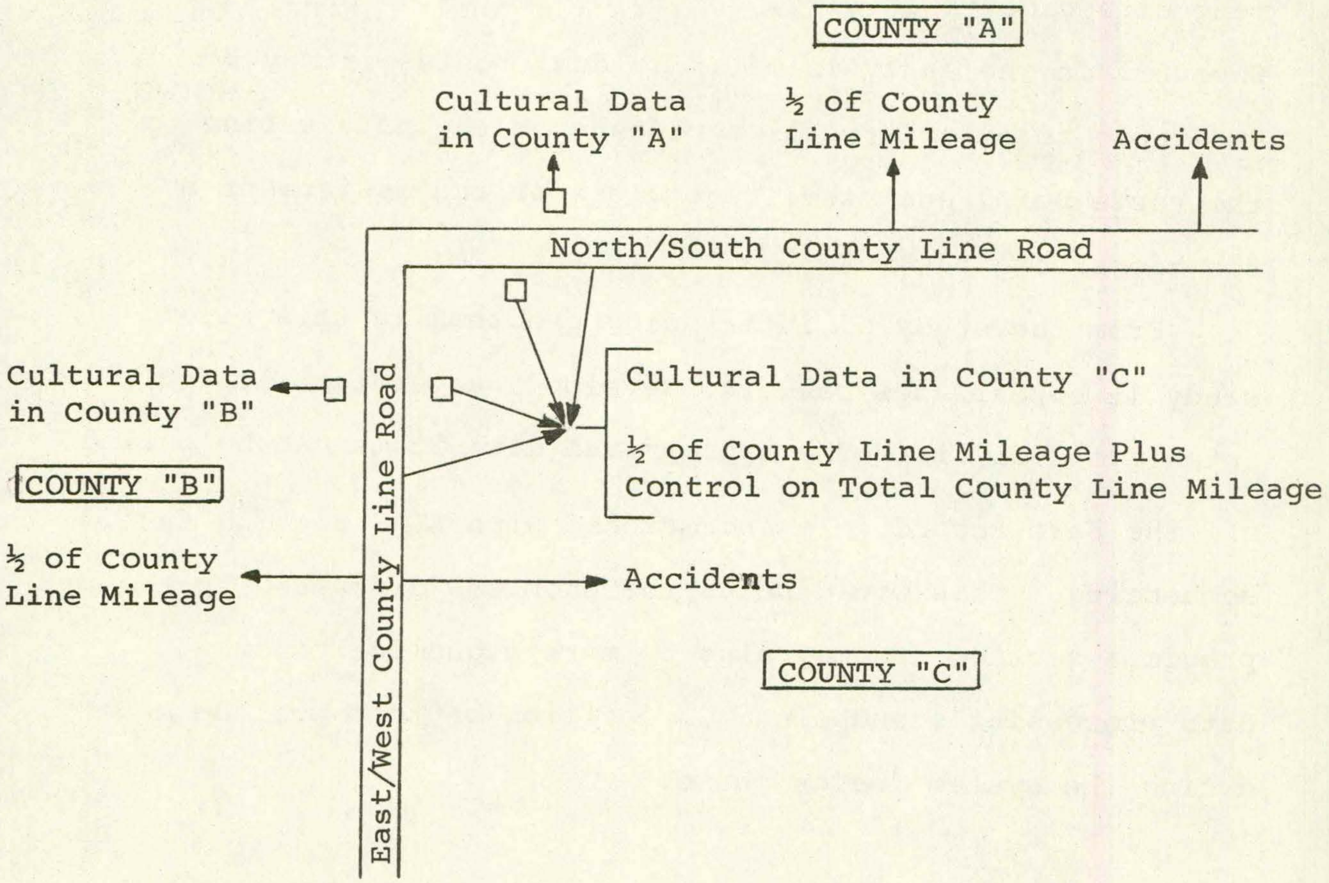
In interfacing the one-way pairs, each direction of travel will be treated as a separate route, with the milepointing relecting the actual mileage along each street. The milepointing of the southbound or westbound street will still be in the north or east direction.

County Line Roads

County line roads will also require special coding and programming. On the Base Record each county line road segment is recorded in both counties, with the mileage split between the two counties. As illustrated in Figure 16 the major coding is in the county to the south or east. The Base Record, in the major county coding, shows the mileage assigned to the other county plus all the road related inventory data. Cultural data is coded to the actual county in which the buildings are located.

Under ALAS coding, accidents on county line roads are assigned to the county to the north or east. The discrepancy

FIGURE 16: ALAS/BASE RECORD CONTROLS FOR COUNTY LINE ROADS



in major coding on north and south county lines will further complicate interface procedures. In developing the Interface Compatibility File all data will be merged into one record using the ALAS guidelines, i.e., assignment to the county to the north or east.

ANALYSIS PROBLEMS

Another type of problem will have to be addressed in developing the analysis programming. Nodes at intersections of two or more federal-aid routes will be associated with each intersecting route node string. Accident analyses will have to be selective in associating accidents with the appropriate route. A hierarchal ranking by road system and/or route number must be developed to eliminate duplicate assignment of accidents in city, county or statewide analyses. However, in the analysis of individual routes it may be desirable to associate all accidents on the node string to the route being analyzed, regardless of the assignment by the hierarchal ranking.

From the study of interfacing problems in this pilot study it appears desirable to develop a separate file for interface analysis. The appropriate data items can be pulled off the Base Record file and matched with ALAS routing and sequencing. This would solve the problems discussed in the previous section and may also be more economical from a data processing standpoint. A decision on this will be made during the system design phase.

CONCLUSIONS

It is evident from this pilot study that the route mile-reference system is a feasible approach to interfacing the ALAS accident file with the Base Record. It does not appear that there will be any major problems in developing and maintaining the interface compatibility file for the federal-aid systems.

In addition to interfacing capabilities, the compatibility file information will provide a means for improved editing of the accident location coding.

GLOSSARY

TERM USAGE

Link - Section of road between adjacent nodes.

Milepoint - A true mileage distance along a route from the county line or beginning of the route.

Milepost - A field marker to indicate the distance from the state line or beginning of route.

ABBREVIATIONS

ALAS - Accident Location and Analysis System

CRT - Cathode Ray Tube (computer terminal)

FAS - Federal-Aid Secondary route

FAU - Federal-Aid Urban route

FHWA - Federal Highway Administration

LIFE - Lowest Investment for a Forgiving Environment (evaluation approach to compare safety of proposed improvement alternatives)

SAS - Statistical Analysis System (Computer software analysis system)

COMPUTER PRINTOUT ABBREVIATIONS

ACCNO - Accident case number

BASELENG - Length of Base Record sequence

DESCRIP - ALAS literal description

HIWAYSYS - Highway System

LINKLENG - Length of road link between adjacent nodes

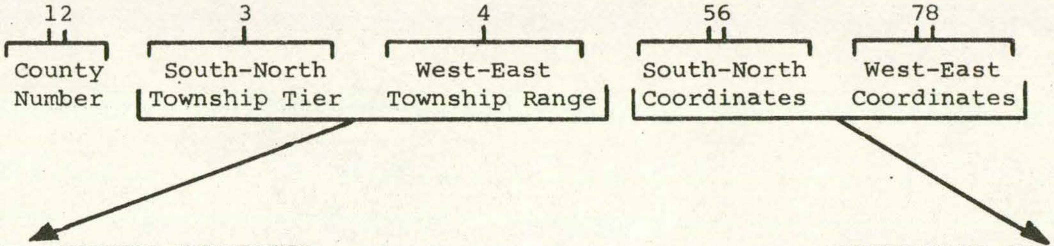
MILEPT - Milepoint

OBS - Observation number

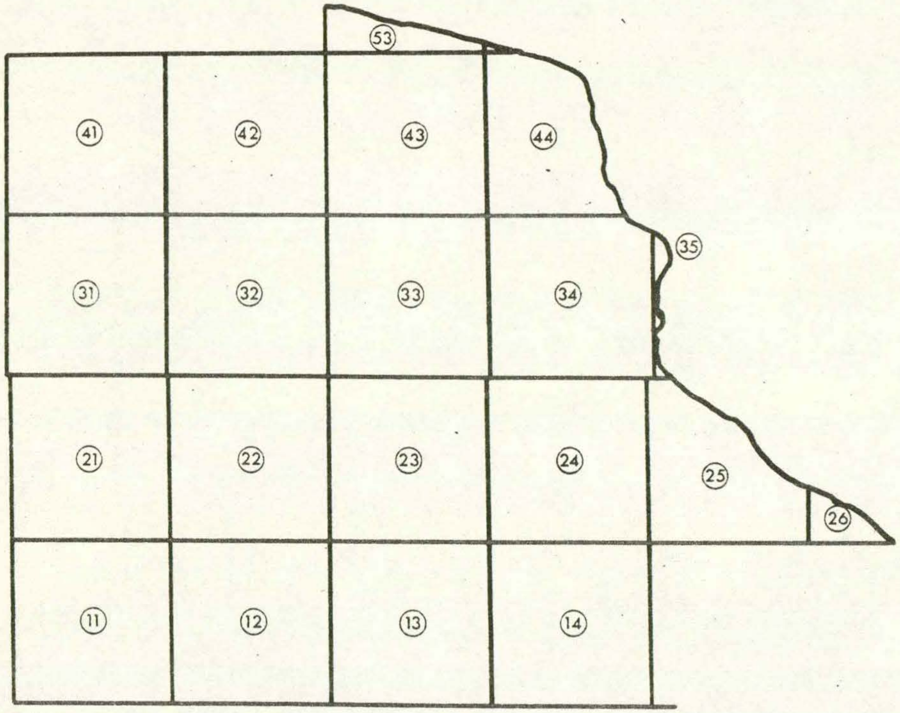
SEQROAD - Base Record route sequence number

SEQCNTY - Base Record county sequence number

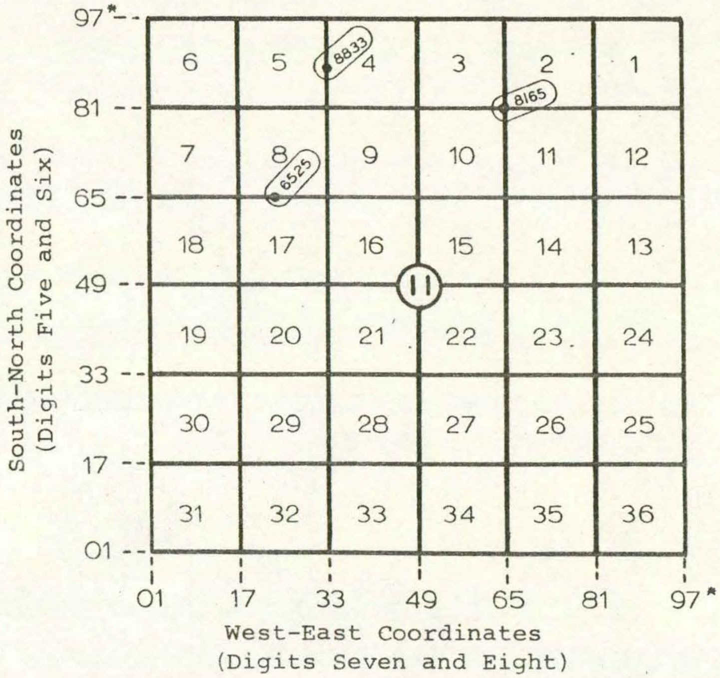
COMPOSITION OF EIGHT-DIGIT NODE NUMBER



EXAMPLE OF CONGRESSIONAL TOWNSHIP NUMBERING
(Digits Three and Four)



COORDINATE SYSTEM NUMBERING ON
SECTION LINES WITHIN A CONGRESSIONAL TOWNSHIP
(Digits Five thru Eight)



* If Township Line is on County Line

ROADWAY ELEMENTS TO WHICH NODE NUMBERS ARE ASSIGNED

1. All Intersections (Except Alleys)
2. Ramp Terminals
3. Railroad Crossings
4. Grade Separation Structures
5. Major Bridges
6. Road Ends
7. 90 Degree Turns (When Each Leg is at Least ¼ Mile Long)
8. County Lines

DESCRIPTION OF THE
IOWA LINK-NODE ACCIDENT LOCATIONAL SYSTEM

IOWA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
OFFICE OF TRAFFIC ENGINEERING

APPENDIX "A"

PRIMARY ROADS

Card Position | Record Position

- Card Type H — Needs Westbound/Southbound Lane
  - 40-49 MPH Curves
  - 50-55 MPH Curves
  - Type of RR Xing
  - Restrictions
    - • Length of Passing
    - Stopping
      - Number
      - • Length
  - Safety Study
  - Parking
  - Drainage
  - Turn Lanes
  - % Turns
  - Traffic Flow
  - Through Width
  - Str. Adq.
    - Wearing Surf.
    - Road Bed
    - Drainage
    - Maint. Econ.
  - Cond.
    - Surface
    - Shoulder/Curb
  - Critical Inters.
    - Turn Lanes
    - % Turns
    - Through Width
  - Suff Typical Sec.
- Card Type G — Conty Control
  - Major Route
  - 1st Duplicate
  - 2nd Duplicate
- Card Type I
  - Available Area

Positions 80 & 93-96 are program generated; no coding required. Positions 260, 303, 332-350 and 355-400 are available for use.

Card Position | Record Position

- Card Type F
  - FHWA Needs I.D.
    - Route Number
    - Section
    - Subsection
  - TOPICS Class
  - Functional Classification
    - Iowa
      - Present
      - Future
    - FHWA
- Card Type G
  - Iowa Needs I.D.
    - Needs Section Number
  - Needs Inventory
    - Typical Section
    - Inventory Year
    - Special Study
    - Cost Area
    - Terrain
    - Type Area
    - Median
      - Type
      - Width
    - ROW
      - Cost Group
      - Available Width
    - Shoulder/Curb
      - Outside
        - Type
        - Width
      - Inside
        - Type
        - Width
  - Needs Not Divided or Eastbound / Northbound Lane
    - Grades
      - • 5.0-5.9 %
      - 6.0-6.9 %
      - 7.0-7.9 %
      - 8.0-9.9 %
      - 10 % & Over
    - • Length
    - Curves
      - 0-29 MPH
      - 30-39 MPH
      - 40-49 MPH
      - 50-55 MPH
    - Type of RR Xing
    - Restrictions
      - • Length of Passing
      - Stopping
        - Number
        - • Length
    - Safety Study
    - Parking
    - Drainage
    - Turn Lanes
    - % Turns
    - Traffic Flow
    - Through Width
    - Str. Adq.
      - Wearing Surf.
      - Road Bed
      - Drainage
      - Maint. Econ.
    - Cond.
      - Surface
      - Shoulder/Curb
- Card Type H
  - Needs Westbound / Southbound Lane
    - Shoulder/Curb
      - Outside
        - Type
        - Width
      - Inside
        - Type
        - Width
    - Grades
      - 5.0-5.9 %
      - 6.0-5.9 %
      - 7.0-7.9 %
      - 8.0-9.9 %
      - 10 % & Over
    - • Length
    - 0-29 MPH Curves
    - 30-39 MPH Curves

Card Position | Record Position

- Card Type E
  - Culture
    - Year Round Dwellings
    - Seasonal Dwellings
    - Businesses
    - Industries
    - Schools
    - Churches
    - Institutions
    - Recreation Area
    - Junk Yards
  - Duplicate Routes
    - First
      - Highway System
      - Route
        - Alternate
        - Number
      - Sequence
        - Road
        - County
    - Second
      - Highway System
      - Route
        - Alternate
        - Number
      - Sequence
        - Road
        - County
  - Railroad Crossings
    - First Number
    - Second Number
    - Third Number
  - Traffic
    - Year Counted
    - A D T
    - Trucks
    - • 1 Year Expansion Factor
  - FHWA Mileage
    - Dup. Mileage
    - Domain
    - Toll
    - Special Systems
    - Census
- Card Type F — Sufficiency Inventory
  - Section
    - Major Route
    - First Duplicate
    - Second Duplicate
  - G. M. I.
    - Major Route
    - First Duplicate
    - Second Duplicate
  - Intersections
    - Major
    - Minor
    - Signal or Stop Sign
  - Entrances
    - Business
    - Private

11-1-75

LRECL = 400

PRIMARY ROADS

Card Position | Record Position

- Card Types A-I
  - County Number
  - Highway System
  - Route
    - Alternate
    - Number
  - Sequence
    - Road
- Card Type C & D
  - Political Code
    - County
    - Township
    - Range
    - Section
  - Road Number
  - City Number
  - F.A.P.
    - Route Number
  - Fed Control Sec.
  - State Control
    - Section
    - Subsection
  - Rural/Municipal
  - F A Status
  - Function
  - I-Travel Way
  - Type Section
  - Control
    - • Length
    - Surface Width
  - Roadway Width
  - Curb
    - • Right Side
    - • Left Side
    - • Both Sides
  - Not Divided or Eastbound/Northbound Lane
    - • Length
    - Surface
      - Width
      - Type
    - • Length Frontage Road
  - Divided Westbound/Southbound Lane
    - • Length
    - Surface
      - Width
      - Type
    - • Length Frontage Road
  - ○ District Number
- Card Type E
  - Adjacent County Number
  - 1990 Urban Area
  - Access Control
  - U.A.T. Code
  - P.S.I.
  - Maintenance Unit
    - District
    - Residency
    - Garage Number
    - ○ Not Divided Eb/Nb Lane
    - ○ Divided Wb/Sb Lane
  - Maint Contract
  - Number Structures
  - Number of Farm Units

11-1-75 LRECL = 400 SECONDARY ROADS

Field	Group	Card Types
County Number		Card Types J-R
Highway System		Card Types L&M
County Route Number		Card Types L&M
(blank)	Sequence	Card Types L&M
County	Sequence	Card Types L&M
Township	Political Code	Card Types J-R
Range	Political Code	Card Types J-R
Section	Political Code	Card Types J-R
Road Number		Card Types J-R
City Number (RURAL-URBAN ONLY)		Card Types L&M
FAS Route (RURAL-RURAL ONLY) FAUS Route (RURAL-URBAN ONLY)	FAS/FAUS Route	Card Types L&M
FAS (RURAL-RURAL ONLY) FAUS (RURAL-URBAN ONLY)	FAS/FAUS Route – Sequence	Card Types L&M
Rural/Municipal		Card Types L&M
F.A. Status		Card Types L&M
Function		Card Types L&M
R, L or M		Card Types L&M
Type Section		Card Types L&M
• Length	Control	Card Types L&M
Surface Width	Control	Card Types L&M
Roadway Width		Card Types L&M
• Right Side	Curb	Card Types L&M
• Left Side	Curb	Card Types L&M
• Both Sides	Curb	Card Types L&M
• Length	Not Divided or Eastbound/Northbound Lane	Card Types L&M
Width	Not Divided or Eastbound/Northbound Lane – Surface	Card Types L&M
Type	Not Divided or Eastbound/Northbound Lane – Surface	Card Types L&M
• Length Frontage Road	Not Divided or Eastbound/Northbound Lane	Card Types L&M
• Length	Divided Westbound/Southbound Lane	Card Types L&M
Width	Divided Westbound/Southbound Lane – Surface	Card Types L&M
Type	Divided Westbound/Southbound Lane – Surface	Card Types L&M
• Length Frontage Road	Divided Westbound/Southbound Lane	Card Types L&M
C District Number		
Adjacent County Number		Card Type N
1990 Urban Area		Card Type N
Access Control		Card Type N
U.A.T. Code		Card Type N
(blank)		Card Type N
Number Structures		Card Type N
Number of Farm Units		Card Type N

Field	Group	Card Type
Year Round Dwellings	Culture	Card Type N
Seasonal Dwellings	Culture	Card Type N
Businesses	Culture	Card Type N
Industries	Culture	Card Type N
Schools	Culture	Card Type N
Churches	Culture	Card Type N
Institutions	Culture	Card Type N
Recreation Area	Culture	Card Type N
Junk Yards	Culture	Card Type N
Highway System	Duplicate Routes – First	Card Type N
Alternate	Duplicate Routes – First – Route	Card Type N
Number	Duplicate Routes – First – Route	Card Type N
Major	Duplicate Routes – First – Sequence	Card Type N
Minor	Duplicate Routes – First – Sequence	Card Type N
County	Duplicate Routes – First – Sequence	Card Type N
Highway System	Duplicate Routes – Second	Card Type N
Alternate	Duplicate Routes – Second – Route	Card Type N
Number	Duplicate Routes – Second – Route	Card Type N
Major	Duplicate Routes – Second – Sequence	Card Type N
Minor	Duplicate Routes – Second – Sequence	Card Type N
County	Duplicate Routes – Second – Sequence	Card Type N
First Number	Railroad Crossings	Card Type N
Second Number	Railroad Crossings	Card Type N
Third Number	Railroad Crossings	Card Type N
Year Counted	Traffic	Card Type O
A D T	Traffic	Card Type O
Trucks	Traffic	Card Type O
• 1 Year Expansion Factor	Traffic	Card Type O
Dup. Mileage	FHWA Mileage	Card Type O
Domain	FHWA Mileage	Card Type O
Toll	FHWA Mileage	Card Type O
Special Systems	FHWA Mileage	Card Type O
Census	FHWA Mileage	Card Type O

Field	Group	Card Type
Route Number	FHWA Needs I.D.	Card Type O
Section	FHWA Needs I.D.	Card Type O
Subsection	FHWA Needs I.D.	Card Type O
TOPICS Class		Card Type O
Present	Functional Classification – Iowa	Card Type O
Future	Functional Classification – Iowa	Card Type O
FHWA	Functional Classification	Card Type O
Needs Route Number	Iowa Needs I.D.	Card Type P
Needs Sequence	Iowa Needs I.D.	Card Type P
Needs Section Number	Iowa Needs I.D.	Card Type P
Typical Section		Card Type P
Inventory Year	Needs Inventory	Card Type P
Special Study	Needs Inventory	Card Type P
Cost Area	Needs Inventory	Card Type P
Terrain	Needs Inventory	Card Type P
Type Area	Needs Inventory	Card Type P
Type	Needs Inventory – Median	Card Type P
Width	Needs Inventory – Median	Card Type P
Cost Group	Needs Inventory – R.O.W.	Card Type P
Available Width	Needs Inventory – R.O.W.	Card Type P
Type	Shoulder/Curb – Outside	Card Type P
Width	Shoulder/Curb – Outside	Card Type P
Type	Shoulder/Curb – Inside	Card Type P
Width	Shoulder/Curb – Inside	Card Type P
5.0-5.9 %	Needs Not Divided or Eastbound / Northbound Lane – Grades	Card Type P
6.0-6.9 %	Needs Not Divided or Eastbound / Northbound Lane – Grades	Card Type P
7.0-7.9 %	Needs Not Divided or Eastbound / Northbound Lane – Grades	Card Type P
8.0-9.9 %	Needs Not Divided or Eastbound / Northbound Lane – Grades	Card Type P
10 % & Over	Needs Not Divided or Eastbound / Northbound Lane – Grades	Card Type P
• Length	Needs Not Divided or Eastbound / Northbound Lane – Grades	Card Type P
0-29 MPH	Needs Not Divided or Eastbound / Northbound Lane – Curves	Card Type P
30-39 MPH	Needs Not Divided or Eastbound / Northbound Lane – Curves	Card Type P
40-49 MPH	Needs Not Divided or Eastbound / Northbound Lane – Curves	Card Type P
50-55 MPH	Needs Not Divided or Eastbound / Northbound Lane – Curves	Card Type P
Classification	Needs Not Divided or Eastbound / Northbound Lane	Card Type P
Type of RR Xing	Needs Not Divided or Eastbound / Northbound Lane	Card Type P
• Length of Passing	Needs Not Divided or Eastbound / Northbound Lane – Restrictions	Card Type P
Number	Needs Not Divided or Eastbound / Northbound Lane – Restrictions – Stopping	Card Type P
• Length	Needs Not Divided or Eastbound / Northbound Lane – Restrictions – Stopping	Card Type P
Safety Study	Needs Not Divided or Eastbound / Northbound Lane	Card Type P
Parking	Needs Not Divided or Eastbound / Northbound Lane	Card Type P
Drainage	Needs Not Divided or Eastbound / Northbound Lane	Card Type P
Turn Lanes	Needs Not Divided or Eastbound / Northbound Lane	Card Type P
% Turns	Needs Not Divided or Eastbound / Northbound Lane	Card Type P
Traffic Flow	Needs Not Divided or Eastbound / Northbound Lane	Card Type P
Through Width	Needs Not Divided or Eastbound / Northbound Lane	Card Type P
Surface Type	Needs Not Divided or Eastbound / Northbound Lane	Card Type P
Foundation	Needs Not Divided or Eastbound / Northbound Lane – Condition	Card Type P
Surface	Needs Not Divided or Eastbound / Northbound Lane – Condition	Card Type P
Drainage	Needs Not Divided or Eastbound / Northbound Lane – Condition	Card Type P
Shoulder/Curb	Needs Not Divided or Eastbound / Northbound Lane – Condition	Card Type P
Type	Needs Westbound / Southbound Lane – Shoulder/Curb – Outside	Card Type Q
Width	Needs Westbound / Southbound Lane – Shoulder/Curb – Outside	Card Type Q
Type	Needs Westbound / Southbound Lane – Shoulder/Curb – Inside	Card Type Q
Width	Needs Westbound / Southbound Lane – Shoulder/Curb – Inside	Card Type Q
5.0-5.9 %	Needs Westbound / Southbound Lane – Grades	Card Type Q
6.0-6.9 %	Needs Westbound / Southbound Lane – Grades	Card Type Q
7.0-7.9 %	Needs Westbound / Southbound Lane – Grades	Card Type Q
8.0-9.9 %	Needs Westbound / Southbound Lane – Grades	Card Type Q
10 % & Over	Needs Westbound / Southbound Lane – Grades	Card Type Q
• Length	Needs Westbound / Southbound Lane – Grades	Card Type Q
0-29 MPH Curves	Needs Westbound / Southbound Lane	Card Type Q
30-39 MPH Curves	Needs Westbound / Southbound Lane	Card Type Q

Field	Group	Card Type
40-49 MPH Curves	Needs Westbound/Southbound Lane	Card Type Q
50-55 MPH Curves	Needs Westbound/Southbound Lane	Card Type Q
Type of RR Xing	Needs Westbound/Southbound Lane	Card Type Q
• Length of Passing	Needs Westbound/Southbound Lane – Restrictions	Card Type Q
Number	Needs Westbound/Southbound Lane – Restrictions – Stopping	Card Type Q
• Length	Needs Westbound/Southbound Lane – Restrictions – Stopping	Card Type Q
Safety Study	Needs Westbound/Southbound Lane	Card Type Q
Parking	Needs Westbound/Southbound Lane	Card Type Q
Drainage	Needs Westbound/Southbound Lane	Card Type Q
Turn Lanes	Needs Westbound/Southbound Lane	Card Type Q
% Turns	Needs Westbound/Southbound Lane	Card Type Q
Traffic Flow	Needs Westbound/Southbound Lane	Card Type Q
Through Width	Needs Westbound/Southbound Lane	Card Type Q
Surface Type	Needs Westbound/Southbound Lane	Card Type Q
Foundation	Needs Westbound/Southbound Lane – Condition	Card Type Q
Surface	Needs Westbound/Southbound Lane – Condition	Card Type Q
Drainage	Needs Westbound/Southbound Lane – Condition	Card Type Q
Shoulder/Curb	Needs Westbound/Southbound Lane – Condition	Card Type Q
Available area		Card Type R

Position 80 is program generated; no coding required. Positions 303, 328-350 and 355-400 are available for use

11-1-75 LRECL = 400

MUNICIPAL STREETS

Card Types	Group	Subgroup	Field	Record Position	Card Position
U&V			County Number	1	14
U&V			Highway System		17
U-Z			Street Number	5	5
U-Z			Street Sequence	10	10, 12
U & V					18
U & V	Political Code		Township	15	20
U & V	Political Code		Range		
U & V	Political Code		Section	20	25
U & V					28
U - Z			City Number	25	1, 4
U & V	FAUS./F.A.S. Route		Route	30	29, 30
U & V	FAUS./F.A.S. Route	Sequence		35	35
U & V			Rural/Municipal		
U & V			F. A. Status		
U & V			Function		40
U & V				40	
U & V			Type Section		
U & V	Control		Length •		
U & V	Control		Surface Width	45	45
U & V			Roadway Width		50
U & V	Curb		Right Side •	50	
U & V	Curb		Left Side •		
U & V	Curb		Both Sides •	55	55
U & V	Not Divided or Eastbound/Northbound Lane		Length •		
U & V	Not Divided or Eastbound/Northbound Lane	Surface	Width	60	60
U & V	Not Divided or Eastbound/Northbound Lane	Surface	Type		65
U & V	Not Divided or Eastbound/Northbound Lane		Length Frontage Road •	65	
U & V	Divided Westbound/Southbound Lane		Length •	70	70
U & V	Divided Westbound/Southbound Lane	Surface	Width		
U & V	Divided Westbound/Southbound Lane	Surface	Type	75	75
U & V	Divided Westbound/Southbound Lane		Length Frontage Road •		80
			C District Number	80	
W			Adjacent County Number		14, 15
W			1990 Urban Area		
W			Access Control		
W			U.A.T. Code	85	
W				90	20, 25
				95	
W			Number Structures	100	26, 29

Card Type	Group	Field	Record Position	Card Position
W			101, 105, 110	30, 35, 40
W		Street Name	115, 120, 125, 130, 135	45, 50, 55, 60, 65
W	Railroad Crossings	First Number	140	70
W	Railroad Crossings	Second Number	145	75
W	Railroad Crossings	Third Number	150	80
X	Traffic	Year Counted		14, 15
X	Traffic	A. D. T.	155	20
X	Traffic	Trucks	160	
X	Traffic	1 Year Expansion Factor •	165	25
X		Traffic Estimation Code		
X	FHWA Mileage	Dup. Mileage		30
X	FHWA Mileage	Domain	170	
X	FHWA Mileage	Toll		
X	FHWA Mileage	Special Systems		35
X	FHWA Mileage	Census		
X			175	
X			180, 185, 190, 195, 200	40, 45, 50, 55, 60, 62

Card Type	Group	Subgroup	Field	Record Position	Card Position
X	FHWA Needs I.D.		Route Number	201	63, 65
X	FHWA Needs I.D.		Section	205	
X	FHWA Needs I.D.		Subsection		70
X			TOPICS Class	210	
X	Functional Classification	Iowa	Present		
X	Functional Classification	Iowa	Future		75
X	Functional Classification		FHWA	215	79
Y				220	14, 15
Y	Iowa Needs I.D.		Needs Section Number	225	20
Y	Iowa Needs I.D.		Typical Section		
Y	Needs Inventory		Inventory Year		25
Y	Needs Inventory		Special Study	230	
Y	Needs Inventory		Cost Area		
Y	Needs Inventory				
Y	Needs Inventory		Type Area		30
Y	Needs Inventory	Median	Type	235	
Y	Needs Inventory	Median	Width		
Y	Needs Inventory	R.O.W.	Cost Group		
Y	Needs Inventory	R.O.W.	Available Width	240	35
Y	Needs Not Divided or Eastbound / Northbound Lane	Shoulder/Curb Outside	Type		
Y	Needs Not Divided or Eastbound / Northbound Lane	Shoulder/Curb Outside	Width		40
Y	Needs Not Divided or Eastbound / Northbound Lane	Shoulder/Curb Inside	Type	245	
Y	Needs Not Divided or Eastbound / Northbound Lane	Shoulder/Curb Inside	Width		
Y	Needs Not Divided or Eastbound / Northbound Lane	Grades	5.0-5.9 %		
Y	Needs Not Divided or Eastbound / Northbound Lane	Grades	6.0-6.9 %		45
Y	Needs Not Divided or Eastbound / Northbound Lane	Grades	7.0-7.9 %	250	
Y	Needs Not Divided or Eastbound / Northbound Lane	Grades	8.0-9.9 %		
Y	Needs Not Divided or Eastbound / Northbound Lane	Grades	10% & Over		
Y	Needs Not Divided or Eastbound / Northbound Lane	Grades	Length •	255	50
Y	Needs Not Divided or Eastbound / Northbound Lane	Curves	0-29 MPH		
Y	Needs Not Divided or Eastbound / Northbound Lane	Curves	30-39 MPH		
Y	Needs Not Divided or Eastbound / Northbound Lane	Curves	40-49 MPH		
Y	Needs Not Divided or Eastbound / Northbound Lane	Curves	50-55MPH		55
Y	Needs Not Divided or Eastbound / Northbound Lane			260	
Y	Needs Not Divided or Eastbound / Northbound Lane		Type of RR Xing		
Y	Needs Not Divided or Eastbound / Northbound Lane	Restrictions	Length of Passing •		60
Y	Needs Not Divided or Eastbound / Northbound Lane	Restrictions Stopping	Number	265	
Y	Needs Not Divided or Eastbound / Northbound Lane	Restrictions Stopping	Length •		65
Y	Needs Not Divided or Eastbound / Northbound Lane		Safety Study	270	
Y	Needs Not Divided or Eastbound / Northbound Lane		Parking		
Y	Needs Not Divided or Eastbound / Northbound Lane		Drainage		
Y	Needs Not Divided or Eastbound / Northbound Lane		Turn Lanes		
Y	Needs Not Divided or Eastbound / Northbound Lane		% Turns		70
Y	Needs Not Divided or Eastbound / Northbound Lane		Traffic Flow	275	
Y	Needs Not Divided or Eastbound / Northbound Lane		Through Width		
Y	Needs Not Divided or Eastbound / Northbound Lane		Surface Type		
Y	Needs Not Divided or Eastbound / Northbound Lane	Condition	Foundation	280	75
Y	Needs Not Divided or Eastbound / Northbound Lane	Condition	Surface		
Y	Needs Not Divided or Eastbound / Northbound Lane	Condition	Drainage		
Y	Needs Not Divided or Eastbound / Northbound Lane	Condition	Shoulder/Curb		80
Z	Needs Westbound / Southbound Lane	Shoulder/Curb Outside	Type	285	14
Z	Needs Westbound / Southbound Lane	Shoulder/Curb Outside	Width		15
Z	Needs Westbound / Southbound Lane	Shoulder/Curb Inside	Type		
Z	Needs Westbound / Southbound Lane	Shoulder/Curb Inside	Width	290	
Z	Needs Westbound / Southbound Lane	Grades	5.0-5.9 %		20
Z	Needs Westbound / Southbound Lane	Grades	6.0-6.9 %		
Z	Needs Westbound / Southbound Lane	Grades	7.0-7.9 %		
Z	Needs Westbound / Southbound Lane	Grades	8.0-9.9 %		
Z	Needs Westbound / Southbound Lane	Grades	10% & Over	295	
Z	Needs Westbound / Southbound Lane	Grades	Length •		25
Z	Needs Westbound / Southbound Lane		0-29 MPH Curves		
Z	Needs Westbound / Southbound Lane		30-39 MPH Curves	300	29

Card Type	Group	Subgroup	Field	Record Position	Card Position
Z	Needs Westbound/Southbound Lane		40-49 MPH Curves	301	30
Z	Needs Westbound/Southbound Lane		50-55 MPH Curves		
Z	Needs Westbound/Southbound Lane				
Z	Needs Westbound/Southbound Lane		Type of RR X-ing		
Z	Needs Westbound/Southbound Lane	Restrictions	Length of Passing •	305	35
Z	Needs Westbound/Southbound Lane	Restrictions Stopping	Number		
Z	Needs Westbound/Southbound Lane	Restrictions Stopping	Length •	310	40
Z	Needs Westbound/Southbound Lane		Safety Study		
Z	Needs Westbound/Southbound Lane		Parking		
Z	Needs Westbound/Southbound Lane		Drainage	315	
Z	Needs Westbound/Southbound Lane		Turn Lanes		45
Z	Needs Westbound/Southbound Lane		% Turns		
Z	Needs Westbound/Southbound Lane		Traffic Flow		
Z	Needs Westbound/Southbound Lane		Through Width	320	
Z	Needs Westbound/Southbound Lane		Surface Type		50
Z	Needs Westbound/Southbound Lane	Condition	Foundation		
Z	Needs Westbound/Southbound Lane	Condition	Surface	325	
Z	Needs Westbound/Southbound Lane	Condition	Drainage		55
Z	Needs Westbound/Southbound Lane	Condition	Shoulder/Curb		
Z				330, 335, 340, 345, 350	60, 65, 70, 75, 80
			Available Area	355, 360, 365, 370, 375, 380, 385, 390, 395, 400	

Position 80 is program generated; no coding required. Positions 260, 303, 328-350, and 355-400 are available for use.

ROADWAY MILEAGE, TRAVEL AND ACCIDENT DATA FOR 1978

ROAD SYSTEM	MILEAGE		TRAVEL		ADT	1978 ACCIDENT TOTALS								1978 ACCIDENTS PER 100 MILES			
						FATAL		PERSONAL INJURY		PROPERTY DAMAGE		ALL					
	MILES	%	MVM	%	VPD	NO.	%	NO.	%	NO.	%	NO.	%	F	PI	PD	ALL
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
PRIMARY																	
Federal-Aid (a)	10,153	9.1	11,698	60.1	3,158	298	52.9	9,100	42.0	25,261	36.6	34,659	38.0	2.9	90	249	341
SECONDARY																	
Federal-Aid	12,626	11.3	1,937	9.9	420	103	18.3	2,520	11.6	4,767	6.9	7,390	8.1	0.8	20	38	59
Non-Federal Aid	76,936	68.9	1,515	7.8	54	80	14.2	1,423	6.6	2,840	4.1	4,343	4.8	0.1	2	4	6
Totals	89,562	80.2	3,452	17.7	105	183	32.5	3,943	18.2	7,607	11.0	11,733	12.9	0.2	4	8	13
MUNICIPAL STREET																	
Federal-Aid	2,502	2.2	2,681	13.8	2,936	58	10.3	6,646	30.7	26,567	38.5	33,271	36.5	2.3	266	1062	1330
Non-Federal Aid	9,505	8.5	1,636	8.4	472	24	4.3	1,962	9.1	9,564	13.9	11,550	12.6	0.3	21	101	122
Totals	12,007	10.7	4,317	22.2	985	82	14.6	8,608	39.8	36,131	52.4	44,821	49.1	0.7	72	301	373
STATE TOTALS																	
Federal-Aid (a)	25,281	22.6	16,316	83.8	1,768	459	81.5	18,266	84.4	56,595	82.0	75,320	82.6	1.8	72	224	298
Non-Federal-Aid	86,441	77.4	3,151	16.2	100	104	18.5	3,385	15.6	12,404	18.0	15,893	17.4	0.1	4	14	18
Totals (b)	111,722	100.0	19,467	100.0	477	563	100.0	21,651	100.0	68,999	100.0	91,213	100.0	0.5	19	62	82

(a) Includes 106 of Non-Federal-Aid Mileage.
(b) Excludes Non-Mainline Ramps and Connections and State Parks and Institutional Roads.

APPENDIX "C"

INTERFACE BASE DATA

ROAD SYSTEM	MILEAGE		ROADWAY INVENTORY RECORDS	ESTIMATED ALAS NODES	ESTIMATED COMPATIBILITY RECORDS	TIME RATIO	ADJUSTED COMPATIBILITY RECORDS			1978 FATAL/INJURY ACCIDENTS	RECORDS/ACCIDENTS
	MILES	%	NUMBER	NUMBER	NUMBER		NUMBER	%	PER 100 MILES	PER 100 MILES	(9)/(10)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
PRIMARY											
Federal-Aid (a)	10,153	9.1	30,000	32,000	35,000	1	35,000	4.5	344.9	92.6	3.7
SECONDARY											
Federal-Aid	12,626	11.3	22,000	12,000	19,000	1	19,000	2.4	150.5	20.8	7.2
Non-Federal Aid	76,936	68.9	129,000	68,000	111,000	2	222,000	28.6	288.6	1.9	151.9
Totals	89,562	80.2	151,000	80,000	130,000	-	241,000	31.0	269.1	4.6	58.5
MUNICIPAL STREET											
Federal-Aid	2,502	2.2	17,000	15,000	30,000	2	60,000	7.7	2398.1	268.0	8.9
Non-Federal Aid	9,505	8.5	64,000	55,000	110,000	4	440,000	56.7	4629.6	20.9	221.5
Totals	12,007	10.7	81,000	70,000	140,000	-	500,000	64.4	4164.6	72.4	57.5
STATE TOTALS											
Federal-Aid (a)	25,281	22.6	69,000	59,000	84,000	-	114,000	14.7	451.0	74.1	6.1
Non-Federal Aid	86,441	77.4	193,000	123,000	221,000	-	662,000	85.3	765.9	4.0	191.5
Totals (b)	111,722	100.0	262,000	182,000	305,000	-	776,000	100.0	694.6	19.9	34.9

(a) Includes 106 miles of Non-Federal-Aid Mileage
(b) Excludes non-mainline ramps and connections and State Parks and Institutional Roads.

NOTE: Column (5) is multiplied by the Time Ratio in Column (6) to obtain the number of Adjusted Compatibility Records in Column (7). The Time Ratio takes into account the necessary route sequencing of Base Record sections and/or necessary scaling to obtain mile-references at node locations that do not have a corresponding Base Record break.

APPENDIX "D"