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16. Abstract

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This report describes the results of a pilot project aimed at developing a prototype computer-based indexing model for reports and engineering data in DOTD. The model is based on a procedure that links signalized intersections and road segments in a GIS environment. The database developed in this project covers data from East Baton Rouge Parish for the past 10 years. Five categories of engineering reports were created: engineering studies, traffic services work orders, inspection reports, Chief Engineers' Orders, and others.

A paper form was developed to facilitate the engineering data extraction process. This form will constitute the basis for a standard report cover form to be submitted with future traffic engineering studies to permit rapid indexing. A computerized version of the paper form and a computerized query form were also developed.

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A DATA STORAGE AND RETRIEVAL MODEL FOR LOUISIANA TRAFFIC OPERATIONS DATA

(Research Project 736-99-0100)

FINAL REPORT

By

DARCY BULLOCK
ASSISTANT PROFESSOR

CESAR A. QUIROGA
GRADUATE RESEARCH ASSISTANT

CIVIL AND ENVIRONMENTAL ENGINEERING DEPARTMENT
REMOTE SENSING AND IMAGE PROCESSING LABORATORY
LOUISIANA STATE UNIVERSITY
BATON ROUGE, LA 70803

CONDUCTED FOR

LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
LOUISIANA TRANSPORTATION RESEARCH CENTER

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ABSTRACT

The type and amount of data managed by the Louisiana Department of Transportation and Development are huge. In many cases, these data are used to perform traffic engineering studies and highway safety analyses, among others. At the present time, however, no shared indexing or archiving system is available for retrieving this data.

This report describes the results of a pilot project aimed at developing a prototype computer-based indexing model for reports and engineering data in DOTD. The model is based on a procedure that links signalized intersections and road segments in a GIS environment. The database developed in this project covers data from East Baton Rouge Parish for the past 10 years. Five categories of engineering reports were created: engineering studies, traffic services work orders, inspection reports, Chief Engineers' Orders, and others.

A paper form was developed to facilitate the engineering data extraction process. This form will constitute the basis for a standard report cover form to be submitted with future traffic engineering studies to permit rapid indexing. A computerized version of the paper form and a computerized query form were also developed.

IMPLEMENTATION STATEMENT

This project was structured taking into consideration programs currently under way by DOTD to modernize and enhance its traffic engineering hardware and software capabilities. In particular, it was desirable to develop a prototype database for reports and engineering data that could be accessed from PC and Intergraph workstations. Because multiple computing compatibility was critical, Intergraph's MGE PC-1 was chosen for this project.

Microsoft's ACCESS v.2 database system was used in this project for handling data entry and non-spatial queries. Two computerized forms, one for data entry and the other one for querying purposes were developed. Because a driver permitting ACCESS to directly link with ORACLE tables was not available in the market, a data conversion procedure between ORACLE and ACCESS was implemented. However, such a driver is scheduled to be released in the third quarter of 1995. This will permit inexpensive PC's to enter data directly into the ORACLE database system used by Intergraph workstations. Consequently, the implementation at DOTD of the prototype database developed here is not expected to require drastic variations.

This database was recently installed at the DOTD Traffic and Planning Division office. At this point, it is located on a stand-alone computer in Peter Allain's office. Once DOTD links this computer to the DOTD network, the database will move from being local to a client-server architecture with a dial up connection. The ultimate goal is to allow engineers from all districts to connect directly to the database. According to DOTD officials, the database will initially be used to track engineering report data in East Baton Rouge Parish, and then it will be extended to cover other parishes. To facilitate this process, the Engineering Report paper cover form will start to be used immediately (Appendix B).

The database structure and use of the data entry and data query forms were explained to DOTD officials at the Traffic and Planning Division office. Because the database structure is simple, its maintenance and population are not expected to become a major issue. In this regard, it is advantageous to be using a relatively simple to use package such as ACCESS because it allows any traffic engineer with a working knowledge of databases to design or modify customized user interfaces in a relatively short period of time. This also means that training is not expected to become a big effort.

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INTRODUCTION

The type and amount of data managed by the Louisiana Department of Transportation and Development is huge. Examples include geometric plans, sign inventories, traffic signal controller timings, maintenance records, traffic volumes, and so on. In many cases, these data are used to perform traffic engineering studies and highway safety analyses, among others. At the present time, however, no shared indexing or archiving system is available for retrieving these data.

For example, each year several hundred traffic engineering studies are performed in DOTD. For each study, a technical report describing the data collected, analyses performed, and recommendations is written. One or more copies of such reports are kept on file at the DOTD Traffic and Planning Division office depending on the number of locations included in the study. Currently, there are approximately 25, five-drawer filing cabinets full of reports. When a new traffic engineering study is requested for any given location, it is frequently necessary to retrieve the history of studies performed at nearby sites. Previous studies are also required to address issues such as accident rates, signal timings, signal installations, passing zones, and speed limits. Unfortunately, the lack of an on-line geographic computer indexing model makes this process labor intensive and difficult.

In addressing this indexing problem, it is necessary to study the requirements and procedures followed by various groups within DOTD. For example, the roadway design group typically references its plans by "Control Section-Log Mile." With this model, a unique identifier is assigned to all sections of roads maintained by the state. As shown in Figure 1a, items or segments within a particular section are located using longitudinal distances (measured approximately along the center line) from a predefined reference point. By contrast, the traffic services group identifies the location of its traffic signal equipment by numerical codes corresponding to parish, town, and intersecting roads (Figure 1b).

Of particular interest is the development of a geographic computer indexing model (and associated procedures) that could be distributed to district traffic engineers on a floppy disk, CD-ROM, or direct network connections. This geographic database would permit engineers to identify and request engineering reports at or adjacent to a proposed study location. In addition to organizational reasons, developing such an indexing model is quickly becoming an urgent need in Louisiana because of increasing regulations and liability considerations. Developing a capability for retrieving historical data and reports efficiently could provide DOTD with a tool for generating management reports and statistics.

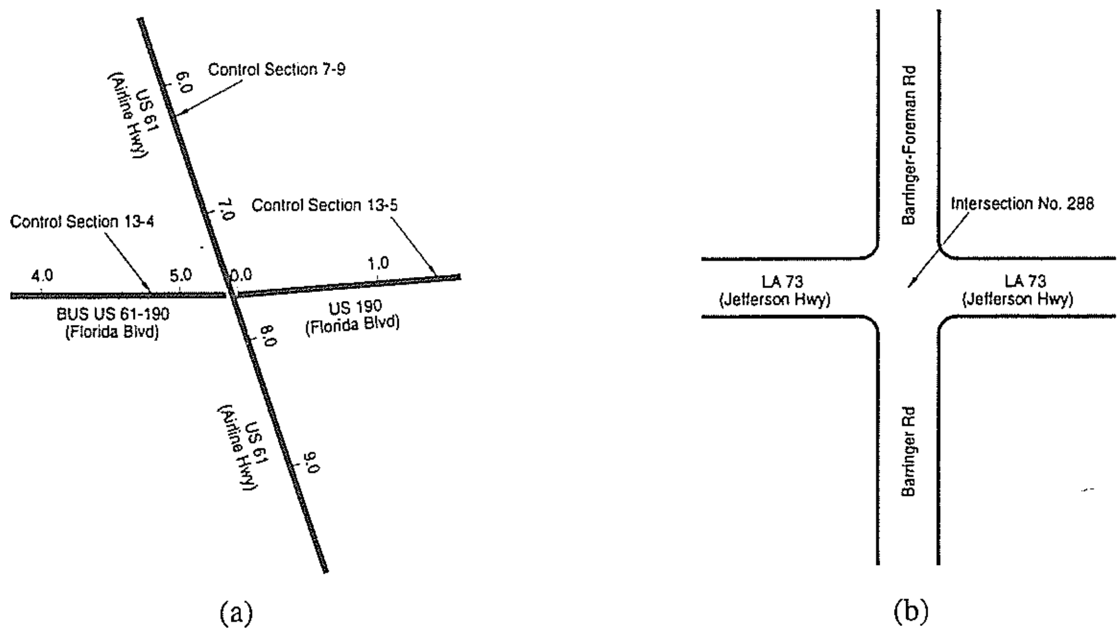


Figure 1: Geographic referencing models used by DOTD: (a) by control-section; (b) by intersecting roads.

OBJECTIVES

The overall goal of this research study is to develop a prototype computer-based indexing model for reports and engineering data in DOTD. Data from East Baton Rouge Parish are used as a case study. Specific objectives are summarized as follows:

- Development of a geographic referencing model to make traffic engineering data compatible with Intergraph's MGE, which is the GIS currently used by DOTD.
- Construction of a PC-based index of traffic engineering studies performed in East Baton Rouge Parish over the past 10 years. This prototype database is to be constructed using the highway network previously developed for the Statewide Intermodal Transportation Planning Project (Ref. 1).
- Compilation of technical information needed to describe all tables and attributes in this prototype database.
- Development of a prototype cover form which will constitute the basis for a standard report cover form to be submitted with future traffic engineering studies to permit rapid indexing.
- Construction of a PC-based model for storing signal inventory and timing data compatible with the index of traffic engineering studies. Originally, this objective included extraction and integration of all existing mainframe signal timing data. However, it was discovered that the structure of the mainframe database did not allow a suitable integration with the PC-based relational database model. Since revision of the existing signal timing database schema would require several months of effort, it was decided to focus the work on developing a basic model, compatible with the traffic engineering index, upon which the complete signal timing database could be constructed later.

SCOPE

The primary objective of this study is to provide a PC-based index of traffic engineering studies that can easily be distributed to district traffic engineers on a floppy disk, CD ROM, or direct network connections. This database would permit engineers to identify and request existing engineering reports adjacent to or at a proposed study location. This model is intended to provide the foundation for integrating traffic engineering data such as historical volumes, geometry, signal timing data and speed zones for all state roads directly into a comprehensive GIS.

This project study uses data from East Baton Rouge Parish. Given the nature of the project and the massive amounts of data that characterize most traffic-related processes, it was decided to limit the scope of the study to the development of a prototype database using East Baton Rouge data as a case study. Experiences from the development and use of this model could then be extrapolated to the entire state of Louisiana.

METHODOLOGY

In order to achieve the objectives described above, the following tasks were completed:

- Extraction of the state road network from the statewide intermodal planning database.
- Assessment and definition of the geographic referencing model required to index traffic engineering studies and associated data.
- Development of the engineering report relational database schema.
- Development of prototype paper cover form and computerized data entry and query forms.
- Extraction of data from paper traffic engineering studies and database population.
- Development of basic model for the traffic signal inventory and timing relational database schema.

EXTRACTION OF STATE ROAD NETWORK

The network of state-maintained roads was retrieved from the geographic database developed for the Statewide Intermodal Transportation Planning Project (Ref. 1) and then stored in an Intergraph MGE PC-1 database. Two reasons were considered for selecting an Intergraph PC environment. First, DOTD uses Intergraph hardware and software for their mapping needs and, consequently, using an Intergraph environment was highly desirable to achieve maximum compatibility with DOTD files. Second, district engineers have more ready access to PCs and, therefore, using a PC environment for the project was given a high priority.

Two maps were retrieved from the intermodal planning database: the parish map (**laparish.dgn**) and the highway network map (**hwynet.dgn**). The parish map contains the boundaries of all parishes in Louisiana, as well as parish codes and parish names. The parish code graphical feature was linked to an attribute table called PAR_DATA. As shown in Table 1, each record in this table stores the association between parish code, parish name, and district code. All records are included in Table A1 in Appendix A. When the parish map with the parish codes is shown on the screen (Figure 2), attribute data at the parish level can be retrieved. In the future, more attributes such as area, population, and so on, could be added to table PAR_DATA.

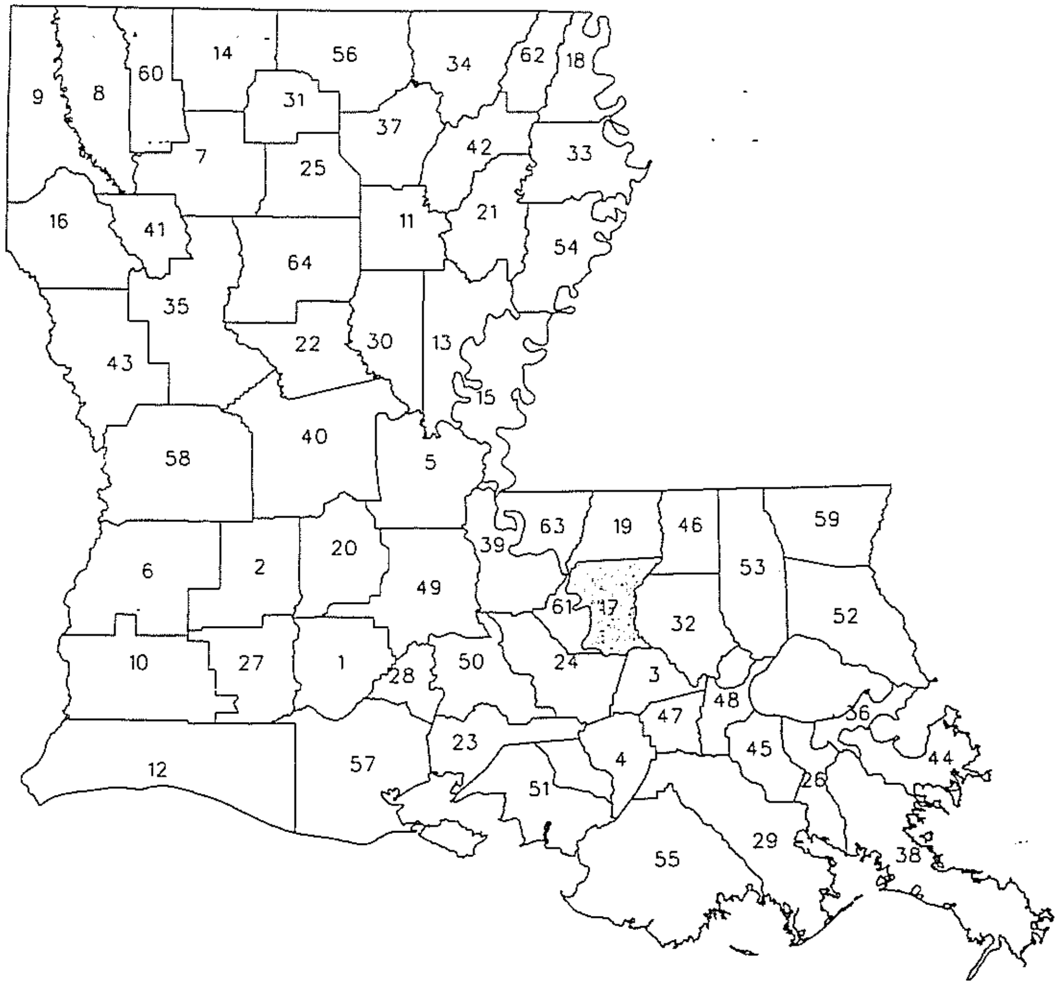


Figure 2: Parish codes in Louisiana. Parish code for East Baton Rouge Parish is 17.

The highway network map contains state maintained road alignments only. All roads, regardless of the number of lanes, are represented graphically by single strings (strings are defined as sets of connected straight lines). As a result, even though **hwynet.dgn** was digitized using 1:24,000 hardcopy USGS maps, the location of all roads and intersections must be considered approximate.

All strings are linked to an attribute table called CSECT_TBL. As shown in Table 1, each record in this table contains the following data: control section code, parish code, length, and linkage to the graphical feature. Two values of length are given: one derived from the Control Section Manual and the other one measured directly from the graphical features. Table A2 in

Appendix A shows the results of the query done on this table, using PARCODE = 17 (i.e., EBR Parish).

Table 1: Description of fundamental tables (Database Schema).

Table	Attribute	Key	Description
PAR_DATA	PARCODE	X	Parish code
	PARNAME		Parish name
	DISTRICT		District code
	MSLINK		Linkage between graphical feature and attribute table: created by MGE
	MAPID		Map identification number: created automatically by MGE
CSECT_TBL	CSECCODE	X	Control section code
	PARCODE		Parish code
	MGEMAPMI		Length of control section, measured graphically with GIS
	CSECLOGMI		Length of control section, according to DOTD Control Section Manual
	MSLINK		Linkage between graphical feature and attribute table: created by MGE
	MAPID		Map identification number: created automatically by MGE
INT_MILEPOST	TSICODE	X	Intersection code
	PARCODE		Parish code
	CSECCODE		Control section code
	MGEMAPMI		Length in miles, along string, used to locate intersection in the map
	MILEPOST		Milepost location of signalized intersection
	CITYNAME		City in which the intersection is located
	MSLINK		Linkage between graphical feature and attribute table: created by MGE
	MAPID		Map identification number: created automatically by MGE
INT_ROADS	TSICODE	X	Intersection code
	PARCODE	X	Parish code
	APPCODE	X	Approaching road unique identifier (1, 2, 3, 4, etc); maximum value depends on the number of approaches to the intersection
	ROADTYPE		Road category (LA, US, I-, or Null)
	ROADCODE		Code associated with road (19, for LA 19; 190 for US 190; 110 for I-110; or Null for a road not maintained by the State)
	ROADLOCNAME		Road local name (Main, Florida Blvd, Highland Rd)

DEVELOPMENT OF GEOGRAPHIC REFERENCING MODEL

Once information on the network of state maintained roads was retrieved, a procedure for locating and linking all signalized intersections to the network was developed. This process was essential for the development of a geographic referencing model that could allow the linkage of both linear and local features in the GIS to attribute tables in the database. As described in this section, such a geographic referencing model is represented by only two tables: one for basic control section data (CSECT_TBL), and the other one for basic signalized intersection data (INT_MILEPOST). This structure makes the addition of modules or groups of tables a straightforward process. Examples of appropriate groups may include engineering report summaries, signalized intersection geometry, signal timing data, traffic volumes, accident data, and so on, as shown in later sections.

For the connection between signalized intersection data and the road network, several factors were taken into consideration:

- No records of geographic coordinates of signalized intersections were available.
- Even if any record had existed, the likelihood of obtaining map registration between roads and intersections would have been slim. An alternative procedure, which was attempted, involved digitizing intersections using hard copy maps. In all cases, however, distances from signal nodes to road alignments were significant. Reasons for this include the fact that the road network and the signalized intersections were digitized independently of each other, using different hard copy maps, and the fact that the road network was just an approximation of the real network. A corollary to this is that signalized intersection locations are practically impossible to reproduce, unless the same digitizing conditions can be guaranteed. An additional disadvantage of this procedure, from a practical point of view, is the need to use a digitizer every time a new signalized intersection is being entered into the database.
- Signalized intersections involving two or more state roads could be located directly in the map because the alignment corresponding to such roads had already been digitized. As the location of road alignments was approximate, however, the location of the corresponding intersections would also have been approximate.
- Signalized intersections involving one state road and one or more city streets could not be located directly in the map. However, in most cases, there were records of milepost location of streets intersecting state roads. These milepost distances allowed the definition of the corresponding intersections by measuring distances along road alignments. As before, the location of all resulting intersections would have been approximate.

It became evident that using geographic coordinates such as latitude and longitude for georeferencing signalized intersections was not feasible. As a result, it was decided to develop the referencing model using the state road network directly, i.e., by measuring distances along road alignments according to milepost location to define signalized intersections involving only one state road and directly defining nodes at intersections involving more than one state road. This approach was conceptually simple. However, its implementation involved a solution to the following problems. First, distances measured along graphical features in the GIS rarely coincided with those derived from the DOTD Control Section Manual, as can be seen by comparing columns MGEMAPMI and CSECLOGMI in Table A2. In most cases, there was a close agreement between the two values (for example, 6.203 vs. 6.20 mi. for Control Section 258-31). In several cases, however, a significant difference was encountered (for example, 8.843 vs. 8.89 mi. for Control Section 450-92). Second, milepost locations frequently involved more than one control section, and third, the milepost listing did not contain the milepost location associated with the end points of some control sections.

The general procedure followed to locate signalized intersections is summarized below:

1. Create linkage graphical feature-attribute data.
2. Create table of intersecting road names.
3. Create map and locate signalized intersections involving two or more state roads.
4. Locate signalized intersections involving one state road.
5. Locate signalized intersections containing two or more traffic signals.
6. Locate signalized intersections on road segments not included in the road network map.
7. Locate decommissioned signalized intersections.
8. Plot signalized intersection map.

A brief description of each step follows.

1. Create linkage graphical feature-attribute data.

An attribute table called INT_MILEPOST was created to link graphical features with the signalized intersection control section and milepost data. A description of the attributes associated with this table is given in Table 1. A sample of records from this table is shown in Table A3 in Appendix A.

2. Create table of intersecting road names.

An attribute table called INT_ROADS was created to store the names of all roads associated with each intersection. A description of the attributes associated with this table is given in Table 1. Table A4 in Appendix A contains the road names for a sample of signalized intersections in EBR Parish. The basis for this table was the card file existing at the DOTD Traffic and Planning office at the Baton Rouge Airport. As described later, table INT_ROADS actually belongs to the traffic signal inventory and timing group of tables and, therefore, a more detailed description of this table is provided in the traffic signal inventory timing relational database schema section.

3. Create design file and locate signalized intersections involving two or more state roads.

A new design file called **intersec.dgn** in which all signalized intersections would be stored was created. The road network map was displayed in the background as a reference. For each signalized intersection involving two or more state roads, a node was defined directly in the signalized intersection map, exactly at the intersection point. Attribution was done following criteria customarily used by DOTD. If both roads were LA roads, the signalized intersection was assigned to the road with the lowest number. If one of the intersecting roads was a US road and the other one was a LA road, the intersection was assigned to the US road. In general, US roads had priority over LA roads, and I- roads had priority over US roads. For example, intersection 14, between LA 19 and LA 423, was assigned to LA 19 (Table A4). The corresponding value for the CSECCODE field in Table A3 was 250-1 (Table A2), which was obtained by querying directly in the map the control section associated with LA 19 at that intersection 14. The value for the MILEPOST field in Table A3 was read from the milepost listing as 2.49.

It may be pointed out that the MGEMAPMI field in Table A3, which contains the lengths used to locate intersections in the map, is irrelevant for intersections involving two or more state roads. In these cases, the MGEMAPMI field was left blank.

4. Locate signalized intersections involving one state road.

All remaining intersections were located in the signalized intersection map as follows. First, the ratio between MGEMAPMI and CSECLOGMI in Table A2 was computed. Then, if the milepost of the beginning of the control section was known, the ratio computed above was multiplied by the difference between the milepost associated with all intersections located along the same control section and the milepost associated with the beginning of the control section. These distances were used to generate the intersections in the map. For checking purposes, these distances were also entered in the MGEMAPMI field of Table A3. For example, for intersection 243, between LA 327SPUR (control section 257-3) and GSRI Avenue, MGEMAPMI was 4.345928, and CSECLOGMI was 4.38 (Table A2). The corresponding ratio between MGEMAPMI and CSECLOGMI was 0.992221. The milepost location of the intersection was 0.89. According to the milepost listing, the milepost location of the origin of control section 257-3 at Highland Road was 0.01. Therefore, the intersection was located in the map at a distance of (0.89-0.01)*0.992221 = 0.873154 mi. from the beginning of the control section at Highland Road. The values for the MGEMAPMI and MILEPOST fields in Table A3 were, respectively, 0.873154 and 0.89.

If the milepost at the beginning of the control section was not known, an attempt was made to define distances from intersections involving two state roads. A problem with this approach was that, since the location of these intersections is approximate, the ratio between MGEMAPMI and CSECLOGMI for the entire control section often did not coincide with the ratio between partial distances using known intersections and the difference in milepost location. In these cases, an analysis was made to determine which intersection offered the closest agreement between the two ratios, and distances were measured from that point. In some cases, the distance between the intersection chosen and the beginning of the control section was measured, and then all distances to intermediate intersections were measured from there.

Occasionally, there were discrepancies regarding the milepost associated with the beginning of the control section. For example, the milepost location for control section 254-2 (LA 37 - Greenwell Springs Road) at Joor Road is, according to the milepost listing, 4.47 mi. However, the milepost location of other intersections along the same control section were more in agreement with 4.61 mi., which is the length of control section 254-1 at the intersection of LA 37 with Joor Road. In this case, 4.47 mi. was ignored in favor of 4.61 mi.

In some cases, the milepost location of the signalized intersection was not given in the milepost listing. If the intersection was located in a city street map, the distance between that intersection and one or more control points that had a known milepost location was measured. This distance was then used to locate the intersection in the map. In cases in which the intersection was not located in a city street map (namely, entrances to shopping centers and hospitals), a verification in the field was conducted, and an assessment of the approximate location of the intersection was made.

5. Locate signalized intersections containing two or more traffic signals.

In general, each signalized intersection was represented in the map by a single point. Each point was assigned the same TSI code as the one contained in DOTD records. While this solution is adequate for intersections in which all approaching and exiting roads converge, it clearly overlooks cases in which more than one traffic signal is associated with the same intersection. In the case of diamond interchanges, for example, two TSI codes are often associated with the same intersection. For cases like these, two points were located on the signalized intersection map: the first one, exactly at the intersection point and the second one, at a very close distance from the first one (about 50 m) off the main route. The option of assigning a single point to the entire diamond interchange was found out to be unfeasible because engineering reports frequently refer to only one of the signals.

6. Locate signalized intersections on road segments not included in the road network map.

Some signalized intersections are located on road segments that have not been digitized by the DOTD cartographic group. Table 2 includes a summary of such road segments and the affected signalized intersections. Because consistency is essential in any cartographic job, it was decided not to digitize such road segments, leaving the task to the DOTD cartographic group. However, in order to enforce referential integrity constraints in the database, records associated with the affected signalized intersections had to exist. As a result, it was decided to locate such intersections in the map on an approximate basis, by reading distances on a paper city street map.

Table 2: Signalized intersections located on roads not included in the highway network map.

Route	Signalized intersections affected	CSECCODE in table INT_MILEPOST
I-10 (Service Rd - Braddock St)	181	450-10 (same as I-10)
I-110 (Service Rd - 9th St)	113, 121, 133, 134, 144, 151	450-92 (same as I-110)
I-110 (Service Rd -10th St)	122, 135, 137, 143, 149, 150	450-92 (same as I-110)
LA 3035 (Sullivan Rd)	276	To be defined by DOTD after digitizing LA 3035

7. Locate decommissioned signalized intersections.

Most TSI codes in East Baton Rouge Parish correspond to active signals. In some cases, however, signals have been decommissioned either because the signals themselves have been removed, or because transfer has been made to the city. Because DOTD has the policy of purging its files every few years, it was considered that locating all decommissioned signalized intersections would be unproductive. Consequently, since this project covers the history of engineering reports for the past 10 years, it was decided to locate only those decommissioned signalized intersections that were referred to in the report history. This way, referential integrity constraints in the database could be maintained.

Originally, it was thought to distinguish such intersections in the map with a different color. However, there was lack of consistency in the records regarding signals that had been recommended in engineering studies for removal and the corresponding follow-up in inspection reports. As a result, it was decided to keep all signalized intersections, active and inactive, with the same convention, leaving the task of clarifying the issue to DOTD.

8. Plot signalized intersection map.

Figure 3 shows the location of all signalized intersections that have been located in the map. It may be pointed out that, for plotting purposes, it was necessary to convert all points to circles. It must be remembered that Intergraph treats points as zero length lines, i.e., with equal beginning and ending coordinates, which means that attempting to plot points directly produces a blank graph. The conversion was accomplished by extracting the graphical information associated with each point into an ASCII file and removing all data in this file except for the first pair of coordinates associated with each point. The extraction was done using EDG, which is an application program outside Microstation.

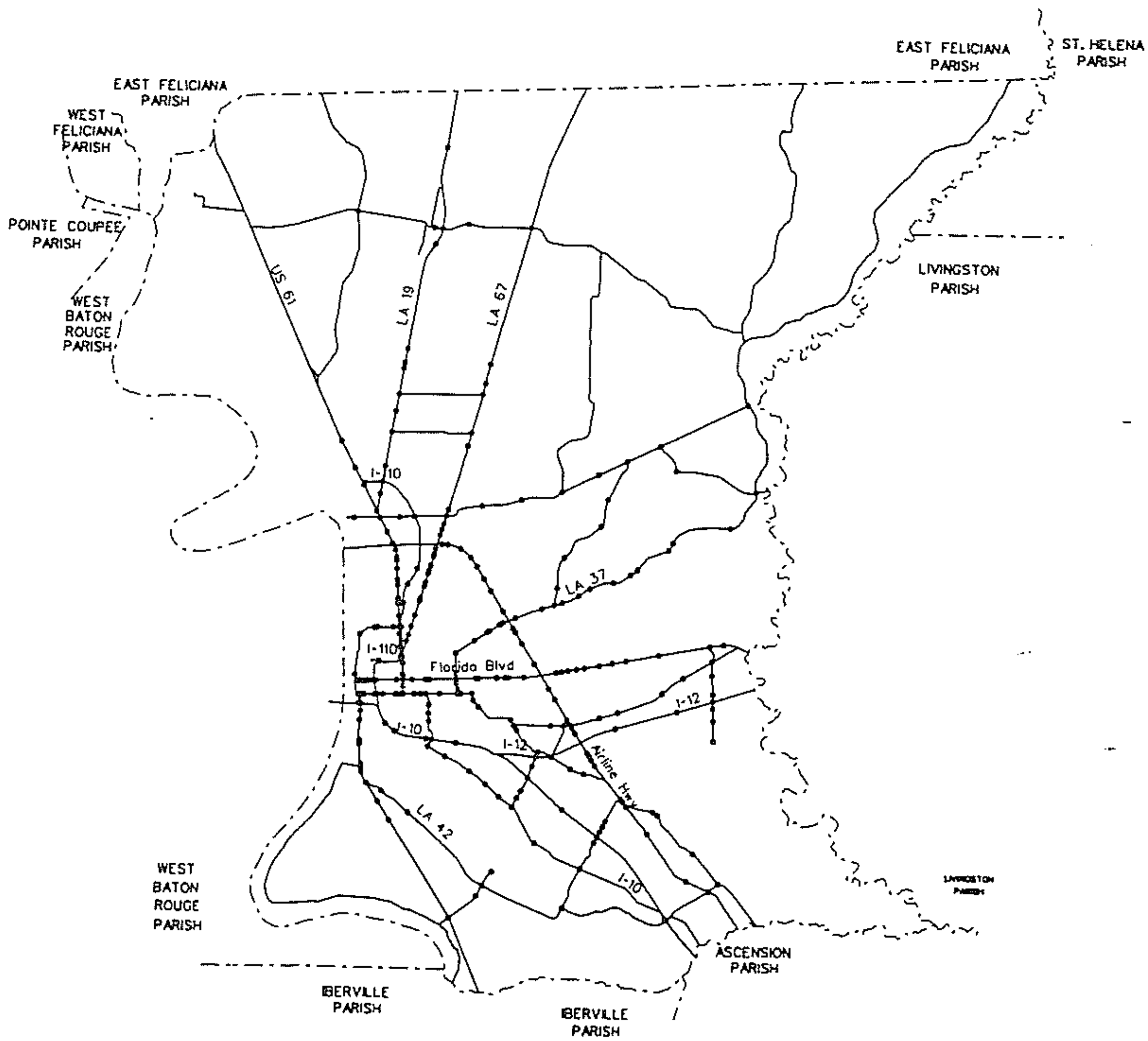


Figure 3: Signalized intersections in state-maintained roads in East Baton Rouge Parish.

ENGINEERING REPORT RELATIONAL DATABASE SCHEMA

The engineering report indexing module is composed of six tables that contain summarized data about the document production process, key conclusions, filing codes, and notes: DOC_TOPIC_DATES, DOC_TYPES, DOC_INT_CONCLUSION, DOC_CSEC_SITES, DOC_CSECT_CONCLUSION, and DOC_NOTES. Figure 4 shows the relationships among these tables, as well as their links to tables INT_MILEPOST and CSECT_TBL. For completeness, tables PAR_DATA and INT_ROADS have also been included.

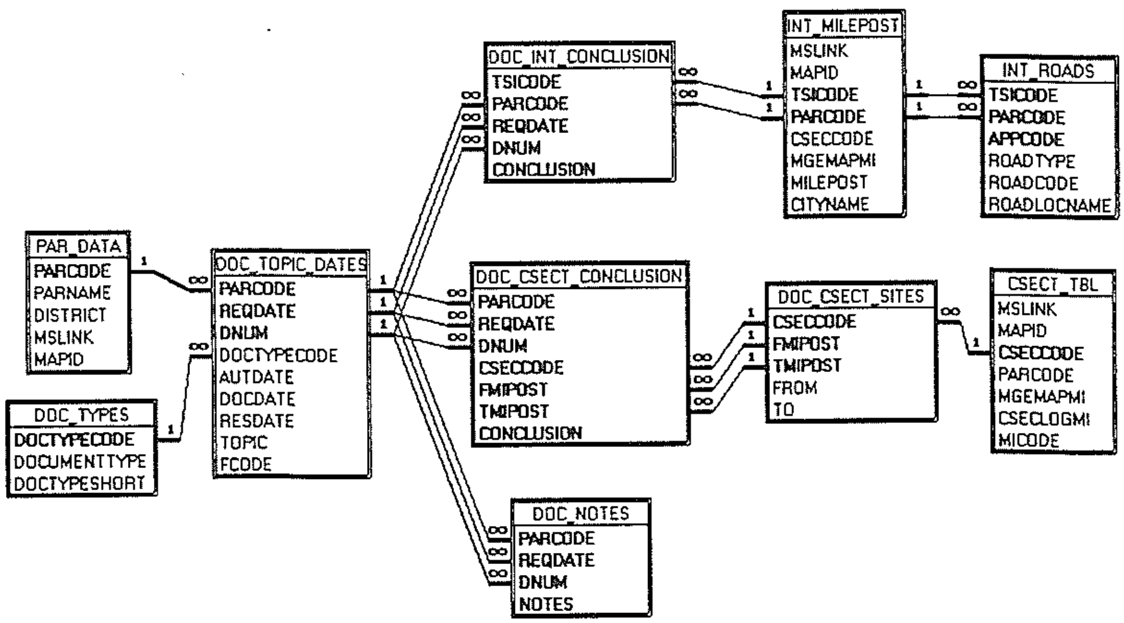


Figure 4: Relationships among tables in the engineering report group.

A short description of the six tables included in the engineering report group is provided below. A description of the associated attributes is provided in Table 3.

Table 3: Description of attributes for the engineering report group.

Table	Attribute	Key	Description
DOC_TOPIC_DATES	PARCODE	X	Parish code
	REQDATE	X	Date document was requested
	DNUM	X	Unique number for documents requested the same date in the same parish
	DOCTYPECODE		Unique number associated with a document type (1, 2, ...)
	AUTDATE		Date document was authorized
	DOCDATE		Date document was completed
	RESDATE		Date document was sent out
	TOPIC		Document main topic
	FCODE		Filing code, according to DOTD conventions
DOC_TYPES	DOCTYPECODE	X	Unique number associated with a document type (1, 2, ...)
	DOCUMENTTYPE		Type of document being indexed (Engineering Study, Work Order, ...)
	DOCTYPESHORT		Short notation for type of document being indexed
DOC_INT_CONCLUSION	PARCODE	X	Parish code
	REQDATE	X	Date document was requested
	DNUM	X	Unique number for documents requested the same date in the same parish
	TSICODE	X	Traffic Signal Inventory code (or intersection code)
	CONCLUSION	X	Summarized description of conclusion associated with TSICODE
DOC_CSECT_SITES	CSECCODE	X	Control section code
	FMIPOST	X	Milepost associated with beginning point of road segment
	TMIPOST	X	Milepost associated with ending point of road segment
	FROM		Short description of beginning point of road segment
	TO		Short description of ending point of road segment
DOC_CSECT_CONCLUSION	PARCODE	X	Parish code
	REQDATE	X	Date document was requested
	DNUM	X	Unique number for documents requested the same date in the same parish
	CSECCODE	X	Control section code
	FMIPOST	X	Milepost associated with beginning point of road segment
	TMIPOST	X	Milepost associated with ending point of road segment
	CONCLUSION	X	Summarized description of conclusion associated with road segment
DOC_NOTES	PARCODE	X	Parish code
	REQDATE	X	Date document was requested
	DNUM	X	Unique number for documents requested the same date in the same parish
	NOTES	X	Summarized description of comments included for clarification purposes

1. DOC_TOPIC_DATES: This table contains basic control data about engineering reports, including tracking dates, document type codes, topic, and filing code (Table A5 in Appendix A). Four date fields have been included to aid in the process of tracking production of new reports: request date (when report was requested), authorization date (when report was assigned for

production), document date (when report was finished), and response date (when report was distributed). This scheme is particularly advantageous because it allows for a reduction in the number of records associated with the same project.

Request date is used as part of the key to uniquely identify all reports. The other components of the key are parish code and a sequential number that distinguishes all reports requested the same date. Request date is used as part of the key because it is the earliest date and because counting days and tracking document development becomes much easier when records for new documents can be created as soon as they are requested.

2. DOC_TYPES: This table is a look-up table that contains the equivalence between the document type codes included in table DOC_TOPIC_DATES and the corresponding document type name (Table A6 in Appendix A). Five document types have been defined so far: Engineering Study, Traffic Services Work Order, Inspection Report, Chief Engineer's Order, and Other. The associated document type codes are 1, 2, 3, 4, and 5, respectively.

3. DOC_INT_CONCLUSION: This table contains a summarized description of the main conclusions reached in a document that refers to one or more signalized intersections (Table A7 in Appendix A). Two attributes in this table, PARCODE and TSICODE, are used to link individual conclusions with additional intersection data through table INT_MILEPOST.

4. DOC_CSECT_SITES: This table contains attributes used to uniquely define segments of roads according to a range in milepost values (Table A8 in Appendix A).

5. DOC_CSECT_CONCLUSION: This table contains a summarized description of the main conclusions reached in a document that refers to one or more segments of roads (Table A9 in Appendix A). Three attributes in this table, CSECCODE, FMIPOST, and TMIPOST, are used to link individual conclusions with additional road segment information through DOC_CSECT_SITES.

6. DOC_NOTES: This table contains additional information needed to clarify specific issues contained in the report, such as inconsistencies in tracking dates, site description, and so on (Table A10 in Appendix A).

PAPER COVER FORM AND COMPUTERIZED DATA ENTRY AND QUERY FORMS

A paper form was developed to facilitate the extraction of data from existing traffic engineering reports. A copy of the form is included in Appendix B, along with a companion set of instructions and two examples. For the most part, the paper form is self-explanatory. It contains blanks for all attributes in the database which are related to engineering reports, except DNUM, i.e., the attribute used for the unique sequential number. Because the objective of such a form is to facilitate the data entry process to the database and not force the user to perform additional calculations, it was decided to leave the computation of DNUM to an automatic procedure within the database based on the comparison between the entered PARCODE and REQDATE values and those already existing in the database.

Two additional aspects in the paper form require special consideration. The first one is that signalized intersections are uniquely identified by TSI Code and Parish Code. Control sections are uniquely identified by Control Section Code. Strictly speaking, the Route, Local Name, City and District fields in the paper cover form are not needed. They are included for completeness and checking purposes. The second aspect is that due to limitations of space, only one location is assumed to be described in the form. For those cases in which a report includes more than one location, a separate paper form must be used for each location considered. For database entry purposes, therefore, it is required to keep all forms associated with the same report together.

A computerized version of the paper cover form was also developed to assist in populating the database. This computerized data entry form was created using Microsoft ACCESS. As mentioned before, MGE PC-1 was the GIS selected for map handling. This implied the use of ORACLE V. 6 for DOS as the relational database system which could operate in association with MGE PC-1. A problem with ORACLE for DOS, although it is a powerful relational database management system, is that its interface with the user is very primitive and, as result, the process of creating forms for data entry is time consuming and laborious. The development of a data entry form in ACCESS required the creation of a parallel database in ACCESS and, then, data conversion into ORACLE. Unfortunately, direct data conversion was not possible because a driver permitting ACCESS to directly link with ORACLE tables was not available in the market. As a result, it was necessary to develop a data conversion procedure that involved exporting tables into a third format and, then, importing those tables from the other application. A summary of this procedure is included in Appendix C. However, such a driver is scheduled to be released in the third quarter of 1995. This will permit inexpensive PCs to enter data directly into the ORACLE database system used by Intergraph workstations. Figure 5 shows the general configuration of such linkage.

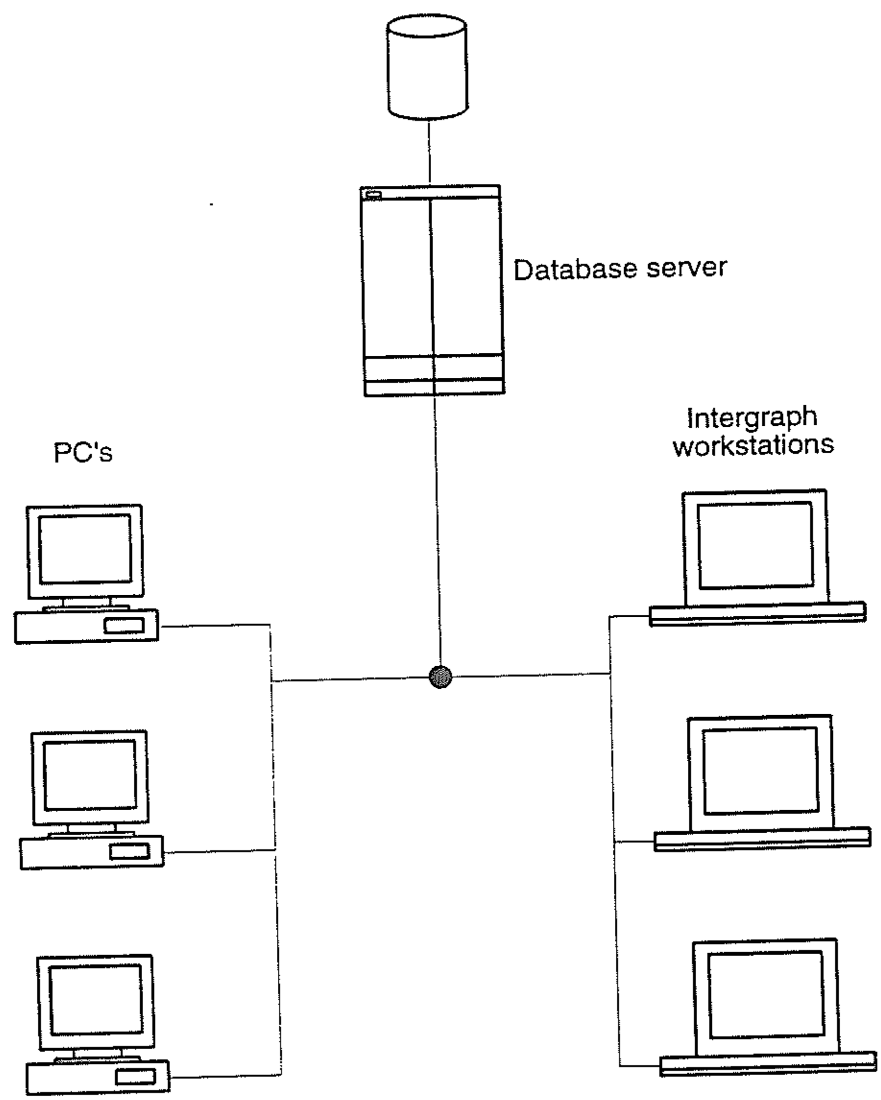


Figure 5: Linkage between PCs, Oracle database and Intergraph workstations.

For consistency, the computerized data entry cover form was designed to resemble the paper form as much as possible (Figure 6). However, some features were implemented in the computerized version to increase the efficiency in the data entry process and to provide data integrity checks. The sequential number that identifies each document, DNUM, is generated automatically. Dates should be entered in chronological order beginning with request date, but only request date is actually required. When the parish code is entered, a window containing a summarized description of the parish name and district code is shown on the screen. Similarly, for signalized-intersection-related reports, when a TSI code is entered a window containing summarized description of the intersection is shown on the screen. Also, for road segment reports when the control section code and the milepost range are entered, a query is performed to determine whether the same location already exists in the database. Finally, as opposed to the paper form, only one screen is required per report regardless of the number of locations associated with the same report.

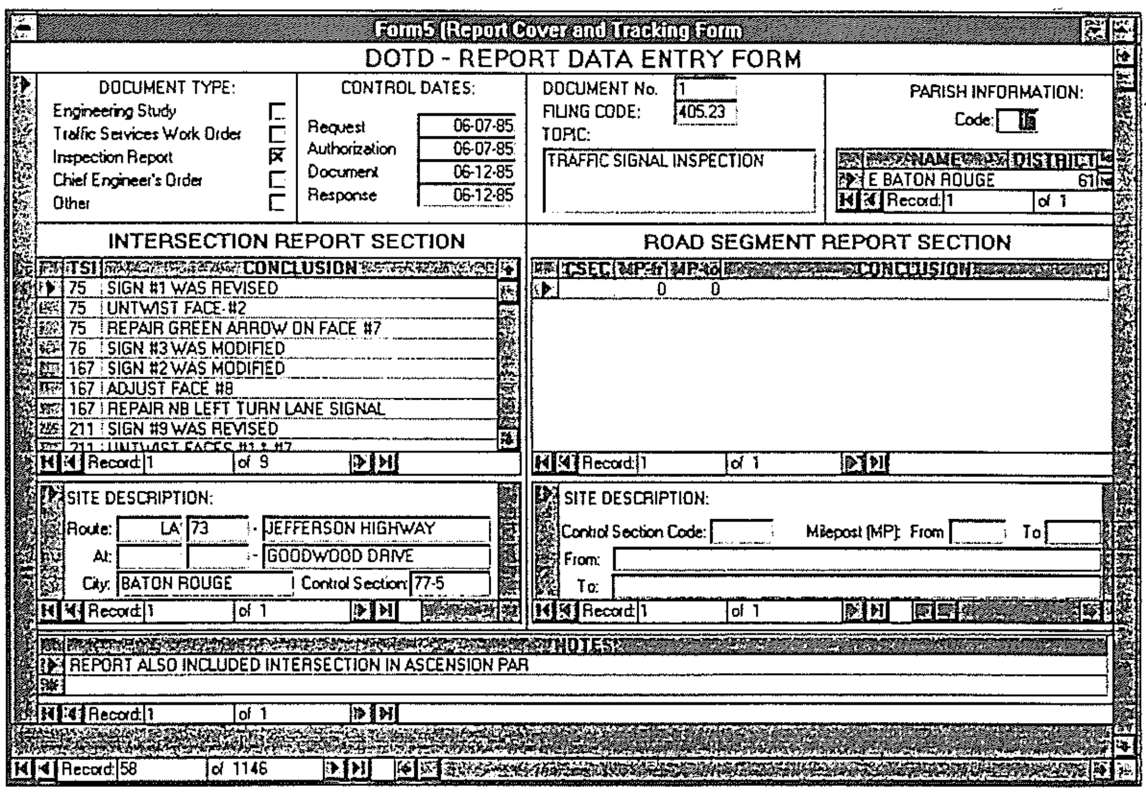


Figure 6: Example of application of computerized data entry form.

Another computerized form was developed for database querying purposes. While the original data entry form allows some simple queries by locating the first record that complies with a specific condition, more sophisticated queries required the construction of a totally different form. Figure 7 shows an example. In general, the query form allows multiple queries by allowing the simultaneous specification of one or more document types, a variety of possibilities for TSI code values, and one parish code. Under this configuration, all documents for the past 10 years that comply with the conditions specified above are retrieved. If even more sophisticated queries are needed, for example, if one wants to limit the query to documents requested since January 1, 1991, there is a button called Complex Query that allows the definition of that extra condition directly in the query design window (Figure 8). There is another button allowing the reset of the form to its default configuration.

In any case, query results can also be routed to a printer using the file menu print option. Care must be taken to ensure that the Document Summary window (Figure 7) is active (the window header must be highlighted) so that its contents are routed to the printer in tabular form.

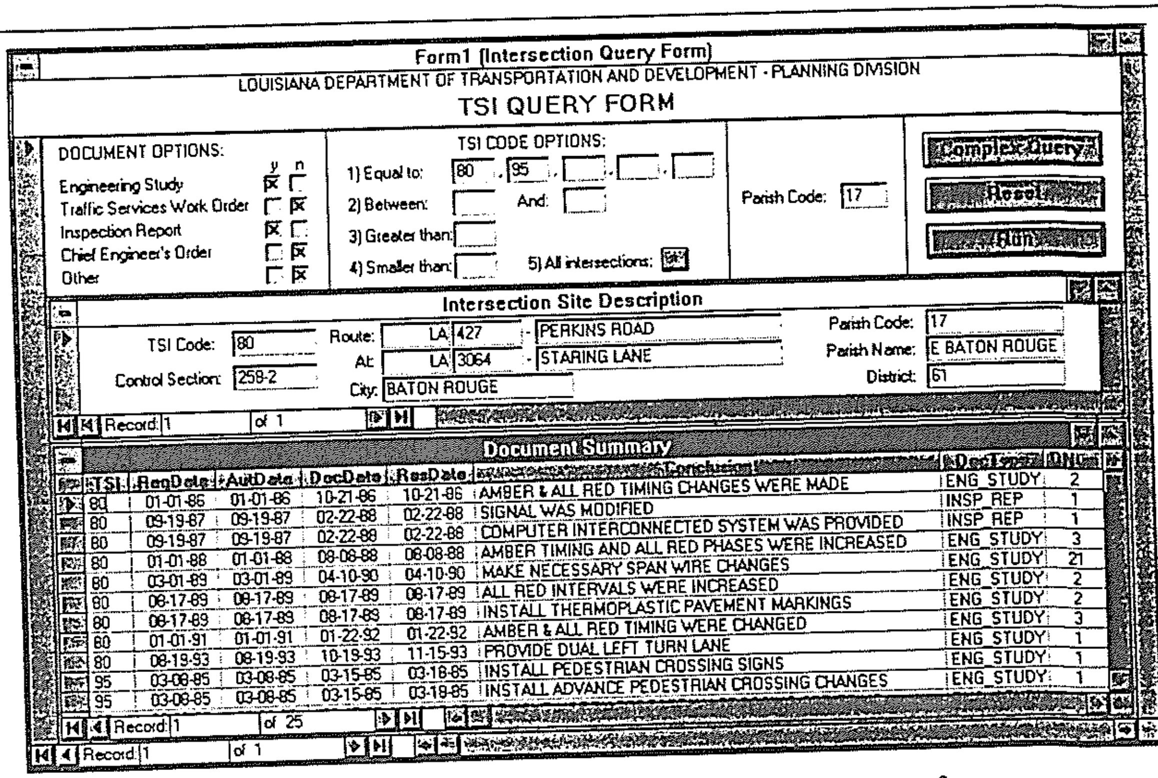


Figure 7: Example of application of computerized query form.

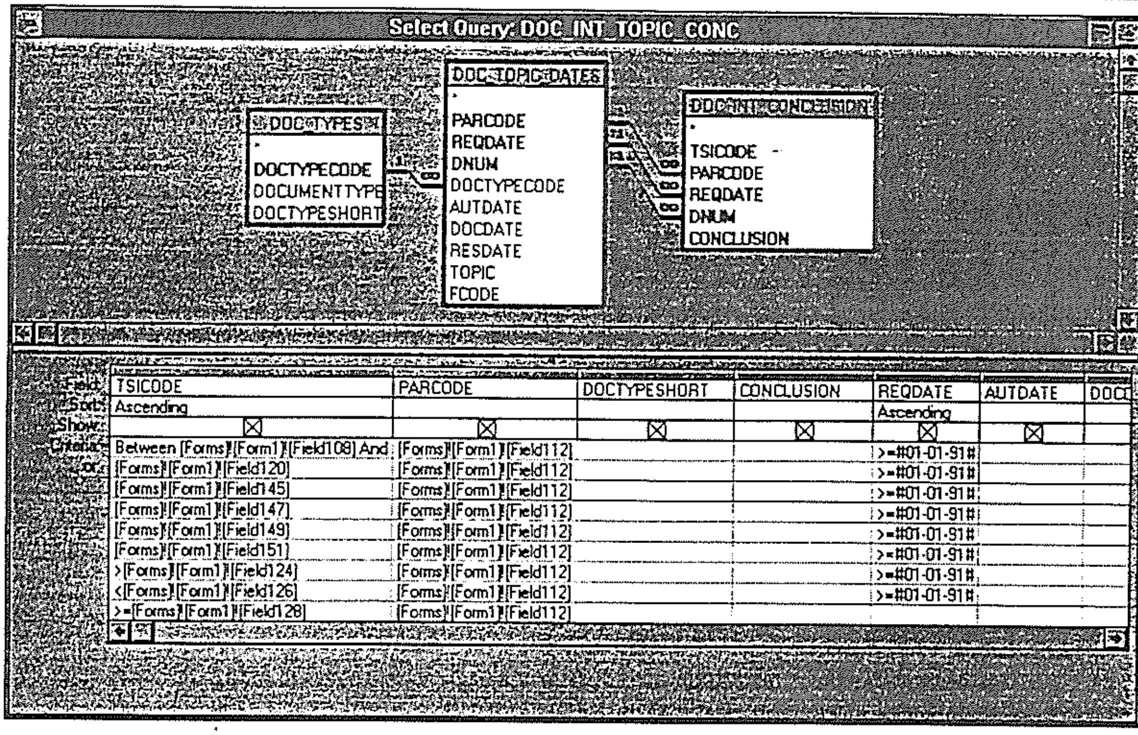


Figure 8: Design window for complex queries.

ENGINEERING REPORT DATABASE POPULATION

Tables A5 to A10 in Appendix A contain entries for engineering reports produced by DOTD in East Baton Rouge Parish for the past 10 years. Most documents indexed correspond to engineering studies and inspection reports. A few documents are chief engineer's orders. The remaining documents were catalogued as "other." No entries were created for traffic services work orders because these documents are not yet filed at the DOTD Baton Rouge Airport office.

An explicit effort was made to limit the index to key documents, i.e., those documents likely to have a significant impact on engineering recommendations and decisions. For example, speed limit studies were considered key documents and were indexed, whereas isolated letters whose only objective was to answer a question were not considered key documents and were not indexed. Similarly, inspection reports which described the state of a particular location after a construction project was carried out as a result of an engineering study were considered key documents and were indexed. However, regular internal maintenance memos which described minor routine inspection activities likely to be performed on a regular basis were not considered key documents and were not indexed.

In general, cataloging documents following this criteria was straightforward. In several cases, however, there was confusion, particularly when the document was actually a letter or a memo, no tracing could be made to any request date, very limited engineering analysis was conducted, and the document conclusions did not seem to contain specific recommendations. In some cases, it was decided to catalog the documents as engineering studies, even if the documents themselves were letters or memos, as long as they contained at least some engineering analysis and recommendations. If no engineering analysis was made but the documents did contain some form of recommendation, the documents were generally cataloged as "other." Finally, if no recommendations were included, the affected documents were not indexed.

Table 4 shows a summary of the engineering reports indexed. The vast majority of entries correspond to intersection-related reports (1,036, or 90%), although it must be taken into consideration that the index for intersection reports covers the past 10 years (up to December 1, 1994), whereas the index for road segment reports only covers the period 1989-1994. When this period, 1989-1994, is considered separately, the percentage of intersection-related entries drops to 86% (667 out of 777), still a high value.

Table 4: Summary of engineering reports indexed.

Document type	Intersections			Road segments	Total
	<1989	1989-1994	total	1989-1994	
Engineering Study	249	339	588	75	663
Traffic Services Work Order	0	0	0	0	0
Inspection Report	75	173	248	0	248
Chief Engineers' Order	1	0	1	16	17
Other	44	155	199	19	218
TOTAL	369	667	1,036	110	1,146

The reason for the discrepancy between the number of entries for intersections and for segments of roads is that when the indexing process began, it was not clear how many documents would be included in the database. Originally, it was thought that 10 years would provide a good testing set for developing and building the database. However, as more reports were indexed, and in agreement with DOTD officials, it was determined that five years would be sufficient for keeping track of documents and projects. Because the indexing process began with signalized intersections, it was decided to complete the intersection report index up to 10 years and then limit the road segment report index to the period 1989-1994.

Most documents indexed were engineering studies (663 out of 1,146, or 58%), although inspection reports and other documents accounted for significant segments (248 and 218, or 22% and 19%, respectively). Chief Engineers' orders accounted for only 17 documents (or 1.5%). If regular internal maintenance memos had been indexed, the total number of inspection reports would have undoubtedly increased.

TRAFFIC SIGNAL INVENTORY AND TIMING RELATIONAL DATABASE SCHEMA

As mentioned before, the structure and format of the existing mainframe signal timing data prevented a suitable integration between the mainframe database and the engineering report relational database. Nonetheless, a basic model for traffic signal inventory and timing data was developed in order to provide an insight regarding the configuration of a more comprehensive database module and its links with the rest of the system.

The basic traffic signal inventory model is composed of seven tables that contain summarized information about intersection geometry, route names and relative position, phases, speed limits, and sign inventory: INT_ROADS, INT_WIDTH_NLANE, INT_SPEED_LIM, INT_PHASE_FLOW, INT_PHASE_SEQUENCE, INT_SIGN_INVENTORY, and INT_LEFT_TURN_STATUS. Figure 9 shows the relationships among these tables, as well as their links to tables INT_MILEPOST, CSECT_TBL, and PAR_DATA.

A short description of the seven tables included in the traffic signal inventory and timing group is provided below. A description of the associated attributes is provided in Table 5. Appendix D includes a population example with data associated with intersection 288.

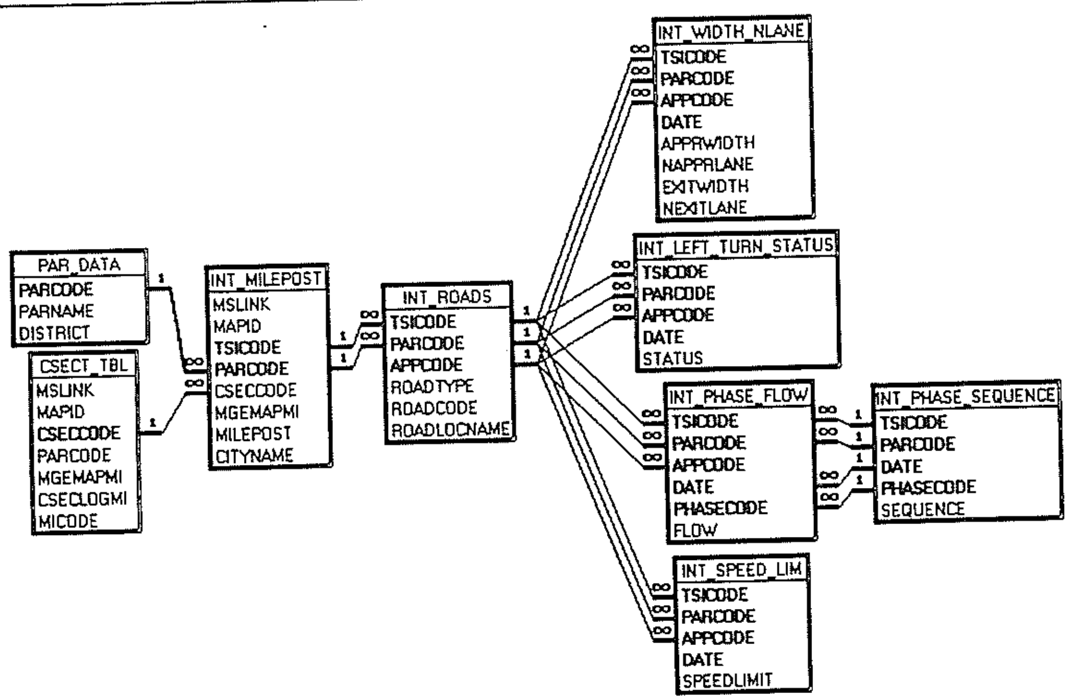


Figure 9: Relationships among tables in the traffic signal inventory and timing group.

Table 5: Description of attributes for the traffic signal inventory group.

Table	Attribute		Description
INT_ROADS	TSICODE	X	Intersection code
	PARCODE	X	Parish code
	APPCODE	X	Approaching road unique identifier (1, 2, 3, 4, etc); maximum value depends on the number of approaches to the intersection
	ROADTYPE		Road category (LA, US, I-, or Null)
	ROADCODE		Code associated with road (19, for LA 19; 190 for US 190; 110 for I-110; or Null for a road not maintained by the State)
	ROADLOCNAME		Road local name (Main, Florida Blvd, Highland Rd)
INT_WIDTH_NLANE	TSICODE	X	Intersection code
	PARCODE	X	Parish code
	APPCODE	X	Approaching road unique identifier
	DATE	X	Date of report specifying changes in lane characteristics
	APPRWIDTH		Total width of incoming lanes in approaching road
	NAPPRLANE		Number of incoming lanes in approaching road
	EXITWIDTH		Total width of exiting lanes in approaching road
	NEXITLANE		Number of exiting lanes in approaching road
INT_SPEED_LIM	TSICODE	X	Intersection code
	PARCODE	X	Parish code
	APPCODE	X	Approaching road unique identifier
	DATE	X	Date of report specifying speed limit change
	SPEEDLIMIT		Speed limit
INT_PHASE_FLOW	TSICODE	X	Intersection code
	PARCODE	X	Parish code
	APPCODE	X	Approaching road unique identifier
	DATE	X	Date of report specifying changes in permitted flows
	PHASECODE	X	Phase code
	FLOW		Flow associated with phase code (L, LT, T, TR, R, LTR, LR)
INT_PHASE_SEQUENCE	TSICODE	X	Intersection code
	PARCODE	X	Parish code
	DATE	X	Date of report specifying changes in phase sequence
	PHASECODE	X	Phase code
	SEQUENCE		Order in which phases occur
INT_LEFT_TURN_STATUS	TSICODE	X	Intersection code
	PARCODE	X	Parish code
	DATE	X	Date of report specifying changes in left turn status
	APPCODE	X	Approaching road unique identifier
	STATUS		Left turn status (X = Not Allowed, U = Unprotected, PO = Protected-Only, PP = Protected/Permissive)
INT_SIGN_INVENTORY	TSICODE	X	Intersection code
	PARCODE	X	Parish code
	APPCODE	X	Approaching road unique identifier
	DATE	X	Date of report specifying changes in sign configuration
	SIGNCODE	X	Sign code
	NUMBERSIGN		Number of signs having the same sign code

1. INT_ROADS: This table contains the names of all approaching roads to each signalized intersection (Table A4 in Appendix A). All approaching roads are treated independently, even if they are located along the same route or street. This allows the assignment of a unique code to each approaching road. Strictly speaking, codes can be assigned at random as long as they are different. For control purposes, however, a systematic approach is preferred. In general, codes are assigned in a counterclockwise fashion, beginning with one of the approaching roads associated with the main route. Since two approaching roads may be located on the same main route, codes are assigned in the same order as the direction in which the mileposts increase, i.e., the lower code is assigned to the approaching road that has lower values of milepost. For example, for intersection 288, the main route is LA 73 (Jefferson Highway). Mileposts on LA 73 increase from southeast to northwest. As a result, the first code is assigned to the southeast approaching segment of LA 73. The second code is assigned to Barringer Road, which is located on the northeast side of the intersection. The third code is assigned to the northwest approaching segment of LA 73, and the fourth code is assigned to Barringer-Foreman Road, which is located on the southwest side of the intersection.

2. INT_WIDTH_NLANE: This table contains total width and number of lanes associated with each approaching road. Since approaching roads may have traffic in both directions, separate fields for incoming and exiting lanes are included.

3. INT_SPEED_LIM: This table contains the speed limits associated with each approaching road.

4. INT_PHASE_FLOW: This table contains the flow directions associated with all phases according to approaching road.

5. INT_PHASE_SEQUENCE: This table describes the sequence in which all phases are operated. Phases that operate simultaneously are assigned the same sequence code.

6. INT_LEFT_TURN_STATUS: This table describes the status of all left turns in the signalized intersection, according to approaching road. The following status codes have been considered so far: X = Not Allowed; U = Unprotected; PO = Protected-Only; and PP = Protected/Permissive. This table is needed because table INT_PHASE_FLOW contains only those phases explicitly included in the TSI diagrams, and unprotected turns may not have a phase code explicitly assigned in these diagrams.

7. INT_SIGN_INVENTORY: This table contains the list and number of signs located on each approaching road. Codes assigned to signs are those contained in the *Manual on Uniform Traffic Control Devices*, published by the Federal Highway Administration.

DISCUSSION

GEOGRAPHIC INDEXING MODEL

Two types of geographic features are included in the database: linear features and point features. Linear features represent segments of the network of state maintained roads. Point features represent signalized intersections. Following the DOTD highway network structure, road segments were uniquely identified in the database by CSECCODE, i.e., control section code, whereas signalized intersections were uniquely identified by TSICODE and PARCODE, i.e., traffic signal inventory code and parish code. A procedure was developed to ensure that signalized intersections and road segments register in the GIS, despite the fact that both linear and point features are highly simplified abstractions and, therefore, their geographic coordinates have to be considered approximate. The procedure was made as systematic and repetitive as possible, taking into account implementation issues.

This procedure is very convenient because, in most cases, milepost data for signalized intersections exist. As far as the database is concerned, however, linear features and point features do not necessarily have to register in the GIS because the database structure allows for an additional linkage between them through CSECCODE. As shown in Figure 9, table CSECT_TBL can also be linked to table INT_MILEPOST. This structure allows for the extension of the procedure to include alternative item location techniques such as GPS. In these cases, item geographic coordinates are known, but the corresponding milepost locations may be unknown. As long as the new features are explicitly assigned a CSECCODE value, their database linkage to the highway network is complete. Their approximate MGEMAPMI distances can even be determined graphically using GIS neighborhood operations. Once the MGEMAPMI values are known, the corresponding MILEPOST locations can be obtained using a procedure similar to the one described earlier in this report, except that the unknown values are milepost values.

DATE FIELDS

Based on needs expressed by DOTD officials, four control dates were included in the engineering report group database schema: response date, authorization date, document date, and response date. In many cases, it was possible to retrieve the response, document and response dates associated with an engineering report. Authorization date is a new control date that DOTD plans to implement and, consequently, no record was encountered in the files at the DOTD airport office. However, for data consistency when using the computerized data entry form, in order for the document date to be entered the authorization date must be already filled in. For this reason, it was assumed in all cases that the authorization date was the same as the request date. In some other cases, as mentioned before, it was not possible to retrieve the request date for a document. For cases such as these, both the request and authorization dates were assumed to be the same as the document date. Finally, when the response date was not available it was also assumed to be the same as the document date.

This scheme of having four dates for tracking document production appears to be an efficient solution to the problem of having to index more documents than strictly needed in order to have a good idea of the evolution of engineering projects through time. However, the engineering report group is built upon a static road and signalized intersection network. This means that while report conclusions and inspection results may describe the construction of new road segments or new signalized intersections, there is no procedure included in the GIS to actually link these changes in a coherent way to their corresponding graphical features. Two types of problems may arise: (1) An item may still exist in the attribute tables, but the corresponding graphical feature no longer exists; a typical case of this situation occurs when road segments are transferred from the state to the parish. (2) The item exists in the attribute table and a graphical feature appears in the screen, but because of changes in the road network its milepost location value does not correspond to the state of the road network at the time of the query.

This temporal issue must be solved in a comprehensive way which, undoubtedly, will involve many groups within DOTD. Unfortunately, current commercial GIS systems do not support spatiotemporal linkages, although considerable effort has been devoted in recent years to deal with this problem (Ref. 2). In the meantime, multiple versions of both the road network and the corresponding fundamental tables will likely be needed to achieve a satisfactory level of compatibility between database and attribute tables. In any case, many more time fields will be required to track evolution of items other than engineering report data, including milepost distances, speed limit changes, and signal timing data. Both world and database time fields should be included in order to account for discrepancies between occurrences in the real world and the time such occurrences are entered in the database.

QUERIES

Two types of queries are possible with the geographic database: through graphical features and through attribute tables. In the first case, queries are based on spatial relationships affecting both graphical features and attribute tables and require the use of the spatial analysis capabilities of the GIS. The linkage between the attribute tables and the graphical elements in the GIS is possible through the unique identifier MSLINK. A typical example of this type of query would be to retrieve all engineering reports produced for the past two years in the area covered by a 1-mile radius from the intersection between Florida Blvd (US 190) and Airline Hwy (US 61) in Baton Rouge. Such a query could be executed by graphically identifying the intersection and by specifying the radius (Figure 10).

In the second case, queries are based on relationships between attribute tables with no actual participation of the graphical features and, therefore, do not require the use of the GIS. However, a relational database management system such as ACCESS is required. A typical example of this type of query would be to retrieve all inspection reports produced at intersections No. 5, 6, and 7 since January 1, 1991. This kind of query is particularly suitable for PCs in which a GIS package has not been installed or that is used mainly for other purposes like document production and tracking.

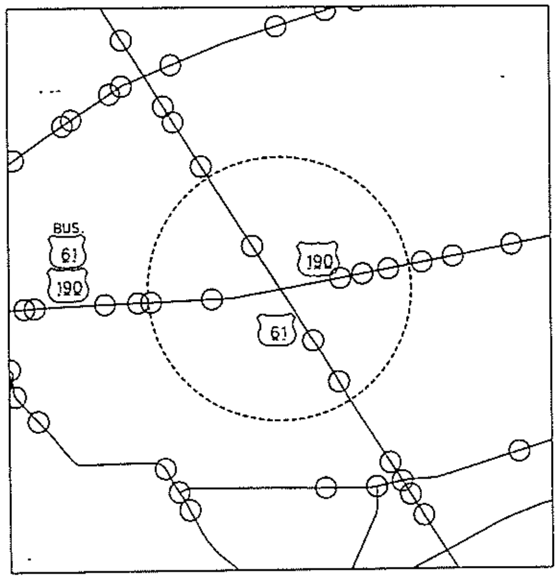


Figure 10: Example of spatial query.

Referential integrity constraints were enforced for the development of the database. This means that meaningful one-to-many relationships can be established between tables and that meaningful queries can be built with them. For example, the relationship set shown in Figure 4 for the engineering report group allowed for the creation of queries used to develop the computerized data entry and query forms. For the data entry form (Figure 6), tables INT_MILEPOST, DOC_INT_CONCLUSION, and INT_ROADS were related in order to retrieve site description data on the intersection report side of the form when a TSICODE value is entered in the TSI field. For the query form (Figure 7), table PAR_DATA was added to the relationship between tables INT_MILEPOST, DOC_INT_CONCLUSION, and INT_ROADS in order to retrieve intersection site description data in a more compact way when a TSI field is double-clicked in the Document Summary subform.

Other relationships and queries may be possible. For deriving the statistics shown in Table 4, for example, two sets of queries were developed. The first set involved defining the number of intersection-related documents. This was done by relating tables DOC_TOPIC_DATES and DOC_INT_MILEPOST and by selecting and counting records that complied with the conditions that DOCTYPECODE be equal to a unique value (1, 2, 3, 4, or 5) and that REQDATE be within a specific range (<01-01-89, or between 01-01-89 and 12-31-94). The second set involved defining the number of road segment-related documents. This was done by relating tables DOC_TOPIC_DATES and DOC_CSECT_CONCLUSION and by selecting and counting records that complied with the condition that DOCTYPECODE be equal to a unique value (1, 2, 3, 4, or 5). Since the index of road segment-related documents began in 1989, no REQDATE condition was established.

CONCLUSIONS

This report describes the results of a pilot project that developed a prototype computer-based indexing model for reports and engineering data in DOTD. This model was based on a procedure to link signalized intersections and road segments in a GIS environment. More specifically, a unified geographic referencing model was developed to make traffic engineering data compatible with MGE, which is the GIS currently used by DOTD.

The prototype engineering report database developed in this project covers data from East Baton Rouge Parish for the past 10 years. A total of 1,146 entries including engineering studies, inspection reports, Chief Engineers' Orders, and others was created.

In order to facilitate the engineering data extraction process, a paper cover form was developed. This form will constitute the basis for a standard report cover form to be submitted with future traffic engineering studies to permit rapid indexing. A computerized version of the paper form was developed using an ACCESS database system. The form will constitute the basis for a series of forms to allow users to communicate effectively with the Oracle database (Figure 5). Similarly, a query form was also developed to facilitate the extraction of engineering data from the database.

A basic model for storing signal inventory and timing data compatible with the index of traffic engineering studies was developed. The scope of such a model was limited due to incompatibility between the existing mainframe signal timing database and the geographic database developed in this project. Nonetheless, it is believed that the basic model developed here will provide the foundation for a comprehensive GIS-based signal timing database.

Based on the experiences gained in the development of the engineering report database, a set of observations with respect to the way current reports reference site description has been compiled. A corresponding set of recommendations to facilitate the report indexing process has also been compiled and is provided below:

- The request date should be clearly defined. In several cases, it was not possible to trace the origins of a report, and the request date was assumed to be the same as the document date. In other cases, the origin was established, but the date associated with the origin was not. A typical example of this situation occurred when a report was submitted because a location was listed in the Abnormal Accident Location Listing for a particular year, but no mention was made of when the study was requested. In cases such as this, the request date was assumed to be January 1st of the year following the year mentioned in the listing.
- Documents intended to provide engineering concepts and recommendations should follow specific guidelines for format and content. Ideally, these guidelines should conform to a DOTD-wide standard. Engineering reports should contain clearly defined sections for site description, data gathered, analyses conducted, and conclusions. Whenever possible, numbered charts and figures should be used. Conclusions, in particular, should be bulleted and concise.
- Eventually, the paper cover form might become redundant once its computerized counterpart becomes fully operational. However, it is envisioned that the paper form (or a modified version of it) will actually constitute the first page of all engineering reports. With the availability of powerful word processors, it is actually possible to develop complete document forms and, hopefully, the cover form could be incorporated as an integral part. An example of this type of application is shown in Appendix B. Since the original paper form was developed in Microsoft Word, filling in the blanks for the two examples included was a straightforward procedure.

REFERENCES

1. Stopher, P. R., Apffel, C., Horn, K., Movassaghi, K., Wilmot, C. G., Kalivoda, E., Niklaus, J. E., Budhu, G., and Jayawaradana, J., *A Model Process For the Development of a Statewide Intermodal Transportation Plan*, final report, Louisiana Transportation Research Center, Federal Highway Administration, FHWA Report: Misc(016), 170 p, July 1994.

2. Langran, G., *Time in Geographic Information Systems*, Taylor & Francis, New York, 1992, 189 p.

3. Elmasri, R., and Navathe, S. B., *Fundamentals of Database Systems*, Benjamin/Cummings, New York, 1989, p. 381.

APPENDIX A
ATTRIBUTE TABLES

Note: Only the first page of each table is included in this report. The total number of pages associated with each table is indicated on the upper right corner of the page. The complete records can be found either at the Remote Sensing and Image Processing Laboratory, Louisiana State University (504/388-5246), or the Louisiana Department of Transportation and Development Planning Division Office (504/358-9131).

Table A1: Parish data (PAR_DATA table). [1 page]

PARCODE	PARNAME	DISTRICT	MSLINK	MAPID
1	ACADIA	3	35	100009
2	ALLEN	7	30	100009
3	ASCENSION	61	52	100009
4	ASSUMPTION	61	54	100009
5	AVOYELLES	8	28	100009
6	BEAUREGARD	7	29	100009
7	BIENVILLE	4	15	100009
8	BOSSIER	4	2	100009
9	CADDO	4	1	100009
10	CALCASIEU	7	33	100009
11	CALDWELL	58	17	100009
12	CAMERON	7	37	100009
13	CATAHOULA	58	24	100009
14	CLAIBORNE	4	4	100009
15	CONCORDIA	58	25	100009
16	DESOTO	4	13	100009
17	E BATON ROUGE	61	47	100009
18	E CARROLL	5	8	100009
19	E FELICIANA	61	42	100009
20	EVANGELINE	3	31	100009
21	FRANKLIN	58	18	100009
22	GRANT	8	22	100009
23	IBERIA	3	39	100009
24	IBERVILLE	61	51	100009
25	JACKSON	5	16	100009
26	JEFFERSON	2	59	100009
27	JEFFERSON DAVIS	7	34	100009
28	LAFAYETTE	3	36	100009
29	LAFOURCHE	2	61	100009
30	LASALLE	58	23	100009
31	LINCOLN	5	9	100009
32	LIVINGSTON	62	48	100009
33	MADISON	5	12	100009
34	MOREHOUSE	5	6	100009
35	NATCHITOCHES	8	21	100009
36	ORLEANS	2	57	100009
37	OUACHITA	5	10	100009
38	PLAQUEMINES	2	63	100009
39	POINTE COUPEE	61	40	100009
40	RAPIDES	8	27	100009
41	RED RIVER	4	14	100009
42	RICHLAND	5	11	100009
43	SABINE	8	64	100009
44	SAINT BERNARD	2	62	100009
45	ST CHARLES	2	58	100009
46	ST HELENA	62	43	100009
47	ST JAMES	61	55	100009
48	ST JOHN	62	56	100009
49	ST LANDRY	3	32	100009
50	ST MARTIN	3	50	100009
51	ST MARY	3	65	100009
52	ST TAMMANY	62	49	100009
53	TANGIPAHOA	62	44	100009
54	TENSAS	58	19	100009
55	TERREBONNE	2	60	100009
56	UNION	5	5	100009
57	VERMILION	3	38	100009
58	VERNON	8	26	100009
59	WASHINGTON	62	45	100009
60	WEBSTER	4	3	100009
61	W BATON ROUGE	61	46	100009
62	W CARROLL	5	7	100009
63	W FELICIANA	61	41	100009
64	WINN	8	20	100009

Table A2: Control-section data for East Baton Rouge Parish (CSECT_TBL table). [1 page]

CSECCODE	PARCODE	MGEMAPMI	CSECLOGMI	MSLINK	MAPID
13-4	17	5.638	5.66	595	100001
13-5	17	6.469	6.41	596	100001
19-1	17	4.574	4.56	645	100001
19-2	17	12.588	12.62	644	100001
19-30	17	9.443	9.41	597	100001
250-1	17	13.079	13.09	602	100001
253-2	17	8.698	8.77	647	100001
253-3	17	2.353	2.46	603	100001
253-4	17	5.510	5.47	604	100001
254-1	17	4.556	4.61	605	100001
254-2	17	12.565	12.50	606	100001
254-3	17	12.354	12.35	607	100001
255-1	17	3.022	3.06	610	100001
255-2	17	9.946	9.98	611	100001
255-30	17	3.524	3.53	614	100001
257-3	17	4.346	4.38	627	100001
257-4	17	4.785	4.77	641	100001
258-1	17	8.122	8.10	625	100001
258-2	17	4.846	4.88	626	100001
258-31	17	6.203	6.20	640	100001
258-32	17	1.855	1.86	621	100001
414-1	17	9.693	9.74	629	100001
450-10	17	13.512	13.50	643	100001
450-9	17	0.860	0.86	642	100001
450-92	17	8.843	8.89	608	100001
454-1	17	8.281	8.30	609	100001
60-1	17	8.209	8.28	598	100001
60-2	17	11.026	11.05	599	100001
7-10	17	1.060	1.11	594	100001
7-8	17	5.814	5.82	600	100001
7-90	17	11.879	11.93	593	100001
77-4	17	5.648	5.78	601	100001
77-5	17	8.574	8.69	631	100001
817-16	17	10.881	10.89	628	100001
817-20	17	3.460	3.53	632	100001
817-23	17	1.299	1.29	624	100001
817-26	17	0.332	0.33	636	100001
817-29	17	0.102	0.08	639	100001
817-30	17	0.963	0.96	617	100001
817-31	17	2.426	2.44	616	100001
817-32	17	1.027	1.03	622	100001
817-33	17	2.535	2.57	615	100001
817-35	17	0.305	0.33	634	100001
817-36	17	1.913	1.91	619	100001
817-4	17	8.544	8.54	620	100001
817-40	17	3.823	3.85	648	100001
817-41	17	2.911	2.92	646	100001
817-42	17	0.240	0.24	649	100001
817-43	17	1.298	1.29	618	100001
817-5	17	8.187	8.34	612	100001
817-8	17	5.215	5.29	613	100001
817-9	17	7.399	7.41	623	100001
CUP01	17	0.100	0.10	630	100001
CUP26	17	0.262	0.26	633	100001
DIVID9	17	1.082	1.08	3,001	100001
EMPT11	17	0.031	0.03	638	100001
EMPT14	17	0.048	0.05	637	100001

Table A3: Control-section and milepost of all signalized intersections in East Baton Rouge Parish (INT_MILEPOST table). [5 pages]

TSICODE	PARCODE	CSECCODE	MGEMAPMI	MILEPOST	CITYNAME	MSLINK	MAPID
1	17	253-2		5.34	ZACHARY	13	100014
10	17	60-2	9.780	9.78	BAKER	24	100014
100	17	60-1	2.880	2.90	BATON ROUGE	31	100014
101	17	60-1	2.930	2.96	BATON ROUGE	32	100014
102	17	60-1	3.320	3.35	BATON ROUGE	33	100014
103	17	60-1	3.470	3.50	BATON ROUGE	34	100014
104	17	60-1	3.720	3.75	BATON ROUGE	35	100014
105	17	60-1	3.810	3.84	BATON ROUGE	36	100014
106	17	60-1	3.970	4.00	BATON ROUGE	37	100014
107	17	60-1		4.30	BATON ROUGE	286	100014
108	17	60-1	4.520	4.56	BATON ROUGE	39	100014
109	17	60-1	4.950	4.99	BATON ROUGE	40	100014
11	17	254-2		15.10	GREENWELL SPRI	96	100014
110	17	60-1	7.790	7.86	BATON ROUGE	45	100014
111	17	60-1		8.28	BATON ROUGE	296	100014
112	17	19-1		83.13	BATON ROUGE	71	100014
113	17	450-92	0.033	1.03	BATON ROUGE	301	100014
114	17	7-90	9.070	80.10	BATON ROUGE	257	100014
116	17	19-1		2.09	BATON ROUGE	176	100014
117	17	19-1		1.62	BATON ROUGE	178	100014
118	17	19-1		1.55	BATON ROUGE	179	100014
119	17	817-35		0.24	BATON ROUGE	289	100014
12	17	255-2		8.98	BATON ROUGE	99	100014
121	17	450-92	0.023	0.69	BATON ROUGE	310	100014
122	17	450-92	0.035	1.24	BATON ROUGE	302	100014
123	17	77-5	3.860	22.42	BATON ROUGE	227	100014
124	17	13-4	0.080	5.07	BATON ROUGE	108	100014
125	17	19-1		82.90	BATON ROUGE	185	100014
126	17	817-20	0.750	3.19	BATON ROUGE	103	100014
127	17	19-1		2.42	BATON ROUGE	175	100014
128	17	7-90	5.640	76.65	BATON ROUGE	249	100014
129	17	7-90	5.240	76.25	BATON ROUGE	248	100014
13	17	255-2		10.09	BATON ROUGE	98	100014
130	17	7-90		73.40	BATON ROUGE	244	100014
131	17	7-90	3.300	74.30	BATON ROUGE	245	100014
133	17	450-92	0.034	1.24	BATON ROUGE	303	100014
134	17	450-92	0.036	1.00	BATON ROUGE	306	100014
135	17	450-92	0.035	1.00	BATON ROUGE	305	100014
136	17	254-1	0.610	0.62	BATON ROUGE	76	100014
137	17	450-92	0.035	1.03	BATON ROUGE	304	100014
138	17	13-4	0.140	5.13	BATON ROUGE	110	100014
139	17	13-4	0.210	5.21	BATON ROUGE	111	100014
14	17	250-1		2.49	BAKER	17	100014
140	17	13-4	0.290	5.29	BATON ROUGE	112	100014
141	17	13-4	0.360	5.36	BATON ROUGE	113	100014
142	17	13-4	0.430	5.43	BATON ROUGE	115	100014
143	17	450-92	0.033	0.94	BATON ROUGE	307	100014
144	17	450-92	0.038	0.94	BATON ROUGE	308	100014
146	17	250-1	0.540	0.54	BATON ROUGE	210	100014
147	17	60-1	5.750	5.80	BATON ROUGE	44	100014
148	17	60-1		5.64	BATON ROUGE	43	100014
149	17	450-92	0.020	0.69	BATON ROUGE	309	100014
15	17	255-2	4.250	4.25	BATON ROUGE	49	100014
150	17	450-92	0.026	0.78	BATON ROUGE	311	100014
151	17	450-92	0.027	0.78	BATON ROUGE	312	100014
152	17	817-20		0.78	BATON ROUGE	129	100014
154	17	450-1	1.180	156.03	BATON ROUGE	265	100014
155	17	414-1		2.78	BATON ROUGE	135	100014
156	17	414-1	1.120	1.93	BATON ROUGE	140	100014
157	17	450-1	1.540	156.39	BATON ROUGE	266	100014
158	17	450-1	0.031	156.39	BATON ROUGE	314	100014

Table A4: Roads associated with each intersection (INT_ROADS table). [19 pages]

TSICODE	PARCODE	APPCODE	ROADTYPE	ROADCODE	ROADLOCNAME
1	17	1	LA	64	
1	17	3	LA	64	
1	17	2	LA	964	
1	17	4	LA	964	
10	17	1	LA	67	PLANK ROAD
10	17	3	LA	67	PLANK ROAD
10	17	2			PETTIT ROAD
10	17	4			GROOM ROAD
100	17	1	LA	67	PLANK ROAD
100	17	3	LA	67	PLANK ROAD
100	17	2			MOHICAN STREET
100	17	4			MOHICAN STREET
101	17	1	LA	67	PLANK ROAD
101	17	3	LA	67	PLANK ROAD
101	17	2			LINDEN STREET
101	17	4			LINDEN STREET
102	17	1	LA	67	PLANK ROAD
102	17	3	LA	67	PLANK ROAD
102	17	2			CLAYTON STREET
102	17	4			SHOPPER'S FAIR
103	17	1	LA	67	PLANK ROAD
103	17	3	LA	67	PLANK ROAD
103	17	2			EVANGELINE STREET
103	17	4			EVANGELINE STREET
104	17	1	LA	67	PLANK ROAD
104	17	3	LA	67	PLANK ROAD
104	17	2			LORRAINE STREET
104	17	4			LORRAINE STREET
105	17	1	LA	67	PLANK ROAD
105	17	3	LA	67	PLANK ROAD
105	17	2			SAINT GERARD STREET
105	17	4			SAINT GERARD STREET
106	17	1	LA	67	PLANK ROAD
106	17	3	LA	67	PLANK ROAD
106	17	2			HOLLYWOOD STREET
106	17	4			HOLLYWOOD STREET
107	17	1	LA	67	PLANK ROAD
107	17	3	LA	67	PLANK ROAD
107	17	2			PLANK VILLAGE SHOPPING CENTER
107	17	4			PLANK VILLAGE SHOPPING CENTER
108	17	1	LA	67	PLANK ROAD
108	17	3	LA	67	PLANK ROAD
108	17	2			DAWSON STREET
108	17	4			SERVICE ROAD
109	17	1	LA	67	PLANK ROAD
109	17	3	LA	67	PLANK ROAD
109	17	2			SUMRALL DRIVE
109	17	4			SUMRALL DRIVE
11	17	1	LA	37	GREENWELL SPRINGS ROAD
11	17	3	LA	37	GREENWELL SPRINGS ROAD
11	17	2	LA	408	HOOPER ROAD
11	17	4	LA	408	HOOPER ROAD
110	17	1	LA	67	PLANK ROAD
110	17	3	LA	67	PLANK ROAD
110	17	2			KLEINPETER ROAD
110	17	4			HALSEY DRIVE
111	17	2			COMITE DRIVE
111	17	4	LA	423	THOMAS ROAD
111	17	1	LA	67	PLANK ROAD
111	17	3	LA	67	PLANK ROAD
112	17	2	LA	19	SWAN AVENUE
112	17	4	LA	19	SWAN AVENUE
112	17	1	US	61	SCENIC HIGHWAY

Table A5: Basic engineering report control data (DOC_TOPIC_DATES table) [19 pages]

PARCODE	REQDATE	DNUM	DOCTYPECODE	AUTDATE	DOCDATE	RESDATE	TOPIC	FCODE
17	2/25/92	1	1	3/4/92	3/11/92	4/10/92	TRAFFIC SIGNAL STUDY	405.23
17	11/19/92	1	3	11/19/92	11/20/92	11/20/92	TRAFFIC SIGNAL INSPECTI	405.23
17	1/1/90	1	1	1/16/91	1/16/91	1/31/91	TRAFFIC SIGNAL MODIFIC	405.23
17	8/11/88	1	1	8/11/88	8/15/88	8/15/88	TRAFFIC SIGNAL MODIFIC	405.23
17	3/26/86	1	1	3/26/86	4/16/86	5/2/86	TRAFFIC SIGNAL PEDESTRI	405.23
17	4/12/85	1	1	4/12/85	4/22/85	5/16/85	TRAFFIC SIGNAL (LEFT TU	405.23
17	2/1/83	1	4	2/1/83	3/18/83	4/19/83	LENGTHENING OF LAGGIN	405.23
17	3/20/84	1	3	3/20/84	3/28/84	3/28/84	MODIFICATION OF TRAFFI	405.23
17	1/1/84	1	1	1/1/84	2/21/85	3/7/85	TRAFFIC SIGNAL	405.23
17	4/15/86	1	3	4/15/86	4/15/86	4/15/86	SIGNAL INSPECTIONS	405.23
17	3/26/86	2	1	3/26/86	4/16/86	5/20/86	INSTALLATION OF PEDEST	405.23
17	6/4/87	1	1	6/4/87	6/23/87	7/9/87	TRAFFIC SIGNAL MODIFIC	405.23
17	1/29/90	1	3	1/29/90	1/30/90	1/30/90	TRAFFIC SIGNAL MODIFIC	405.23
17	3/1/89	1	1	3/1/89	3/13/90	3/13/90	TRAFFIC SIGNAL MODIFIC	405.23
17	10/5/92	1	3	10/5/92	10/6/92	10/6/92	SIGNAL INSPECTION	405.23
17	4/13/84	1	1	4/13/84	4/13/84	4/13/84	STRIPING	405.23
17	7/31/84	1	1	7/31/84	9/11/84	9/25/84	LEFT TURN PHASE	405.23
17	10/7/86	1	3	10/7/86	10/8/86	10/8/86	TRAFFIC SIGNAL INSPECTI	405.23
17	3/1/89	2	5	3/1/89	3/15/90	3/15/90	SPAN WIRE SIGN UPGRADE	405.23
17	3/1/90	1	1	3/1/90	3/1/90	3/15/90	TRAFFIC SIGNAL UPGRADE	405.23
17	1/1/90	2	1	1/1/90	1/22/91	2/1/91	SPEED	405.23
17	5/15/91	1	3	5/15/91	5/16/91	5/16/91	TRAFFIC SIGNAL INSPECTI	405.23
17	1/1/91	1	1	1/1/91	7/23/91	8/7/91	ABNORMAL ACCIDENT LO	405.23
17	8/24/92	1	1	8/24/92	9/2/92	9/2/92	TRAFFIC SIGNAL MODIFIC	405.23
17	10/27/92	1	3	10/27/92	10/28/92	10/28/92	MODIFICATION OF TRAFFI	405.23
17	10/10/85	1	1	10/10/85	10/15/85	10/15/85	TIMING CHANGE	405.23
17	11/30/84	1	1	11/30/84	1/15/85	1/29/85	TURN LANES	405.23
17	10/10/86	1	1	10/10/86	10/15/86	10/15/86	"NO U-TURN" SIGNS	405.23
17	5/20/87	1	1	5/20/87	5/20/87	6/3/87	TRAFFIC SIGNAL MODIFIC	405.23
17	12/3/90	1	1	12/3/90	12/5/90	1/9/91	PROTECTED ONLY LEFT TU	405.23
17	5/26/92	1	3	5/26/92	5/27/92	5/27/92	TRAFFIC SIGNAL INSPECTI	405.23
17	12/2/85	1	1	12/2/85	12/6/85	12/6/85	TIMING	405.23
17	1/7/87	1	1	1/7/87	1/14/87	2/4/87	SIGNS AND PAVEMENT MA	405.23
17	5/16/90	1	1	5/16/90	6/1/90	6/1/90	MEDIAN CROSSOVER	405.23
17	12/12/90	1	1	12/12/90	12/12/90	1/29/91	TRAFFIC SIGNAL PROTECT	405.23
17	10/24/91	1	3	10/24/91	10/25/91	10/25/91	TRAFFIC SIGNAL INSPECTI	405.23
17	11/15/88	1	3	11/15/88	11/21/88	11/21/88	TRAFFIC SIGNAL INSPECTI	405.23
17	7/14/88	1	1	7/14/88	7/21/88	8/15/88	PAVEMENT STRIPING (RIG	405.23
17	10/4/89	1	1	10/4/89	10/4/89	11/8/89	TRAFFIC SIGNAL MODIFIC	405.23
17	3/1/89	3	1	3/1/89	3/13/90	3/13/90	TRAFFIC SIGNAL MODIFIC	405.23
17	10/26/90	1	3	10/26/90	10/29/90	10/29/90	TRAFFIC SIGNAL & FLASHI	405.23
17	3/15/91	1	3	3/15/91	3/18/91	3/18/91	TRAFFIC SIGNAL & FLASHI	405.23
17	2/25/87	1	3	2/25/87	2/26/87	2/26/87	TRAFFIC SIGNAL INSPECTI	405.23
17	8/12/88	1	1	8/12/88	8/23/88	9/2/88	PAVEMENT MARKING	405.23
17	8/18/89	1	3	8/18/89	9/8/89	9/8/89	TRAFFIC SIGNAL INSPECTI	405.23
17	3/1/90	2	1	3/1/90	3/1/90	3/1/90	TRAFFIC SIGNAL MODIFIC	405.23
17	5/3/90	1	3	5/3/90	5/7/90	5/7/90	TRAFFIC SIGNAL INSPECTI	405.23
17	8/2/91	1	1	8/2/91	8/7/91	8/7/91	"ST. ISIDORE SCHOOL" SIG	405.23
17	7/23/93	1	3	7/23/93	7/23/93	7/23/93	TRAFFIC SIGNAL INSPECTI	405.23
17	4/5/89	1	3	4/5/89	4/6/89	4/6/89	TRAFFIC SIGNAL INSPECTI	405.23
17	12/11/84	1	1	12/11/84	12/19/84	1/14/85	CURB REMOVAL AND PAV	405.23
17	5/14/84	1	5	5/14/84	1/14/85	1/14/85	TRAFFIC CONTROL CHANG	405.23
17	3/18/86	1	3	3/18/86	3/18/86	3/18/86	TRAFFIC SIGNAL INSPECTI	405.23
17	1/1/88	1	1	1/1/88	8/10/88	8/30/88	TRAFFIC SIGNAL MODIFIC	405.23
17	12/31/87	1	1	12/31/87	2/23/90	2/23/90	TRAFFIC SIGNAL MODIFIC	405.23
17	2/14/91	1	3	2/14/91	2/14/91	2/14/91	TRAFFIC SIGNAL INSPECTI	405.23
17	12/13/84	1	1	12/13/84	1/21/85	2/4/85	STRIPING (ISLAND)	405.23
17	1/31/86	1	1	1/31/86	2/3/86	2/3/86	TRAFFIC SIGNAL MODIFIC	405.23
17	1/28/86	1	1	1/28/86	1/29/86	2/12/86	TRAFFIC SIGNAL MODIFIC	405.23
17	10/10/86	2	1	10/10/86	10/16/86	10/16/86	THERMOPLASTIC STOP BA	405.23
17	4/2/87	1	1	4/2/87	4/9/87	4/27/87	TRAFFIC SIGNAL MODIFIC	405.23
17	2/10/87	1	5	2/10/87	7/10/87	7/10/87	TRAFFIC CONTROL CHANG	405.23
17	11/17/86	1	3	11/17/86	2/25/88	2/25/88	TRAFFIC SIGNAL INSPECTI	405.23

Table A6: Look-up table for document types (DOC_TYPES table). [1 page]

DOCTYPECODE	DOCUMENTTYPE	DOCTYPESHORT
1	ENGINEERING STUDY	ENG_STUDY
2	TRAFFIC SERVICES WORK ORDER	WORK_ORD
3	INSPECTION REPORT	INSP_REP
4	CHIEF ENGINEER'S ORDER	CHIEF_ENG
5	OTHER	OTHER

Table A7: Conclusions from signalized intersection reports (DOC_INT_CONCLUSION table).

[42 pages]

PARCODE	REQDATE	DNUM	TSICODE	CONCLUSION
17	2/1/83	1	6	DO NOT ADJUST TRAFFIC SIGNAL
17	2/1/83	1	6	BUILD LEFT TURN LANES ON LA 19
17	2/1/83	1	6	USE HIGHWAY SAFETY FUNDS TO BUILD LEFT TURN LANES
17	1/1/84	1	6	INCLUDE IMPROVED RADDI CONNECTIONS TO GROOM RD
17	1/1/84	1	6	CLEARANCE WAS INCREASED ON 02/22/85
17	1/1/84	1	6	INCREASE ALL LENSES TO 12" IN DIAMETER
17	1/1/84	2	27	AMBER TIME WAS INCREASED
17	1/1/84	3	91	LENGTHEN LEFT TURN LANES
17	1/1/84	3	91	AMBER TIMING WAS INCREASED
17	1/1/84	3	91	OFFSET LEFT TURN LANES
17	1/1/84	4	103	LEFT TURN PHASE WAS ADDED & INSPECTED ON 12-19-84
17	1/1/84	4	103	PAVEMENT MARKINGS & OVERHEAD SIGNS WERE ADDED
17	1/1/84	5	127	ALL RED PHASES WERE ADDED
17	1/1/84	5	127	ADD STOP BARS
17	1/1/84	5	127	12" RED LENSES WERE ADDED
17	1/1/84	6	185	INCREASE ALL LENSES TO 12"
17	1/1/84	7	253	INSTALL SIGNS
17	1/1/84	7	253	INSTALL 3 PHASE, FIXED TIME, INTERCONNECTED SIGNAL
17	1/1/84	7	253	STRIPE LANES
17	3/20/84	1	14	EXISTING SYSTEM WAS INTERCONNECTED
17	3/20/84	1	14	SIGNAL FACES #1, #4, #7, AND #9 WERE REVISED
17	3/20/84	1	14	FACES 8 AND 10 WERE PROVIDED 12 IN RED INDICATIONS
17	3/20/84	1	14	TIMING WAS MODIFIED
17	3/20/84	1	196	TIMING WAS MODIFIED
17	3/20/84	1	242	EXISTING SYSTEM WAS INTERCONNECTED
17	3/20/84	1	242	TIMING WAS MODIFIED
17	3/20/84	1	6	TIMING WAS MODIFIED
17	3/20/84	1	7	TIMING WAS MODIFIED
17	3/20/84	1	8	TIMING WAS MODIFIED
17	3/26/84	1	29	PREPARE FINAL PLANS
17	3/26/84	1	29	FIND FUNDING SOURCE
17	3/26/84	1	29	DESIGN SIGNAL MODIFICATION AT A FUTURE DATE
17	4/13/84	1	7	REPLACE THERMOPLASTIC TAPE STOP BARS
17	5/14/84	1	164	DIAL II WAS CHANGED
17	5/14/84	1	17	SIGNAL WAS INTERCONN. WITH OTHER SIGNALS ON FOSTER
17	5/14/84	1	17	INTERCONNECT UNIT & 2 DIAL UNITS WERE ADDED
17	5/14/84	1	229	DIAL II OPERATION WAS REVISED
17	5/14/84	1	26	NB/SB "LEFT TURN SIGNAL" SIGNS WERE REMOVED
17	5/14/84	1	90	"ONLY" WAS ADDED TO ALL SINGLE ARROW LANE SIGNS
17	5/14/84	1	91	"ONLY" WAS ADDED TO ALL SINGLE ARROW LANE SIGNS
17	5/16/84	1	60	DO NOT PROVIDE PROTECTED LEFT TURN PHASE
17	7/31/84	1	8	DENY INSTALLATION OF A SEPARATE LEFT TURN PHASE
17	8/28/84	1	78	MAKE STRIPING MODIFICATIONS
17	8/28/84	1	78	INSTALL SIGN #4
17	9/17/84	1	252	INSTALL SIGNAL AFTER CONSTRUCTION ON LA 3064
17	9/17/84	1	252	INSTALL TRAFFIC SIGNAL #252
17	9/17/84	1	252	INTERCONNECT TO ADJACENT SIGNALS ON LA 3064
17	11/16/84	1	63	INSTALL STRIPED CROSSWALK
17	11/16/84	1	63	DO NOT INSTALL PEDESTRIAN SIGNALS
17	11/28/84	1	242	CHECK SIGNAL TO SEE IF IT IS OPERATING PROPERLY
17	11/28/84	1	242	DO NOT REMOVE SIGNAL
17	11/30/84	1	14	INSTALL RAISED PAVEMENT MARKERS
17	11/30/84	1	14	STRIPE LA 423
17	11/30/84	1	14	ADD SPAN WIRE AND GROUND MOUNTED SIGNS
17	11/30/84	1	14	MAKE INSIDE LANE AS SEPARATE LEFT TURN LANE
17	11/30/84	1	14	MAKE OUTSIDE LANE AS COMB. THROUGH AND RIGHT TURN
17	11/30/84	1	9	DESIGN RIGHT TURN ONLY LANE ON OUTSIDE LANE
17	11/30/84	1	9	STRIPE LA 3006
17	11/30/84	1	9	INSTALL AND SIGN RAISED PAVEMENT MARKERS
17	12/11/84	1	17	REPLACE WITH STRIPING & RAISED PAVEMENT MARKINGS
17	12/11/84	1	17	REMOVE EXISTING CONCRETE CURBING

Table A8: Segment of road description (DOC_CSECT_SITES table). [2 pages]

CSECCODE	FMIPOST	TMIPOST	FROM	TO
13-4	0.00	2.59	LA 37 (FOSTER DR.)	US 61 (AIRLINE HWY.)
19-1	81.73	81.75	68TH AVENUE	GOUDCHAUX ST.
19-1	82.50	82.50	0.1 MILE NORTH OF LA 408	0.1 MILE NORTH OF LA 408
19-2	94.49	94.49	MP 94.49	60 FT. EAST OF MP 94.49
19-30	0.80	0.80	GROOM RD.	GROOM RD.
19-30	2.30	8.20	PORT HUDSON RD.	HECH YOUNG RD.
250-1	1.10	1.38	0.2 MILE NORTH OF I-110	0.5 MILE NORTH OF I-110
250-1	2.29	2.29	0.22 MILES S. OF LA 423	0.22 MILES S. OF LA 423
250-1	3.64	6.19	MILEPOST 3.64	MILEPOST 6.19
250-1	3.64	5.44	LA 3006	OLD BAKER- ZACHARY RD.
250-1	3.64	3.64	LA 3006	LA 3006
250-1	10.10	12.10	PRIDE-PORT HUDSON RD.	PRIDE- PORT HUDSON RD.
253-2	0.64	0.64	ZACHARY PLAZA MALL ENTRANCE	ZACHARY PLAZA MALL ENTRANCE
253-2	2.67	2.95	LA 19	1500 FT EAST OF LA 19
253-2	5.30	5.40	750 FT WEST OF LA 67	LA 67
253-2	5.44	5.63	LA 67	1000 FT. E OF LA 67
253-3	5.40	5.58	LA 67	750 FT EAST OF LA 67
253-3	6.55	6.55	TUCKER RD.	TUCKER RD.
253-4	10.30	10.70	JUST WEST OF HUBBS RD.	JUST WEST OF HUBBS RD.
253-4	12.50	13.00	0.25 MILE WEST OF LA 409	0.75 MILE WEST OF LA 409
253-4	13.08	13.08	LA 409	LA 409
254-2	5.83	6.52	RIDGEMONT	N. SHERWOOD FOREST BLVD.
254-2	8.08	8.08	14025 GREENWELL SPRINGS ROAD	14025 GREENWELL SPRINGS ROAD
254-2	9.97	9.97	SHADY PARK DRIVE	SHADY PARK DRIVE
254-2	10.46	10.46	DONNYBROOK AVE.	DONNYBROOK AVE.
254-2	12.61	12.61	OLD WAX RD.	OLD WAX RD.
254-2	13.01	13.01	20120 GREENWELL SPRINGS RD.	20120 GREENWELL SPRINGS RD.
254-2	14.18	14.18	EDNIE LANE	EDNIE LANE
254-2	17.11	17.11	LA 64	LA 64
254-3	17.86	17.86	0.75 MILE N OF LA 64	0.75 MILE N OF LA 64
254-3	18.63	18.76	JIM PRICE RD	0.30 MI NORTH OF PRIDE-BAYWOOD R
254-3	26.90	26.90	38941 GREENWELL SPRINGS RD.	38941 GREENWELL SPRINGS RD.
254-3	31.16	31.16	JUST SOUTH OF EBR/E FELICIANA PAR	JUST SOUTH OF EBR/E FELICIANA PAR
254-4	32.78	32.85	MP 32.78 ON BURBANK	MP 32.85 ON BURBANK
255-1	1.10	1.10	LIFE SAVINGS BANK	LIFE SAVINGS BANK
255-1	2.06	3.06	I-110	LA 67
255-2	7.51	7.74	TANGLEWOOD DR.	LANSDOWNE RD.
255-2	7.57	11.20	MP 7.57	MP 11.2
255-2	8.91	8.98	350 FT SW OF LA 946	LA 946 (JOOR ROAD)
255-2	9.62	9.62	SHOE CREEK RD.	SHOE CREEK RD.
255-30	2.66	3.60	LA 408 (HOOPER RD.)	LA 3034 (WAX RD.)
257-3	0.38	0.41	LA 30	150 FT EAST OF LA 30
257-3	3.49	4.38	LA 42 (HIGHLAND RD)	LA 30
257-4	1.00	1.80	2500 FT SE OF JENNIFER JEAN DR	1000 FT SE OF LEE DR
258-1	9.16	9.72	BROOKHOLLOW DR.	PECUE LANE
258-1	10.67	10.69	I-10	0.1 MILE N OF LA 427
258-1	12.24	12.24	LA 42/LA 948	LA 42/LA 948
258-2	0.45	0.45	IVORY MANAGEMENT LTD.	IVORY MANAGEMENT LTD.
258-2	3.29	4.88	100 FT. EAST OF DAWSON CREEK BRI	LA 3064
414-1	0.96	0.96	LA SHERIFF'S ASSOCIATION DRIVE	LA SHERIFF'S ASSOCIATION
414-1	1.02	1.02	100 FT. NORTH OF TERRACE AVE.	100 FT. NORTH OF TERRACE AVE.
414-1	1.60	1.60	MAGNOLIA MOUND PLANTATION	MAGNOLIA MOUND PLANTATION
414-1	2.76	2.80	LA 327 SPUR (GARDERE LANE)	225 FT SOUTH OF LA 327
414-1	8.09	8.09	LA 327 SPUR	LA 327 SPUR
450-10	0.10	0.40	CONTINENTAL DR.	800 FT. E OF CONTINENTAL DR.
450-10	154.90	168.40	MISSISSIPPI RIVER BRIDGE	ASCENSION PARISH LINE
450-9	154.04	154.90	MISSISSIPPI RIVER BRIDGE	MISSISSIPPI RIVER BRIDGE
450-92	0.00	8.15	I-10	LA 19
450-92	1.61	1.96	LA 3045	N. 19TH ST.
450-92	1.98	2.08	RAMPS (N. 19TH)	RAMPS (N. 21 ST)
450-92	2.34	2.34	LA 67 (PLANK RD.) OVERPASS	LA 67 (PLANK RD.) OVERPASS
450-92	2.96	3.85	JUST SOUTH OF CHIPPEWA ST.	JUST SOUTH OF MOHICAN ST.
454-1	0.00	8.30	I-10	LIVINGSTON PARISH LINE

Table A9: Conclusions from road segment reports (DOC_CSECT_CONCLUSION table). [3 pages]

PARCODE	REQDATE	DNUM	CSECCODE	FMIPOST	TMIPOST	CONCLUSION
17	6/22/89	1	254-3	18.63	18.76	SET SPEED LIMIT TO 45 MPH
17	10/5/89	1	60-2	14.90	19.20	NOTIFY POLICE AUTHORITIES OF SPEEDING VEHICLES
17	10/5/89	1	60-2	14.90	19.20	INSTALL "CROSSROAD" WARNING SIGNS
17	11/13/89	1	253-2	5.44	5.63	INSTALL " NO PARKING ON SHOULDER" SIGNS
17	12/11/89	1	7-90	174.03	174.40	INSTALL "NO PARKING ON SHOULDER" SIGN
17	12/11/89	2	253-4	12.50	13.00	REINSTALL "NO PASSING PENNANT" SIGN
17	12/11/89	2	253-4	12.50	13.00	DO NOT REPLACE "SCHOOL BUS STOP AHEAD" SIGN
17	12/11/89	2	253-4	12.50	13.00	DO NOT LOWER SPEED LIMT
17	1/1/90	18	7-90	174.50	175.13	NOTIFY POLICE OF SPEEDING VEHICLES
17	1/1/90	19	450-92	1.98	2.08	NOTIFY POLICE OF SPEEDING VEHICLES
17	1/1/90	20	414-1	8.09	8.09	INSTALL "NO PARKING ON RIGHT OF WAY" SIGNS
17	1/1/90	22	250-1	2.29	2.29	TAKE ACTION TO ALLEVIATE LOW SKID NUMBERS
17	1/1/90	24	7-8	65.30	66.64	INSTALL CROSSROAD SIGNS
17	1/1/90	24	7-8	65.30	66.64	REFURBISH ROADWAY MARKINGS
17	1/1/90	25	450-92	2.96	3.85	NOTIFY POLICE AUTHORITIES OF SPEEDING VEHICLES
17	1/25/90	1	255-2	9.62	9.62	DO NOT INSTALL NO PASSING PAVEMENT MARKINGS
17	4/18/90	1	817-20	0.51	0.55	INSTALL PAVEMENT STRIPING
17	4/18/90	1	817-20	0.51	0.55	ESTABLISH NO PARKING ZONE
17	5/11/90	1	817-20	0.51	0.55	ONLY EMERGENCY PARKING SHALL BE ALLOWED
17	5/11/90	2	817-20	0.51	0.55	ONLY EMERG PARKING ON LA 30 PAV. SHALL BE ALLO
17	5/14/90	1	258-2	0.45	0.45	DO NOT INSTALL CROSSOVER
17	6/4/90	1	254-2	9.97	9.97	NOTIFY POLICE AUTHORITIES OF SPEEDING VEHICLES
17	6/4/90	1	254-2	9.97	9.97	DO NOT PROVIDE NO PASSING STRIPING
17	6/12/90	2	254-2	10.46	10.46	NOTIFY POLICE AUTHORITIES OF SPEEDING VEHICLES
17	6/12/90	2	254-2	10.46	10.46	DO NOT PROVIDE NO PASSING MARKINGS
17	6/25/90	1	253-4	10.30	10.70	DO NOT INSTALL "SCHOOL BUS STOP AHEAD" SIGN
17	6/25/90	1	253-4	10.30	10.70	INSTALL MISSING "NO PASSING ZONE" PENNANT
17	6/25/90	1	253-4	10.30	10.70	DO NOT LOWER SPEED LIMIT
17	6/25/90	1	253-4	10.30	10.70	DO NOT INSTALL GUARDRAIL
17	6/25/90	1	253-4	10.30	10.70	INSTALL CHEVRON ALIGNMENT SIGNS THRU REVERSE
17	6/25/90	1	253-4	10.30	10.70	NOTIFY POLICE AUTHORITIES OF SPEEDING VEHICLES
17	6/25/90	1	253-4	10.30	10.70	DO NOT INSTALL CROSSWALK MARKINGS
17	6/26/90	2	817-16	15.30	15.50	INSTALL "ADVANCE PEDESTRIAN" SIGNS
17	6/26/90	2	817-16	15.30	15.50	ESTABLISH 35 MPH SPEED LIMIT
17	6/26/90	2	817-16	15.30	15.50	FIX SPEED LIMIT AT 45 MPH
17	7/9/90	1	253-2	5.30	5.40	FIX SPEED LIMIT AT 45 MPH
17	7/9/90	1	253-3	5.40	5.58	FIX SPEED LIMIT AT 45 MPH
17	7/9/90	1	60-2	14.59	14.87	DO NOT LOWER SPEED LIMIT
17	7/9/90	2	77-4	11.84	15.73	NOTIFY POLICE AUTHORITIES OF SPEEDING VEHICLES
17	7/17/90	1	258-2	3.29	4.88	DO NOT LOWER SPEED LIMIT
17	7/17/90	1	258-2	3.29	4.88	INSTALL "NO PARKING ON SHOULDER" SIGN
17	8/6/90	1	454-1	4.00	4.00	NOTIFY POLICE AUTHORITIES OF SPEEDING VEHICLES
17	8/12/90	1	254-4	32.78	32.85	DO NOT INSTALL FLASHING BEACON OR GUARDRAIL
17	8/12/90	1	254-4	32.78	32.85	INSTALL 25 MPH "CURVE" WARNING SIGN
17	8/12/90	1	254-4	32.78	32.85	SET SPEED LIMIT TO 35 MPH
17	8/14/90	1	817-16	15.30	15.50	INSTALL SIDE ROAD WARNING SIGNS
17	8/17/90	3	60-2	6.35	6.60	DO NOT INSTALL NO PASSING PAVEMENT MARKINGS
17	8/17/90	3	60-2	6.35	6.60	INSTALL "NO PARKING ON RIGHT OF WAY" SIGNS.
17	8/31/90	2	7-90	71.70	71.80	DO NOT REDUCE SPEED LIMITS FOR TRUCKS
17	9/27/90	1	450-10	154.90	168.40	DO NOT REDUCE SPEED LIMITS FOR TRUCKS
17	9/27/90	1	450-9	154.04	154.90	DO NOT REDUCE SPEED LIMITS FOR TRUCKS
17	9/27/90	1	450-92	0.00	8.15	DO NOT REDUCE SPEED LIMITS FOR TRUCKS
17	9/27/90	1	454-1	0.00	8.30	INSTALL "SCHOOL BUS STOP AHEAD" SIGN
17	9/28/90	1	254-3	26.90	26.90	LIMIT PARKING ON SERVICE ROAD TO EMERG. SITUAT
17	10/3/90	1	7-90	71.70	71.80	ESTABLISH 30 MPH SPEED LIMIT
17	10/17/90	1	817-35	0.00	0.33	INSTALL 15 MPH TURN WARNING SIGNS E OF W.HIGHW
17	10/17/90	1	817-35	0.00	0.33	REPAIR OR UPGRADE GUARD RAIL
17	10/22/90	1	817-4	5.00	5.00	DO NOT PROVIDE CROSSOVER
17	11/8/90	2	254-2	8.08	8.08	SET SPEED LIMIT TO 30 MPH
17	11/16/90	1	817-35	0.00	0.33	INCREASE SPEED LIMIT TO 45 MPH
17	12/3/90	2	77-5	19.44	21.03	SET SPEED LIMIT TO 45 MPH
17	12/10/90	2	257-4	1.00	1.80	

Table A10: Document notes (DOC_NOTES table). [9 pages]

PARCODE	REQDATE	DNUM	NOTES
17	1/1/84	1	INTERSECTION LISTED ON '83 ABNORMAL ACCIDENT L
17	1/1/84	1	REQUEST DATE WAS ASSUMED TO BE 01-01-84
17	1/1/84	2	LOCATION LISTED ON ABNORMAL ACCIDENT LIST FOR
17	1/1/84	3	LOCATION LISTED ON ABNORMAL ACCIDENT LIST FOR
17	1/1/84	3	REQUEST DATE WAS ASSUMED
17	1/1/84	4	LOCATION LISTED ON ABNORMAL ACCIDENT LIST FOR
17	1/1/84	4	DOCUMENT TYPE WAS A MEMO
17	1/1/84	4	REQUEST DATE WAS ASSUMED
17	1/1/84	5	REQUEST DATE WAS ASSUMED
17	1/1/84	5	LOCATION LISTED ON ABNORMAL ACCIDENT LIST FOR
17	1/1/84	6	LOCATION LISTED ON ABNORMAL ACCIDENT LIST FOR
17	1/1/84	7	LOCATION LISTED ON ABNORMAL ACCIDENT LIST FOR
17	3/20/84	1	6 INTERSECTIONS WERE REFERENCED
17	3/20/84	1	NO FURTHER EXPLANATIONS WERE GIVEN
17	3/26/84	1	REPORT DUE TO NEED TO LENGTHEN LEFT TURN LANE
17	4/13/84	1	REQUEST DATE WAS ASSUMED
17	5/14/84	1	LETTER FROM DEP. OF PUBLIC WORKS TO MR. BUCKLE
17	12/17/84	1	LETTER FROM DEPT. OF PUBLIC WORKS TO TOM BUCK
17	12/17/84	1	REQUEST DATE IS EARLIEST DATE FOUND IN LETTER
17	12/26/84	1	REQUEST DATE WAS ASSUMED
17	1/1/85	1	REQUEST DATE WAS ASSUMED
17	1/1/85	1	LOCATION LISTED ON ABNORMAL ACCIDENT LIST FOR
17	1/1/85	2	LOCATION LISTED ON ABNORMAL ACCIDENT LIST FOR
17	1/1/85	2	DOCUMENT TYPE WAS A MEMO
17	1/1/85	2	REQUEST DATE WAS ASSUMED
17	1/1/85	3	DOCUMENT TYPE WAS A MEMO
17	1/1/85	4	LOCATION LISTED ON ABNORMAL ACCIDENT LIST FOR
17	1/1/85	4	REQUEST DATE WAS ASSUMED
17	1/1/85	5	REQUEST DATE WAS ASSUMED
17	1/1/85	5	LOCATION LISTED ON ABNORMAL ACCIDENT LIST FOR
17	1/1/85	6	LOCATION LISTED ON ABNORMAL ACCIDENT LIST FOR
17	1/1/85	7	LOCATION LISTED ON ABNORMAL ACCIDENT LIST FOR
17	1/1/85	8	LOCATION LISTED ON ABNORMAL ACCIDENT LIST FOR
17	1/1/85	9	LOCATION LISTED ON ABNORMAL ACCIDENT LIST FOR
17	1/4/85	1	REQUEST DATE WAS ASSUMED
17	1/9/85	1	REQUEST DATE WAS ASSUMED
17	1/18/85	2	REQUEST DATE WAS ASSUMED
17	1/28/85	1	REPORT INCLUDED 4 INTERSECTIONS IN ASCENSION P
17	2/4/85	1	REPORT SUBMITTED DUE TO CLOSURE OF WB LEFT TU
17	4/8/85	1	REQUEST DATE WAS ASSUMED
17	4/26/85	1	REPORT SUBMITTED DUE TO CONSTRUCTION OF INTE
17	4/26/85	2	REQUEST DATE WAS ASSUMED
17	4/26/85	3	REQUEST DATE WAS ASSUMED
17	4/26/85	3	REPORT INCLUDED INTERSECTION IN ASCENSION PARI
17	4/26/85	3	REPORT SUBMITTED DUE TO MUTCD
17	5/7/85	2	REQUEST DATE WAS ASSUMED
17	6/4/85	1	REPORT SUBMITTED DUE TO OBSERVED NEED
17	6/7/85	1	REPORT ALSO INCLUDED INTERSECTION IN ASCENSIO
17	7/1/85	2	REQUEST DATE WAS ASSUMED
17	8/13/85	1	REQUEST DATE WAS ASSUMED
17	8/13/85	1	REPORT SUBMITTED IN RESPONSE TO AN OBSERVED N
17	8/16/85	1	REQUEST DATE IS EARLIEST DATE MENTIONED IN LET
17	8/16/85	1	LETTER FROM DEPT OF PUBLIC WORKS TO TOM BUCK
17	8/27/85	1	REPORT INCLUDED 2 INTERSECTIONS IN ASCENSION P
17	9/3/85	2	REQUEST DATE WAS ASSUMED
17	9/3/85	2	DOCUMENT TYPE WAS A MEMO
17	9/9/85	1	REQUEST DATE WAS ASSUMED
17	9/20/85	1	REQUEST DATE WAS ASSUMED
17	9/23/85	1	REPORT SUBMITTED DUE TO CONSTRUCTION PROJECT
17	11/12/85	2	REPORT SUBMITTED DUE TO CONTRUCTION
17	11/12/85	2	REQUEST DATE WAS ASSUMED
17	11/12/85	3	REPORT SUBMITTED DUE TO NEED
17	11/12/85	3	REQUEST DATE WAS ASSUMED

APPENDIX B

PAPER REPORT COVER AND TRACKING FORM

LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT

PLANNING DIVISION

REPORT COVER AND TRACKING FORM

(See reverse for instructions)

DOCUMENT TYPE:	CONTROL DATES:	FILING CODE: ________
Engineering Study ☐	Request ___/___/___	TOPIC:
Traffic Services Work Order ☐	Authorization ___/___/___	____________
Inspection Report ☐	Document ___/___/___	____________
Chief Engineer's Order ☐	Response ___/___/___	____________
Other ____________ ☐		

SITE DESCRIPTION:

Route: I- ☐ US ☐ LA ☐ ________ Local name ____________

Control ☐☐☐ Section ☐☐

At ____________ TSI Code ☐☐☐☐☐

From ____________

To: ____________

Milepost (MP) From ________ To ________

City ________ Parish ________ ☐☐☐ District ☐☐

DOCUMENT CONCLUSIONS:

1) ____________
2) ____________
3) ____________
4) ____________
5) ____________
6) ____________
7) ____________
8) ____________
9) ____________

NOTES:

1) ____________
2) ____________

INSTRUCTIONS

(Reverse of Report Cover and Tracking Form)

Most fields are self explanatory. Those that may need additional explanation are briefly described below.

DOCUMENT TYPE: Kind of report that is being indexed. Only one field can be checked off. Note that request letters, response letters and most internal memos are considered to be part of the process of report production and, therefore, no separate field for them is defined.

CONTROL DATES: Dates used to track document development. When reports are finished and sent out, all date fields should have been completed. The following dates are defined:

- Request: Date in which the document was requested.
- Authorization: Date in which document was assigned for action.
- Document Date in which document was finalized and signed.
- Response Date in which document was sent out (usually accompanied by a cover letter or memo).

Examples:

1) Signal request:

Request date:	Date on the letter of request.
Authorization date:	Date the request was entered at the District Traffic Office.
Document date:	Date the report was finished and signed.
Response date:	Date of the response back to the requester.

2) If the request was approved, a work order document is then created:

Request date:	Response date from the traffic study.
Authorization date:	Date that the request is entered as a work order.
Document date:	Same as the authorization date.
Response date:	Date of the completion notice.

3) A speed study was requested, and a speed change recommended and approved. A Chief Engineer's Order document is created:

Request date:	Response date from the traffic study.
Authorization date:	Same as the document date.
Document date:	Date the order was finalized and signed.
Response date:	Date the order was filed in the parish clerk of courts office.

FILING CODE: Folder filing code number: 405.23, 407.1707, etc..

TOPIC: Very short description of the main report topic. It should not exceed 40 characters in length.

ROUTE: It refers to the state maintained road to which the report is being attached. The appropriate road type (I-, US, or LA) must be checked off. The blank refers to the road number (for example, 67, if the report refers to LA 67). LOCAL NAME refers to the local name of the road (for example, Plank Road, if the report refers to LA 67 in Baker). If the report refers to a signalized intersection in which more two or more state roads are involved, the attachment must follow criteria customarily used by DOTD. If both roads are LA roads, the road with the lowest number is selected. If one of the roads is a US road, it must be selected. In general, US roads have priority over LA roads, and I- roads have priority over US roads.

CONTROL, SECTION: Control-section code associated with ROUTE.

AT: Very short description of a specific location along the control-section. It should not exceed 40 characters in length. If the location involves a sector along the control-section, FROM and TO must be used instead of AT.

LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT

PLANNING DIVISION

REPORT COVER AND TRACKING FORM

(See reverse for instructions)

DOCUMENT TYPE:		CONTROL DATES:		FILING CODE: 405.23
Engineering Study	■	Request	12 / 14 / 93	TOPIC:
Traffic Services Work Order	☐	Authorization	12 / 14 / 93	Signs
Inspection Report	☐	Document	12 / 17 / 93	
Chief Engineer's Order	☐	Response	12 / 17 / 93	
Other ______	☐			

SITE DESCRIPTION:

Route: I- ☐ US ☐ LA ■ 67 Local name Plank Road

Control 0 6 0 Section 0 1

At LA 408 (Hooper Road) TSI Code 0 0 1 4 7

From ______

To: ______

Milepost (MP) From ______ To ______

City Baton Rouge Parish East Baton Rouge 0 1 7 District 6 1

DOCUMENT CONCLUSIONS:

1) Install "Stop Ahead" sign
2) Install "Speed Limit" signs
3) Install Chevron alignment signs
4) ______
5) ______
6) ______
7) ______
8) ______
9) ______
10) ______

NOTES:

1) ______
2) ______

LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
PLANNING DIVISION
REPORT COVER AND TRACKING FORM
(See reverse for instructions)

DOCUMENT TYPE:		CONTROL DATES:		FILING CODE: 413.17
Engineering Study	☒	Request	12 / 11 / 89	TOPIC:
Traffic Services Work Order	☐	Authorization	12 / 11 / 89	Speed Limit Study
Inspection Report	☐	Document	12 / 21 / 89	Signing
Chief Engineer's Order	☐	Response	01 / 16 / 90	
Other ______	☐			

SITE DESCRIPTION:

Route: I- ☐ US ☐ LA ☒ 64 Local name ______

Control 2 5 3 Section 0 4

At ______ TSI Code ☐☐☐☐☐

From 0.25 miles west of LA 409

To: 0.75 miles west of LA 409

Milepost (MP) From 12.5 To 13.0

City Indian Mound Parish East Baton Rouge 0 1 7 District 6 1

DOCUMENT CONCLUSIONS:

1) Reinstall "No Passing" pennant sign
2) Do not replace "School Bus Stop Ahead" sign
3) Do not lower speed limit
4) ______
5) ______
6) ______
7) ______
8) ______
9) ______
10) ______

NOTES:
1) ______
2) ______

APPENDIX C

PROCEDURE FOR DATA CONVERSION BETWEEN ACCESS AND ORACLE

The procedure described below summarizes the steps needed to convert tables back and forth between ACCESS and ORACLE. This procedure was required because the use of special drivers turned out to be unfeasible.

ACCESS TO ORACLE

This procedure is very simple. It involves exporting the table from ACCESS in .WKS format, and then typing a single command line at the DOS prompt after loading ORACLE:

A. In ACCESS

1) In the File menu, choose Export.

2) In the Export dialog box, choose the .WKS format (when the .WK1 format is chosen, ACCESS actually creates a .WKS file with a .WK1 extension). By the way, ORACLE also accepts files in .WK1 format, as well as DBASE files. ACCESS can also export tables in DBASE format, but the process of importing such tables into ORACLE is not straightforward, involving, in general, several steps.

B. In ORACLE

1) Make sure ORACLE is mounted. If not, type ORACLE at the DOS prompt.

2) If the table being imported already exists in ORACLE, it may be convenient to make a backup copy of such table:

- Go to SQLPLUS.
- Type RENAME tablename TO tablename_BACK.
- Quit SQLPLUS.

3) At the DOS prompt, type 123PREP [-option] user/password tablename.WKS. See the ORACLE Database Installation and User's Guide (page 11-9) for more information on valid options.

4) ORACLE automatically detects date/time data, and stores it in DD-MON-YY format (e.g., 10-FEB-86).

ORACLE TO ACCESS

This procedure is more complicated because ORACLE's exporting capabilities are very limited. It involves storing the results of a query in a file using SQL*PLUS, editing the file, and then importing the edited file to ACCESS with the Fixed-Width format option:

A. <u>In ORACLE'S SQL*PLUS</u>

1) Take note of the data type definition of all columns. This will be needed in ACCESS. Type DESCRIBE tablename (for example, DESCRIBE INT_MILEPOST)

2) Set the page size to a number slightly higher than the total number of records to be queried. Type SET PAGESIZE 1150 (for example, if the total number of records is 1140). This way, the editing process will be simplified.

3) Set the line size to a number slightly higher than the total number of columns to be created in the file. Keep in mind that ORACLE automatically defines a space between columns and that, unless titles and headers are formatted, the width of each column is the same as the width specified in the data type definition.

4) Type SPOOL filename.LST (for example, SPOOL INT_MILE.LST)

5) Type the query (for example SELECT * FROM INT_MILEPOST)

6) Type SPOOL OFF to stop spooling information to the file.

B. <u>In a Text Editor (Usually the MS-DOS Editor)</u>

1) Take note of the column numbers associated with the beginning and ending of all columns in the file. Use actual records as reference. Do not use the headers as reference because they are occasionally misplaced.

2) Delete all non-data records, including column headers. If the page size was defined correctly, there should be only two groups of lines to be deleted: one group at the beginning of the file, and the other one at the end of the file.

3) Save the file.

C. <u>In ACCESS</u>

1) In the File menu, choose Import.

2) In the Import dialog box, choose Text (Fixed Width).

3) Select the file to be imported (for example INT_MILE.LST), and choose Import to open the Import Text Options window.

4) In general, a new table is created. If this is the case, select Create new table. Do not select OK yet.

5) Choose Edit specs... to open the Import/Export Setup window.

6) In file type, choose the DOS or OS/2 option.

7) In text delimiter, choose {none}

8) In field separator, choose {space}

9) Define all the fields in the same order as they appear in the edited file. Note that the field width refers to the actual column width and does not include the space between columns. Data type equivalence is straightforward, except Date/Time. As mentioned, the ORACLE format for Date is DD-MON-YY (e.g., 25-FEB-92). ACCESS supports this format, but not when importing data. An easy solution to this problem is to choose Text for those fields containing Date/Time data and later on, when the table has been imported, to go to Table Design and change their data type to Date/Time.

10) Save the specifications by clicking on Save As and defining a name. Choose OK twice to go back to the Import Text Options window.

11) MAKE SURE that the specification name is the one that was just saved. Then click OK.

APPENDIX D

EXAMPLE OF POPULATION OF TRAFFIC SIGNAL INVENTORY TABLES FOR INTERSECTION 288

INT_ROADS

TSICODE	PARCODE	APPCODE	ROADTYPE	ROADCODE	ROADLOCNAME
288	17	1	LA	73	JEFFERSON HIGHWAY
288	17	2			BARRINGER ROAD
288	17	3	LA	73	JEFFERSON HIGHWAY
288	17	4			BARRINGER-FOREMAN ROAD

INT_WIDTH_NLANE

TSICODE	PARCODE	APPCODE	DATE	APPRWIDTH	NAPPRLANE	EXITWIDTH	NEXITLANE
288	17	1	09/19/90	12	1	12	1
288	17	2	09/19/90	20	2	20	1
288	17	3	09/19/90	12	1	12	1
288	17	4	09/19/90	10	1	10	1

INT_SPEED_LIM

TSICODE	PARCODE	APPCODE	DATE	SPEEDLIMIT
288	17	1	09/19/90	55
288	17	2	09/19/90	30
288	17	3	09/19/90	55
288	17	4	09/19/90	45

INT_PHASE_FLOW

TSICODE	PARCODE	APPCODE	DATE	PHASECODE	FLOW
288	17	1	09/19/90	1	L
288	17	1	09/19/90	6	TR
288	17	2	09/19/90	8	TR
288	17	3	09/19/90	2	TR
288	17	4	09/19/90	4	TR

INT_PHASE_SEQUENCE

TSICODE	PARCODE	DATE	PHASECODE	SEQUENCE
288	17	09/19/90	2	1
288	17	09/19/90	6	1
288	17	09/19/90	4	2
288	17	09/19/90	8	2
288	17	09/19/90	1	3
288	17	09/19/90	6	3

INT_LEFT_TURN_STATUS

TSICODE	PARCODE	DATE	APPCODE	STATUS
288	17	09/19/90	1	PP
288	17	09/19/90	2	U
288	17	09/19/90	3	U
288	17	09/19/90	4	U

INT_SIGN_INVENTORY

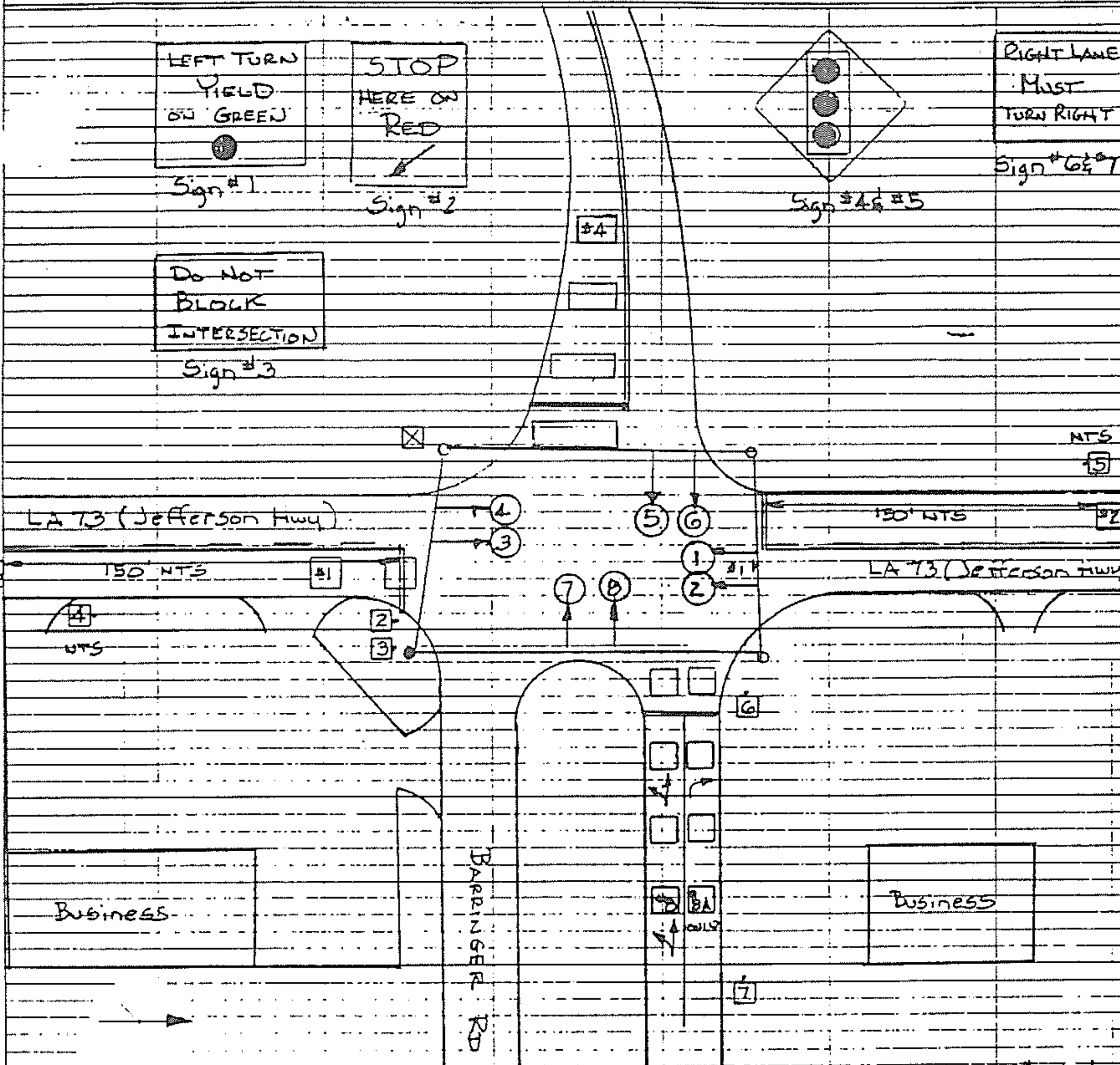
TSICODE	PARCODE	APPCODE	DATE	SIGNCODE	NUMBERSIGN
288	17	1	09/19/90	W3-3	1
288	17	1	09/19/90	R10-6	1
288	17	1	09/19/90	R10-7	1
288	17	1	09/19/90	R10-12	1
288	17	2	09/19/90	R3-7 R	2
288	17	3	09/19/90	W3-3	1

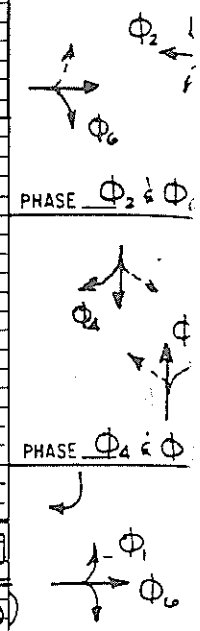
LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT

TRAFFIC AND PLANNING SECTION

TRAFFIC SIGNAL INVENTORY

CONTROL SECTION 0 7 7 0 4 HIGHWAY NO. 0 0 7





PHASE Φ2 & Φ6

PHASE Φ4 & Φ

PHASE Φ1 & Φ

PHASE ___

SHOW NORTH ARROW — SKETCH OF INTERSECTION — SCALE 1" = 40'

PHASE ___

LEGEND

○	WOOD POLE	⊠	CONTROLLER		OVERHEAD SIGNAL & NO.		OVERHEAD SIGN & NO.
●	METAL POLE		SKIP LINE		GROUND MOUNTED SIGN & NO.		PEDESTAL SIGNAL & NO.
○—○	SPAN WIRE		SOLID LINE		PARALLEL PARKING STALLS		MAST ARM SIGNAL & NO.
	SIGNAL FACE & NO.		STOP LINE		ANGLE PARKING STALLS		EXISTING SPEED LIMITS
	PEDESTRIAN SIGNAL & NO.		CROSS WALK	NP	NO PARKING		LA 73 - 55 MPH
	PRESSURE DETECTOR		BUILDING AREA	NPAT	NO PARKING ANYTIME		BARRINGER RD - 30 MPH
	MAGNETIC DETECTOR		TURN RESTRICTIONS:	NPLZ	NO PARKING LOAD ZONE		BARRINGER FOREMAN RD - 45
⊗	RADAR DETECTOR	NLT	NO LEFT TURN	NPHTC	NO PARKING HERE TO CORNER		
	SONIC DETECTOR	NRT	NO RIGHT TURN	NPBS	NO PARKING BUS STOP		
	LOOP DETECTOR	NT	NO TURNS, ETC		NO PARKING 4-6PM, 7-9AM, ETC.		

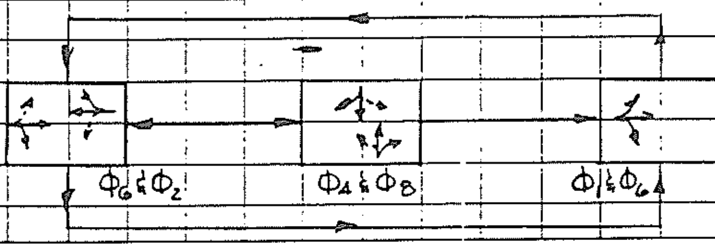
Remarks ______

INTERSECTION LA 73 (Jefferson Hwy) @ Barringer - Foreman Rd (DESJR.BE) NO. 0 0 2 8 E

DISTRICT 61 PARISH East Baton Rouge 0 1 7 CITY Baton Rouge 0 9 5

TYPE SIGNAL Volume Density V D DATE Sept 19 1990 0 9 1 9 9 0

SIGNAL FACE NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	G	Y	R				G/G	G/Y	G						Y	EMERGENCY FLASHING OPERATION
2	G	Y	R				G	G	G						Y	
3	G	Y	R												Y	
4	G	Y	R												Y	
5				G	Y	R									R	
6				G	Y	R									R	
7				G	Y	R									R	
8				G	Y	R	R/G	R/Y	R						R	
9																
10																
11																
12																
13																
14																
15																
16																



TIME	
SEC.	
%	
SEC.	
%	
SEC.	
%	

CONTROLLER TIMING DATA

FUNCTION	PHASE A	B	C
ARTERY MINIMUM			
INITIAL INTERVAL			
VEHICLE INTERVAL			
MAXIMUM INTERVAL			
CLEARANCE INTERVAL			
PEDESTRIAN INTERVAL			
PEDESTRIAN CLEARANCE			
RECALL SWITCH			
OTHERS			

DIAL NO. ____
TOTAL CYCLE LENGTH ____ SEC

DIAL NO. ____
TOTAL CYCLE LENGTH ____ SEC

DIAL NO. ____
TOTAL CYCLE LENGTH ____ SEC

SIGNAL FACE INDICATIONS

FACE NO.	2 thru 7							
TOTAL	6							
LENS LEGEND	R 12, Y 12, G 12							

LENS LEGEND: R RED, Y YELLOW, G GREEN, ARROW (SHOW COLOR), WALK, WAIT, DON'T WALK, " LENS, " LENS

PEDESTRIAN SIGNALS

SHOW OTHERS: face #1: R 12, ←Y 12, Y 12, ←G 12, G 12; face #8: R 12, Y 12, Y→ 12, G 12, G→ 12

REMARKS: INSTALL TRAFFIC SIGNAL, LOOPS, SIGNS & PAVEMENT MARKINGS. REMOVE FLASHING BEACON 3/12/9

INSPECTED 11/10/92

FORM TSI-1

APPENDIX E

GLOSSARY

Attribute: Property or descriptor associated with an item or relation.

Attribute table: Set of attributes and corresponding records associated with an item or relation. Any subset of attributes that allows the user to uniquely identify records in the table is called a candidate key. One of such subsets is usually selected as the table primary key.

Control-Section: Unique identifier assigned to all sections of roads maintained by the state.

Database schema: Description of the database.

Field: Space in a record used for storing values associated with the corresponding attribute.

Form: Layout created to facilitate data entry and/or query for one or several related tables.

Georeferencing: Process of linking an object with its geographic location.

GIS: Geographic Information System.

Integrity constraints: Conditions imposed on a database to ensure data consistency and quality. The basic constraints used in this project were: (1) candidate key values must be unique for every record; (2) primary key values cannot be null; and (3) only one-to-many relationships between pairs of tables are allowed. This means that two tables can be related only if the common attributes used to establish the relationship between the tables are the same attributes which constitute the primary key of one of the tables.

Log mile: Location of an object on a road segment, obtained by measuring a longitudinal distance (approximately along the center line) from a predefined reference point.

Normal form: Structure of an attribute table so that it complies with a predefined set of desirable features. In this project, the Boyce-Codd normal form (Ref. 3) was used to ensure that all non-key attributes in a table were functionally dependent on the primary key of the table.

Query: Set of operations required to retrieve data from a database.

Relational database: Type of database composed of a set of attribute tables and a set of integrity constraints.

SQL: Structured Query Language used to define queries in a database.

TSI code: Traffic Signal Inventory code used to uniquely identify signalized intersections.