SCHOOL OF
CIVIL ENGINEERING

INDIANA
DEPARTMENT OF HIGHWAYS

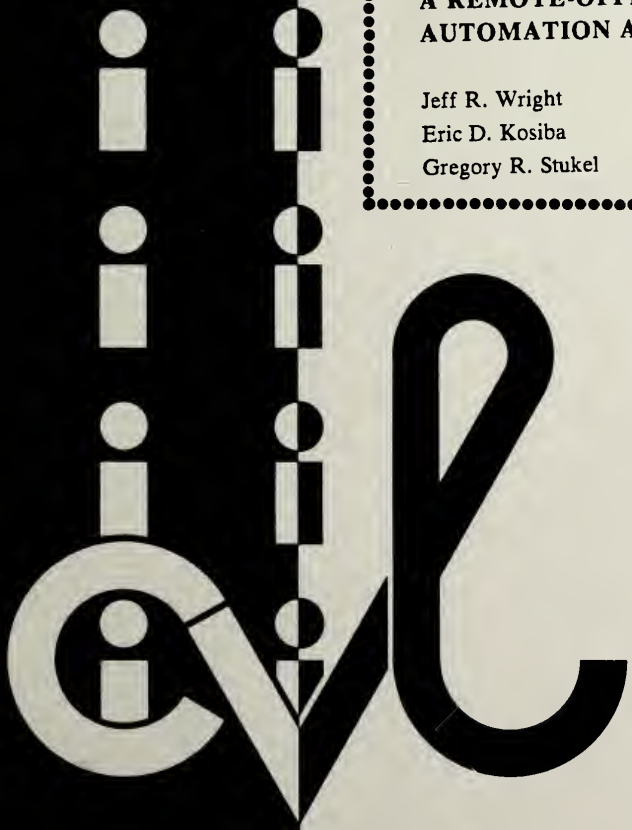
JOINT HIGHWAY RESEARCH PROJECT

JHRP-86/23

Final Report

A REMOTE-OFFICE AUTOMATION ANALYSIS

Jeff R. Wright
Eric D. Kosiba
Gregory R. Stukel



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FINAL REPORT

A REMOTE-OFFICE AUTOMATION ANALYSIS

by

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Joint Highway Research Project
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Purdue University

in cooperation with the
Indiana Department of Highways

Purdue University
West Lafayette, Indiana

December 10, 1986
August 4, 1987, Revised

PURDUE UNIVERSITY

SCHOOL OF CIVIL
ENGINEERING

FINAL REPORT

December 10, 1986
August 4, 1987, Revised

To: H.L. Michael, Director
Joint Highway Research Project

From: J. R. Wright
Research Engineer

File: 9-11-23
Project: C-36-67X

Please find the attached copy of the final report entitled, "A Remote Office Automation Analysis" presenting the results of the JHRP project by the same title. The report has undergone two separate revisions with review comments by IDOH personnel incorporated into this, the final version.

Thank you for the opportunity to conduct this research and to make a positive contribution to the work of the JHRP.

Respectfully Submitted,

JEFF R. Wright

Jeff R. Wright
Research Engineer

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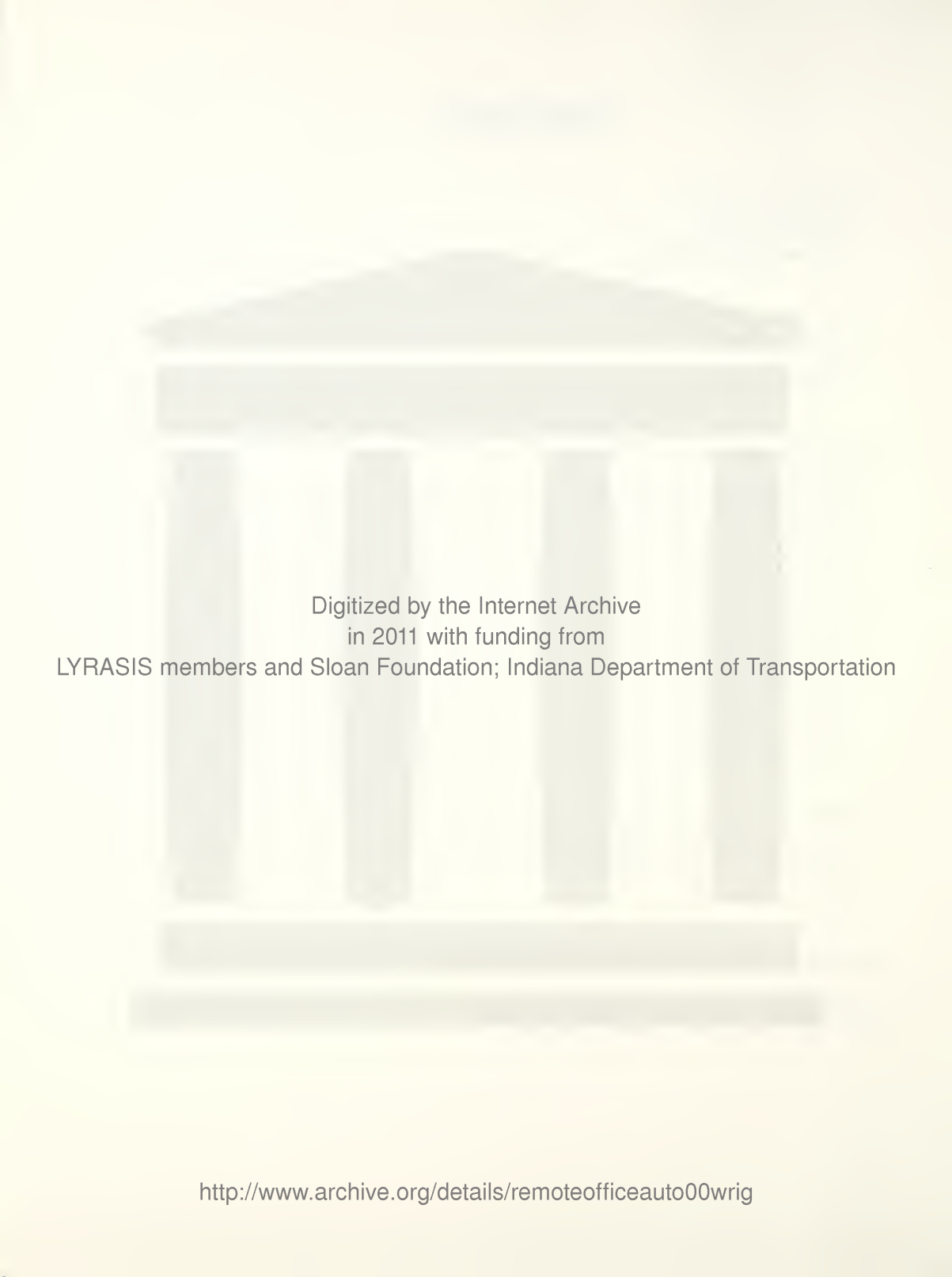

1. INTRODUCTION AND SCOPE

1.1 Background

This report presents the results of a year long study aimed at identifying alternative strategies for automating remote-office (district and Sub-district) information collection and handling within the Indiana Department of Highways (IDOH). Originally presented to the Joint Highways Research Project (JHRP) Board in December, 1986, the draft report has undergone two revisions following review by key IDOH personnel and administrative groups. In particular, detailed review comments by Mr. Bill Bonning and Mr. Tom Stuper, both of IDOH Data Services, have greatly influenced this final report.

The nature of information handling within IDOH but outside of the central office has developed in response to the needs of dedicated and sincere workers trying to serve the State of Indiana in the highest and best possible way. The breadth of services provided by IDOH is vast and most of these services require a large level of information management and processing. Until very recently, information flow and data handling in support of these activities have been accomplished completely *by hand.*

Spawned by the concerns of IDOH Data Services Personnel together with IDOH staff throughout the State, office automation technology, much of which has been used for some time at the central office, is finding its way to the remote offices. Looking toward the future of information management within IDOH, Data Services distributed to each district during 1986, one or more personal computer (PC) systems configured as shown in Table 1. Each of these systems was installed as a stand-alone workstation at fairly central locations within each office. Initial training of individuals at each office was initiated and a *PC user's group* was formed. This distribution was intended not as a means of completely satisfying the needs for office automation, but rather as a preliminary "experiment" to see how this technology would be received by IDOH district staff.

TABLE 1: District Office PC Configuration

HARDWARE	SOFTWARE
IBM PC/XT Microcomputer	PC-DOS 3.1 Operating System
-8088 Processing Chip	Fixed Disk Organizer
-8087 Math Coprocessor	IBM Filing Assistant
-640KB RAM Memory	IBM Reporting Assistant
-10 MB Fixed Disk Storage	IBM Graphing Assistant
-360 KB Floppy Disk Drive	IBM Planning Assistant
-EGA Graphics Card	Lotus 1-2-3 Spreadsheet
IBM Enhanced Color Monitor	IBM Displaywrite
Epxon Dot Matrix Printer	PARADOX DBMS
IBM Quietwriter Printer	KEDIT File Editor

Early in 1986, Data Services supported a proposal for the present study to help give direction to this spread of office-automation technology to remote sites first, by identifying the nature and extent of information handling activities at remote locations, and second by attempting to define alternative approaches to automate those systems. This report presents the findings of that study. A general summary of important results is presented in the next section of this Chapter. Chapter 2 describes the methodology followed in collecting data and presents an important set of preliminary observations about information management throughout IDOH at the outset of the project. The results of the study are presented in Chapter 3 referenced to a complete set of information system profiles included as an Appendix to this report. The final chapter of the report —Chapter 4— presents some recommendations for future study and action.

1.2 Summary of Results

Results and recommendations from this study fall into two categories: 1) recommendations for automating existing remote-office information systems as an evolutionary extension of the existing hardware/software system (Chapter 3); 2) recommendations for revolutionary changes in information management with implications for IDOH central office computer protocols (Chapter 4). The first category is satisfies the original research objectives of this project while the second extends beyond the original scope of work. While a much larger effort, the authors support the revolutionary approach. A general listing of all results/recommendations is presented below.

1. Some 84 separate information systems are routinely used by IDOH personnel at remote office locations. Relatively few of these presently use any form of office automation (section 2.3).

2. Each of these 84 information systems could be automated to different degrees and with different levels of effort (time & cost) using the PC-based hardware and software configurations recently provided by Data Services to each district (section 3.3).

3. Serious problems would be expected to result from an approach to automation that would use these systems as models for their automated counterpart (section 3.4).

4. A better approach to remote-office automation would be to design a set of larger loosely coupled data bases that would be distributed at an appropriate level throughout IDOH and that would provide much more comprehensive information access and management (section 4.1).

5. Positions should be created for computer staff persons located at remote offices who can administer remote hardware and software systems in concert with central office personnel and who can provide training and support for users (section 4.2).

6. Incentives should be provided to IDOH remote-office personnel to learn and use computer technology to increase overall decision-making efficiency and effectiveness (section 4.3).

2. THE NEEDS SURVEY

2.1 Introduction

The goals of this research were 1) to understand and document how information is handled at IDOH district and sub-district offices, 2) describe the information systems presently in use, 3) expose those information systems that would benefit from automation, and 4) suggest new ways in which information already gathered, coupled with new automated systems tools, could improve decision making processes throughout IDOH.

Managing the quantity of information that is being collected in the IDOH is complex. What is required is an understanding of what information is being gathered, and why, and a working knowledge of who should be allowed access to this information, and in what form. While general district operations are essentially the same throughout Indiana, the importance placed on these tasks and the methods and personnel used vary significantly.

The method used to capture this information was to conduct informal interviews with representatives of all sections in every district office, and at least one subdistrict office in each district. A wide range of personnel was interviewed from top-level managers to clerical staff and skilled workers. This provided insights as to the views not only of those responsible for the content of information used at remote locations, but of those who actually collect and handle that information. We learned of the willingness of some IDOH personnel to use computers as well as reasons for the reluctance on the part of some others.

This study began with a series of interviews with IDOH central office management personnel representing six divisions within the IDOH: 1) Administration, 2) Construction, 3) Development, 4) Maintenance, 5) Material and Testing, and 6) Traffic. The central office interviews were followed by individual site visits to the district offices located at Vincennes, Seymour, Fort Wayne, Greenfield, Crawfordsville, and LaPorte. Personnel interviewed at each district office ranged from departmental secretaries to the District Engineer. The goal of the visits was to gain an understanding of how information was processed and what type of information was being used at the district and subdistrict office in administering the overall mission of IDOH.

Each site visit began with a general meeting with the District Engineer and each section head. This meeting served to introduce the reasons for the visit and allow for the

planning of the interviewing agenda. The informal interviews in each section were conducted over 1-week period. District and subdistrict personnel described their individual job functions and were allowed to express a "wish list" of tools that would make their jobs easier or better. Through these interviews, an overall picture of what information is required to maintain the IDOH was obtained, as well as possible avenues for system improvements.

2.2 Methodology

Initially, the scope of this study was restricted to information systems presently in place at remote offices. The goal was to provide recommendations for the appropriate level of automation (both hardware and software) only for existing systems. To evaluate the computer needs of the IDOH it was first necessary to know what information was being collected, and why, and to compare these needs relative to the *best* modes of operation, both automated or non-automated, for each information system. A three-step procedure was followed:

STEP 1: Categorizing and Describing Existing Systems

Exhaustive interviews were scheduled and conducted throughout the state to obtain a true perspective on the type and quantity of information used in the daily administration of IDOH activities. Through this process, some 250 IDOH personnel were questioned at virtually all levels of the agency. Careful records of these interviews were synthesized into descriptions by functional area. Each functional area was thus able to be described by a set of *information systems.*

STEP 2: Identifying Information Flow

Once the systems were identified, it became necessary to find where the information is collected, who needs the information, who can use the information to support decisions, and in what form. This is imperative as the information flow within a system will likely influence the hardware and software requirements. Therefore, the information flow of each information system was noted.

STEP 3: Developing Information System Profiles

For each information system identified, a brief report called a "profile", was drafted. Each profile presents a general description of the information system including the purpose, information flow, central office interface, existing forms, and additional remarks. In all cases, information profiles were identified through observation made during the site visits; they were not an attempt to explain the current systems outlined in IDOH manuals or presently in use.

Preliminary profiles were sent to each district office, reviewed by district personnel, and returned. With additional input from the districts the final profiles accurately describe district and subdistrict activities. The resulting information system profiles are appended for reference. Each profile describes an information system currently in use

within the IDOH, and represents a target for potential automation over a wide range of computer support, from a dedicated micro computer to remote access on an existing central computer. An important result of this study was this categorization and description of the information systems being used by IDOH.

It should be noted that each of these systems identified was labeled without consideration for labels presently use by IDOH. Hence while these information system names may commonly be used to describe a specific function within IDOH, the reader should assume no direct relationship between the information system label and these functions.

2.3 Summary of Initial Observations

The interviews described in the previous section took place over a 2-month period during Summer 1986. From the outset, several important initial observations were made and continually reinforced as additional site visits were made. The more important of these impressions are presented to reflect a general perspective on the state of information management at that point in time:

1. **Existing hardware and software systems are used (almost) exclusively for data entry.** For the most part, personnel in the district and subdistrict were very open, encouraging and provided extremely thoughtful comments. In each case, negative comments about the existing computer system resulted because of the feeling that information management did not benefit local operations. While most district personnel interviewed were not computer educated, they seem willing to learn new systems; particularly if these systems are shown to save time, or improve decision making. Reluctance and skepticism on the part of some workers was usually traced to some previous negative experience with computers or discouragement at having to do data entry with no perceived purpose. Generally, district personnel view computer work as extra, or duplicate work, as keypunched data are often followed by written verification.

2. **Data collected at remote sites have little or no influence on decision making at those sites.** It is also important to educate district personnel on all levels in the capability of any new system and allow for district use. Information often sent to the central office could be readily used in the districts and subdistricts to improve statewide decision making. This computer hesitancy could be eased if the district personnel reap a direct benefit from their efforts. For instance, Crew Day Cards are now being entered into the central office mainframe at the district offices, yet district personnel have little use of this information, and serve only as central office keypunch and check. They could, however, make use of this information in a reasonable monthly or weekly form. The crew day card system should return to the district a timely, automated report as a benefit of the keypunch effort.

3. **There is currently a large amount of redundant paperwork being done throughout the IDOH.** A good example of paperwork redundancy is in the IDOH development department's Billboard Inventory. The highway beautification act specifies that roadside billboards be inventoried every six months. Central office sends each district two copies of an inventory report - one copy is updated directly in the field, the other remains at the district office. The second copy is used to make "neater" corrections on the inventory printout. The second copy is sent to the central office where a development division secretary pages through the report, copying each billboard update on a separate computer form. The computer forms are sent to data entry personnel and entered in the computer. This example demonstrates three areas where data can be misentered; when data are transferred from the field copy to the second copy, when data are transferred to the computer form, and when the data are entered in the computer. There are many such systems in the IDOH including the crew day card system and the construction daily reports.

4. **The PC equipment that has been recently been placed at the district offices is being used very different across districts.** Last year each district received two IBM PC XT's. While each district has had a few users who have taken to the machines, the districts of Crawfordsville & LaPorte have taxed the machines to their fullest, and in some cases require a rigid 1/2 hour interval time schedule to allow users time on the machines. PC usage in the districts seems to be proportional to the previous PC experience of the district personnel. The result of these constraints is that some divisions in each district have received adequate computer exposure, and have developed many PC applications, while others have not.

5. **Information flow between districts is minimal, and best served by non-automated means.** At all levels of district work, inter-district communication was not significant enough to warrant a high level of automation. Most communication seemed to deal with informal trading or loaning of equipment and materials and is best served by the present mode: the telephone. While an IDOH bulletin board system could be used to support inter-district communication, a special effort in this vein would probably not be cost effective.

6. **The potential for cost savings through increasing the overall efficiency of information management is large though most of these savings would result from intangibles.** The main goal of the IDOH is to provide a high level of service to Indiana residents. While financial responsibility is important, it is also desirable to increase the level of service to the State. A primary result of efficient automation is large increases in system performance. For instance a roadway history is currently being kept in each district that includes information on large maintenance and construction contracts. If this system were to be automated, the capacity for storing and retrieving this information would increase dramatically. The capability to store information such as daily maintenance activities and accident and signal histories as well as large maintenance and construction contracts could be

incorporated.

The cost savings become apparent when the applications are explored. One possible use of a central, complete roadway history is as a pavement management tool. By knowing the composition of a stretch of road, as well as it's maintenance history, it would be possible to better study the construction of new roadways and a more durable road would save the State immeasurably.

Another application of a complete roadway history could be to answer legal interrogatories. If this system could produce complete roadway reports, time would be saved scouring files for such information, as well as increase the professional appearance of these reports. If only one lawsuit is averted or won due to a sophisticated data management capability, the system could be financially worthwhile. Another possible avenue of improvement is in interdepartment communications. There are several documented cases of roadway paving soon after painting or installing raised pavement markers. Installing a computer calendar, where all projects from each division are entered and updated might prevent such an occurrence and save expensive repainting, or reinstallation of the markers.

A related benefit of automation would be in public perception. Subdistricts report large time delays in the issuance of oversize/overweight permits due to inefficient system design. If this system was efficiently automated, and the public served faster, this would have a direct positive impact on the public and departmental view of IDOH efficiency.

It should be noted that, in most cases, these intangible benefits would result not from automating existing information systems but from the implementation of new ones. For example, there is no present formal mechanism for interdepartment exchange of work scheduling information. This would require a new information to be designed and implemented, perhaps using some form of automation.

3. SURVEY RESULTS AND DISCUSSION

3.1 Synthesis of Survey Results

The methodology described in a previous section of this report (section 2.2) resulted in the identification and documentation of some 84 separate information systems. A profile of presenting important features of each information system was prepared and are provided as an appendix to this report. In developing *profiles* for these systems, six evaluation parameters were established: 1) mode of use; 2) information backup and recovery requirements; 3) system security requirements; 4) computer time requirements; 5) auditability; and 6) data integrity. Each of these parameter will be discussed prior to the presentation of specific results.

1. MODE OF USE: This parameter addresses the way in which a particular user might best interact with a computer-based information system. Mode of use reflects a presupposed level of understanding and experience on the part of the user as well as having implications for the hardware and software required to support that user mode. Five (5) levels or modes of system use have been identified for purposes of this study:

    1. **No Automation**—Some information systems are best left non-automated either because the expense of any level of automation would not be cost effective, or because automation would tend to isolate the decision maker from the system. For example, the final construction record (see Appendix) should not be automated; compiling and finalizing this report serves to familiarize the construction with the complete history of the project. In automating this report preparation process, this familiarization might be lost. However, many of the reports included within the final construction report such as daily, weekly and monthly status reports should indeed be automated.

    2. **Local Stand-Alone Computer**—There are many instances where stand alone computer applications would enhance day-to-day activities without the need to transfer data to or from the computer being used. These activities would best be served by a centrally located stand-alone (micro)computer. For example many materials test analyses could be done by single-purpose

programs running on personal computers.

3. **Local DBMS**—An important consideration in the optimal design of an automated information management system is the location of data. A well thought out protocol must be established for who will have overall responsibility for the "true" data set; particularly in cases where the possibility of more than one copy of the data at different locations is possible. For some information systems, it is clear that the the best location for the *master* data set is the remote location. For others, a central location is optimal. For example, on-line inventory data would best be maintained at the districts, while budget and accounting data should reside at the central office.

4. **Local CPU with Remote Data Access**—Even if the actual data reside at the central office, those data may be needed by models and applications at the district offices. When local analyses requires remote data, those applications might best be served by a local CPU that can access and "download" data from a remote host. For example, information on State-wide road closures might be needed by users at a Sub-district office for purposes of issuing an oversized vehicle permit.

5. **Remote Data Input/Access Only**—In many cases, a remote workstation might simply be used to request information from a central computer (either at the central office, or a CPU located in the district office) or for routine data entry. This is the mode of use presently employed at district offices throughout IDOH.

Mode of use is only one parameter that should be considered in determining the appropriate end-of-line hardware best suited to automate a given information system. In many cases one type of hardware can be used to function in more than one mode. A personal computer, for example, might be configured for modes 2 - 4.

2. BACKUP & RECOVERY REQUIREMENTS:

If information is collected, that information is considered important and should either be protected against loss, or some mechanism should be provided to insure that, if loss occurs, the information can be recovered. However, some information is more "important" than other information. Because information backup (providing multiple and possibly archived copies of data) has a real cost, the importance of data for particular information systems should be considered in any hardware and software specification. Information backup considerations are complicated by the fact that data frequently has a lifetime, and its importance typically changes over that lifetime. Some data might only be important for a short period of time but loss of data during that time might be severe. Other data might not be particularly important, but might potentially be needed for a long period of time. In considering the level

of backup required for any particular type of information, one must consider the costs of recovering those data vs. potential costs of not being able to do so. For purposes of this study, three levels of backup importance have been established:

HIGH: Extremely important data that must be recovered within a very short time of being lost.

MEDIUM: Data are important, but loss would not be catastrophic, or recovery, though expensive, would always be possible.

LOW: If lost, information would not need to be recovered, or recovery of information would not be expensive.

3. SYSTEM SECURITY: Related to the inherent importance of information is the concern that some information might require special access restrictions. For example, personnel data such as wage and salary histories should have access privileges only for those individuals whose jobs require that information. Like backup considerations, data security is specific for each data set used. For example, inventory data may properly be copied and read by a large group of individuals but only changed by a privileged few. Again, three security levels have been identified for this study:

HIGH: Permission to view the data restricted to a select few. Permission to edit the data restricted to that individual responsible for the integrity of the data.

MEDIUM: Software and/or administrative measures are sufficient to control read/copy access to the data or read/copy access unrestricted. Edit permission restricted to that individual responsible for the integrity of the data or his designate.

LOW: Read/copy access to data unrestricted. Edit permission not an issue.

4. COMPUTER ACCESS TIME: Careful consideration in the design of an information system should be given to the amount of use that system should expect. System performance must be viewed relative to the number and/or frequency of transactions or data/query processes. If a quantitative estimate of system use can be developed, the number of terminals or computers can be determined. Efficient automation will, itself, cause shifts in system use. The numbers presented in the following tables reflect our estimate of maximum hours/day computer/terminal use for each information system. Because some information systems would require intense computer/terminal use for only a few days each month or quarter, the overall estimate of stations required by IDOH division is conservative. In addition, because some functions are performed by different divisions at different district offices, aggregating levels of use across districts is somewhat speculative.

5. AUDITABILITY: Some information systems require a high level of "auditability"; the ability to trace the data to their origins or to the individual responsible for some type of authorization relative to the information. Auditability is particularly important for transactions involving monetary exchange. While security issues pertain to limits of data access, auditability is concerned with identifying individuals who must be associated with specific data. Three levels of auditability have been defined:

   HIGH: Accountability must be traceable to the individual with responsibility; authorization.

   MEDIUM: Accountability may be traced to working group or division. Can be used to verify or monitor data collection, transfer or analysis.

   LOW: Not an issue as information is temporary or task specific.

6. DATA INTEGRITY: This refers to the accuracy, completeness and/or correctness of the information at the time that information is used in a decision-making activity. This can range from information that MUST be accurate, complete and correct at the time of input, to data where one or more of these factors may not be important or will be "caught" somewhere down the line. Integrity is particularly complex where multiple copies of a data set must be used at separate locations. It must emphasized that while technologies are available to insure integrity of information, these technologies are expensive and should be used sparingly. Three categories of information integrity have been specified:

   HIGH: Data must be accurate, complete and/or correct prior to use in all circumstances.

   MEDIUM: Inaccurate, incomplete and/or incorrect information will be caught and corrected when failure to do so will cause significant expense.

   LOW: Accuracy and completeness is not important and incorrect data will be caught and corrected when failure to do so will cause significant expense.

3.2 Information Systems Tables

An evaluation of important information systems at district and Sub-district IDOH offices (by division) are presented in this section of the report. The information system tables (Tables 2 - 8) summarize the design criteria for automating each information system profile. Included are the aforementioned parameters; modes of use, backup and recovery, security, time of use required, auditability, and data integrity for each profile. It should be noted that these are are not the only parameters to be considered; adequate software design in support of each information system is assumed.

3.2.1 Administration Information Systems

The administration office in the districts serves to coordinate district activities and disburse instructions from the central office. This makes this division unique in that they can serve as an assembling point for all data coming in and out of the district. A summary of criteria for automating Administration information systems is presented in Table 2.

An important consideration in designing the automated information systems is the "ownership" of the data. That is, who is responsible for the data and who updates and makes decisions based upon this data. The mode of use will define data ownership. For instance, affirmative action reports, safety records, personnel records, payroll records, and Administration's inventory would be best served by granting ownership of the data to the Administration division. It is also important for each of these systems to allow data retrieval by other users. Therefore, the best mode of operation would be a local DBMS owned and controlled by Administration with links to central office and other divisions.

Another important consideration when discussing the mode of use for an automated information system is the importance of data access or data communication. For instance, inventory management, utility bill management, and payroll vouchers are systems that require Administration input, yet other divisions or central office should retain control over the data. In this case, a local CPU with a data link would best serve the IDOH.

An important change should be incorporated into any automated inventory management system. Presently all inventories are kept at the central office and are updated annually or bi-annually in the districts. A more efficient system would allow local control over the inventories, allowing each division to keep a running inventory which is periodically sent to Administration and central office. Therefore, the administrative control would be a local CPU with data access, while each division would "own" it's inventories and have a local DBMS with data transfer.

Many systems do not require district administrative inquiry. For example, the district serves to only collect and pass along information contained in the requisition, vehicle control, and petty cash systems. Administration does not have any use for this information on a routine basis except to enter the information and to check the validity of the information. It would, therefore, be preferable to design the system to be used for remote data input and access only.

It is important to note several systems which are indigenous to each division. These are payroll, vehicle control, requisitions, and inventories. Just as in the case of inventory management, payroll should be checked by administration. Each division should continue to submit pay vouchers to administration. Administration would serve as keypunch and check, and could use this information locally in the form of payroll records. The system could be broadened to include personnel records and safety records as well as payroll records.

Table 2: ADMINISTRATION INFORMATION SYSTEMS

Information System	M	B	S	T	A	I
Inventory Management	4	M	M	3	H	H
Affirmative Action	3	L	M	1/2	M	L
Utility Bill Management	4	M	M	1	H	H
Safety Records	3	M	H	1	M	M
Personnel Records	3	H	H	3	H	H
Payroll Records	3	H	H	4	H	H
Fuel Inventory	4	M	H	2	H	H
Petty Cash	5	M	H	1/2	H	H
Payroll	4	H	H	2	H	H
Vehicle Control	5	L	L	2	M	M
Requisition	5	M	H	3	H	H
Inventory	3	M	H	1	H	H

M - Mode of use:
1 = No automation recommended
2 = Local dedicated CPU
3 = Local DBMS with data transfer
4 = Local CPU with data access
5 = Remote data input/access

B - Backup & Recovery:

S - Security:

T - Time of use: (hours per day)

A - Auditability:

I - Integrity of data:

L - Low concern

M - Medium concern

H - High concern

An important consideration is backup and recovery of administrative systems. For instance, it is very important that payroll records are not lost or corrupted. Therefore, when designing an automated payroll system, special care should be taken to insure that the data can be recovered. Opposite of the payroll system would be the vehicle control system. If the weekly vehicle updates were lost this could easily be recovered with the next weeks vehicle update.

Administration routinely works with sensitive information systems. Safety, personnel, and payroll records are all systems where security is a prime concern. Access to these systems should be limited and password protected.

For each administration information system an estimate of the maximum daily usage was made. Inventory management, requisitions, personnel records, and payroll were seen as systems that would require the most computer time on their busiest days. With full automation, it is estimated the the heaviest computer use day of any month would require some 23 person hours within the Administrative division of the average district. Assuming 8-hour work days, 3 computer stations (total keyboards) would be sufficient to carry this maximum load.

The ability to audit system additions and deletions is critical on many administrative systems. Inventory management, personnel records, payroll records, utility bill management, fuel and equipment inventories, and petty cash records must be designed such that all transactions can be monitored and audited.

For many of the administrative systems, it is important that data residing in different offices concur. Inventories, personnel records, payroll records, and all requisitions must agree between offices. It is imperative that data integrity be a strong concern for these administrative systems.

3.2.2 Construction Information Systems

The construction office in the districts serve to coordinate all contracted maintenance and construction projects. Included is the creation of all contract agreements as well as daily reports and contractor correspondence, which monitor construction progress. A summary of Construction information systems at remote offices is presented in Table 3.

As mentioned earlier, one of the important benefits of automation is the extraction of progress reports out of a local DBMS. One system that would clearly benefit from such automation is the daily, weekly, and monthly construction progress reports. With a local DBMS with data transfer, much time would be saved by combining these systems and allowing for the extraction of these reports. The reports would be more accurate and would allow inclusion of other items of concern to the construction engineer, such as comments and contractor correspondence as well as a copy of the contracts and subcontracts themselves.

Most of the information in construction systems are easily reproduced. Therefore, while there must be a backup protocol, it is not a major concern. One exception would be in the case of extra work agreements and contracts. It is important that these are not

Table 3: CONSTRUCTION INFORMATION SYSTEMS

Information System	M	B	S	T	A	I
Monthly Project Reports	3	M	L	1/2	M	M
Final Construction Record	1	-	-	-	-	-
Contract Correspondence	1	-	-	-	-	-
Extra Work Agreements	3	H	M	1	H	H
Daily Reports	3	M	L	3	M	M
Contract Completion Reports	4	M	M	1/2	M	M
Subcontracts	3	M	L	1	M	L
Contractor Performance	3	L	H	1/2	M	H
Inspector Assignment	2	L	L	1/2	L	-
Weekly Project Reports	3	M	L	1	L	L
Payroll	1	-	-	-	-	-
Vehicle Control	5	L	L	1/2	L	L
Requisition	5	M	H	1	H	H
Inventory	3	M	H	1/2	H	H

M - Mode of use:
1 = No automation recommended
2 = Local dedicated CPU
3 = Local DBMS with data transfer
4 = Local CPU with data access
5 = Remote data input/access

B - Backup & Recovery:

S - Security:

T - Time of use: (hours per day)

A - Auditability:

I - Integrity of data:

L - Low concern
M - Medium concern
H - High concern

lost or corrupted, and therefore there must be periodic backups programmed into an automated contract system.

Another area of equal importance to the design of a secure system, is the proper design of an "un-secure" or public system. Many construction systems should be designed so security is relaxed enough such that any interested IDOH employee can access information of interest. Such is the case of the daily, weekly, and monthly reports. If it is necessary to check on the progress of a project, or the next scheduled activity, this information should be accessible. Therefore, the system should be designed with security as a low concern. On the other hand, contractor performance is a sensitive report that should only be seen by authorized employees. This system would rate security as a high concern.

Properly automated, construction would increase efficiency such that time dedicated to each of these systems is minimal. The time required to complete contracts, weekly reports, monthly reports, and contract completion reports would be almost insignificant. However, in order to automate the project progress reports, a concerted effort must be made to compile and enter all daily progress reports. The estimated daily usage reflects this fact. A conservative estimate for the maximum computer time requirement for automating these systems is 10.5 person hours per day.

While many of the construction systems should be accessible enough to extract reports, there should be designed into many systems auditability measures. For instance, contractor performance reports, extra work agreements, and contract completion reports, should include an accounting routine to keep track of who is responsible for editing these documents. For the contractor performance systems and extra work contracts it is an important concern that data residing in different locations be consistent. All contract wording should agree in both the district offices and central office. Therefore, an important feature of such a system is assurance of data integrity.

3.2.3 Development Information Systems

The Development Office plays a very diverse roll in the district. Included is the responsibility for the approval of driveway permits, for all survey work done by the district, for simple intersection design, for maintaining a roadlife history, and for public relations and communications. Another vital function of the Development Office is the co-ordination of many engineering functions. Development most often requires input for their projects from other divisions, and supplies input to other divisions and central office. A summary of important information systems within this division together with considerations for automation are presented in Table 4.

Development is unique in that many of it's activities do not have to be communicated to central office. The results of survey operations and engineering calculations need to be communicated, but the calculations do not. For such systems a local dedicated CPU would be the best mode of automation.

Many of Developments systems are inventories by nature. There is a billboard inventory, a bridge log, and a railroad crossing inventory, as well as equipment

Table 4: DEVELOPMENT INFORMATION SYSTEMS

Information System	M	B	S	T	A	I
Roadlife Log	4	H	L	4	H	L
Bridge Log	3	L	L	1/2	L	M
Permits	3	H	M	1	H	M
Billboard Inventory	3	M	L	1	H	H
Railroad Crossing Inventory	3	M	L	1	L	M
Survey Operations	2	M	L	4	M	L
Design Operations	2	L	L	4	M	L
Public & Utility Information	2	L	L	1	M	L
Right of Way Inventory	4	H	L	1	M	H
Payroll	1	-	-	-	-	-
Vehicle Control	5	L	L	1/2	L	L
Requisition	5	M	H	1	H	H
Inventory	3	M	H	1/2	H	H

M - Mode of use:
1 = No automation recommended
2 = Local dedicated CPU
3 = Local DBMS with data transfer
4 = Local CPU with data access
5 = Remote data input/access

B - Backup & Recovery:

S - Security:

T - Time of use: (hours per day)

A - Auditability:

I - Integrity of data:

L - Low concern

M - Medium concern

H - High concern

inventories common to each division. As discussed before, it is imperative that these inventories are "owned" and controlled by Development, and the communication of the information is automated. Therefore, a local DBMS with data transfer is preferred.

An important benefit of district automation is the inclusion of a complete roadlife log. Presently Development keeps a chart of major roadway contracts. Once the system is automated, regular roadway and signal maintenance may be added to the data bank. This roadway history would best be served by giving "ownership" of the data to the central office, but allowing data access and input to a local district CPU.

Several of Development's systems require important backup protocols. The roadlife log, the driveway permits, and the right of way inventory would best be subject to frequent data backups, as accurate and timely information is vital.

As Development is often a service organization for the other divisions, many of the information systems in Development should be easily accessed by the other divisions. The roadlife log, as well as Development's many inventories should be "public" systems available for use by the required or interested IDOH employee.

As with the other divisions, system use will fluctuate according to the important activity of the day. It is easily foreseeable that, with appropriate engineering software, the demand for design operations will peak as a design is due, and might take full use of a dedicated CPU for as many as four hours in a given day. Similarly, both surveying software and the roadway history could keep a dedicated CPU busy as long, as applications become apparent. Maximum month-day use within the Development division is estimated at 19.5 hours.

The ability to audit the permit system and the billboard inventory is important, as both systems involve the issuance of public licenses, and involve the public trust. As the importance of the roadlife log increases to include roadway and signal maintenance, the importance of the log's audit will increase. It will become imperative to be able to track the person responsible for the data, or the data entry.

Data integrity becomes crucial to an inventory when an inventory supports the decision making process. The right of way inventory supports surveying operations as well as design operations and, therefore, the accuracy of the data must be assured.

Similarly, the billboard inventory can be used to determine dismantling orders and legal liability for the billboard. Thus, data residing in central office and the district Development office must concur.

3.2.4 Maintenance Information Systems

The Maintenance Division[1] in the district office plays an important role in managing all district Maintenance activities. Included is the responsibility for the Maintenance

Management System, the Preventive Maintenance System, the Pavement Management System, and the Winter Transfer Employee System. Many of these systems require extensive input from each subdistrict in the form of manhour reports and work progress. This lends itself well to automation; information gathered by the subdistrict for central office can easily be put into meaningful district reports. Relevant parameters for automation of Maintenance division information systems are presented in Table 5[2].

district maintenance keeps several important inventories. In addition to maintenance equipment inventories there are the Building and Grounds Inventory and the Bridge Inspection Log. As is the case of most other IDOH inventories, the best mode of operation for these systems would include local control of the systems with a local DBMS with data transfer.

Maintenance Management should become controlled at the district level. Presently, this is passed from the central office to the district in the form of a budget book. An automated Maintenance Management System would enable the district offices to retrieve data from subdistrict Crew Day Cards and make comparisons of work accomplished versus work planned.

Similarly, it would be feasible to control the Preventive Maintenance System at the district office. Preventive Maintenance would be more timely, and the level of service to district vehicles and equipment would improve. Of course, the information contained in the system might be needed in central office as well as in each subdistrict office. Therefore, the best mode of operation would be a local DBMS with data transfer.

There are several systems in which backup and recovery are important. As the districts become responsible for these systems, special care must be considered for backup and recovery. If the data for the Preventive Maintenance System and the Maintenance Management System is to be kept in the district, special steps should be taken to ensure this data are not lost.

Security of district maintenance systems is not a vital concern. Further, it might be appropriate to allow access to these systems to most district personnel.

The Preventive Management System and the Maintenance Management System are seen as the most computer intensive systems, in terms of time. With automation, the Maintenance Management System would be a powerful tool that could be used by several different maintenance engineers for many different purposes. At least two

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1 Recall that "Maintenance" and "Sub-district" are separate entities for purposes of this study while in actuality, Sub-districts are administered by the Maintenance divisions of each district.

2 A separate computer-based "Maintenance Management System" has been ongoing in support of the activities of this division for the past several years. The present software for this system resides on the mainframe computer in the IDOH central office. The information systems presented in Table 5 are in no way connected to the program elements of that system. It is hypothesized that automation of many of the systems presented in that table would duplicate the tasks being designed into the present effort.

Table 5: MAINTENANCE INFORMATION SYSTEMS

Information System	M	B	S	T	A	I
Preventive Maintenance System	3	H	M	4	M	M
Crew Day Cards	4	M	L	1	M	H
Winter Transfer Employee Report	3	M	L	1	M	H
Building & Grounds Inventory	3	M	L	1	L	M
Bridge Inspection Log	3	L	L	2	M	L
Maintenance Management	3	H	M	3	M	H
Pavement Management	3	L	L	1	L	L
Payroll	1	-	-	-	-	-
Vehicle Control	5	L	L	1/2	L	L
Requisition	5	M	H	1	H	H
Inventory	3	M	H	1/2	H	H

M - Mode of use:
1 = No automation recommended
2 = Local dedicated CPU
3 = Local DBMS with data transfer
4 = Local CPU with data access
5 = Remote data input/access

B - Backup & Recovery:

S - Security:

T - Time of use: (hours per day)

A - Auditability:

I - Integrity of data:

L - Low concern

M - Medium concern

H - High concern

computer stations would be required to handle the maximum-use day each month in the Maintenance division and it is anticipated that proportionally more high-use days would occur in this division than in most others.

Maintenance systems are not as sensitive to intentional or unintentional abuses, and therefore, auditability is not a major concern. There are several systems in which data integrity becomes significant. The Winter Transfer Report, the Maintenance Management System, and Crew Cay Cards all contain information that must be consistent wherever the data resides.

3.2.5 Materials and Test Information Systems

The logistics of sample management for the IDOH is complex. Samples must be taken for each material used on IDOH projects and then be tested and analyzed at various locations in the State before the material is approved. Approval of the samples must be timely as construction may wait for testing results. Thus, system efficiency becomes significant. A summary of important factors in automating information systems within the materials and testing division is presented in Table 6.

Sample analysis, like engineering calculations, can be easily automated and are best served by a local dedicated CPU. This system can include a test report generator which would report the results to central office if required. With this system enhancement, a local DBMS with data transfer would be best.

The independent assurance system and aggregate certification could be automated so data could be retrieved from the central office and the systems monitored by the interested party. This would, of course, require a local CPU with data access.

It is important that all materials and tests be accounted for. Therefore, independent assurance tests, sample management, and all test reports must be backed up regularly. These tests cannot be lost. The security of these systems are not a major concern. Interested employees should be allowed access to tests of interest.

Material analysis and test reports presently take the most time within the Material and Test office. This would continue to be the case, as the systems are better automated. Peak system use each month is anticipated to be 12 person-hours.

The nature of the tests would imply that auditability be a major concern when automating these systems. The originator of all test reports, aggregate certification tests, and independent assurance tests must be noted.

It is important that the results of any sample tests be consistent wherever the data may reside. Data located in the central office must concur with the results in the districts, and, therefore, data integrity takes an important role in designing Material and Test's systems.

Table 6: MATERIALS & TESTING INFORMATION SYSTEMS

Information System	M	B	S	T	A	I
Aggregate Certification	4	H	M	1	H	H
Material Sample Management	3	H	M	2	H	H
Independant Assurance System	4	H	M	1/2	H	H
Site Inspector Assignment	2	L	L	1/2	L	L
Test Reports	3	H	M	2	H	H
Material Analysis	2	M	L	4	H	L
Payroll	1	-	-	-	-	-
Vehicle Control	5	L	L	1/2	L	L
Requisition	5	M	H	1	H	H
Inventory	3	M	H	1/2	H	H

M - Mode of use:
1 = No automation recommended
2 = Local dedicated CPU
3 = Local DBMS with data transfer
4 = Local CPU with data access
5 = Remote data input/access

B - Backup & Recovery:

S - Security:

T - Time of use: (hours per day)

A - Auditability:

I - Integrity of data:

L - Low concern

M - Medium concern

H - High concern

3.2.6 Subdistrict Information Systems

The subdistrict is the most visible arm of the IDOH. They repair the Indiana roadways, confirm overweight/oversize permits, maintain IDOH vehicles, plow the roads during winter storms, and help plan highway improvement projects. The subdistricts are, therefore, the main source of maintenance data; data that is used to feed several important information systems. Automation at the subdistrict level would open up exciting new information system applications, and is highly recommended. Table 7 presents a summary of important factors to be considered in automating the information systems of at the Sub-district offices.

As computers are introduced in the subdistrict new protocols for data entry/retrieval should be made. For instance, a new crew day card system should be designed to allow data entry to be made daily in the subdistrict office. This information can be transmitted to the district and central offices, and can be used to generate daily, weekly, and monthly progress reports. These data could also be used to feed a roadway history system, the maintenance management system, a budget planning system, a pavement management system, and many more. With a well thought out local DBMS with data transmittal to these other systems, the IDOH would be well on it's way to creating new powerful system tools.

Another system improvement could be made in efficiently automating the oversize/overweight permit system. Presently, when a permit is requested, the subdistrict clerk calls central office to check on road closures to ensure a safe route. A more efficient system would allow the subdistrict computer to call the central office computer at an obscure time, and download any road closure information to the local subdistrict computer. This would allow all permits to be approved at the subdistrict office and avoid long waits for the issuance of the permit. In this case data are controlled by the central office but retrieved by the subdistrict CPU.

While backup and recovery of subdistrict systems is an issue, it is the most important in the gas and parts inventories. Data lost here can lead to abuses of these systems, and, thus, must be easily recovered.

Subdistrict systems are not security risks. Rather, access to these systems are necessary to perform many district and central office tasks, and therefore should be left open.

With distributed data entry of crew day cards, the time required per subdistrict should be minimal and the benefit of this data entry effort would yield daily summaries, weekly and monthly progress reports at a keystroke. Queries to the data base would allow complex analysis of subdistrict performance and it is likely that subdistrict personnel may choose to spend additional time utilizing these new capabilities.

With an automated permit system, it would be necessary to have a CPU accessible as permit applicants enter the subdistrict office. While it is not necessary that a unit be dedicated solely to permit use, it should be recognized that this system take priority over other subdistrict systems, so that permit applicants are served quickly. It is estimated that this system would take up to three hours maximum per day. Two computer stations

Table 7: SUBDISTRICT INFORMATION SYSTEMS

Information System	M	B	S	T	A	I
Crew Day Cards	3	M	L	1	M	H
Daily Summary Sheet	3	M	L	1/2	M	M
Monthly Report	3	M	L	1/2	M	M
Permits	4	M	M	3	H	H
Claim Vouchers	5	M	H	1/2	H	H
The Central Garage Book	1	-	-	-	-	-
Highway Improvement Program	4	L	L	1/2	L	M
Inventory Parts & Gasoline	3	M	H	2	H	H
Payroll	1	-	-	-	-	-
Vehicle Control	5	L	L	1/2	L	L
Requisitions	5	M	H	1	H	H
Inventory	3	M	H	1/2	H	H

M - Mode of use:
1 = No automation recommended
2 = Local dedicated CPU
3 = Local DBMS with data transfer
4 = Local CPU with data access
5 = Remote data input/access

B - Backup & Recovery:

S - Security:

T - Time of use: (hours per day)

A - Auditability:

I - Integrity of data:

L - Low concern

M - Medium concern

H - High concern

would be expected to be able to handle heavy periods with one being sufficient for most days.

There are several subdistrict systems that require rigid auditability features. The permit system, claim vouchers, and the parts and gas inventory are systems that cannot be compromised. Entries and deletions must be made by approved employees only.

Subdistricts information systems in which data integrity is a primary concern is the permit system, claim vouchers, the parts and gas inventory, and the crew day card system. The integrity of the crew day card system is important in that this system can feed so many other district and central office systems.

3.2.7 Traffic Information Systems

The Traffic Division's responsibilities include the response to signal malfunctions, the re-analysis of traffic flow patterns, the maintenance of traffic signs, and the annual repainting of the highways. Like the subdistrict systems, the Traffic Division systems can feed and support many district and central office systems. A synthesis of Traffic division information systems automation is presented in Table 8.

The Traffic Division also makes use of the crew day card system to monitor and plan traffic maintenance systems. This system, as well as the trouble call log, and the illumination outage summary can be used to support comprehensive central office reports and a roadway history. The best modes for these systems would be a local DBMS with data transfer. The signal inventory, the road closure log, and the paint records, as is the case for all other inventories, would also be best automated using a local DBMS with data transfer.

Backup of traffic systems should be designed to occur on a periodic basis. However, this is not a major design factor.

As with many other systems, traffic systems should be available for study by district, subdistrict, and central office personnel. The system should be designed to allow this easy access.

Most traffic systems need only be updated and consulted when needed. For example, crew day cards need to be entered daily, but with disbursed data entry, this task is minimal. One exception would be with the roadway investigation system. This system is an engineering function and would require an intensive dedicated work session.

One system that obviously would require a strong auditability feature is the trouble call log. As this system keeps track of when traffic signals malfunction and the time of response, responsibility for the call and for the recording is paramount.

Several systems require a strong data integrity design. The crew day cards, the signal inventory, and the road closure log all must be consulted at different locations in the IDOH and this data cannot be discordant.

Table 8: TRAFFIC INFORMATION SYSTEMS

Information System	M	B	S	T	A	I
Trouble Call Log	3	M	L	1	H	M
Crew Day Cards	3	M	L	1	M	H
Signal Inventory	3	M	L	1/2	M	H
Paint Records	3	L	L	1/2	L	M
Roadway Investigations	2	L	L	4	L	L
Road Closure Log	3	M	M	1/2	M	H
Illumination Outage Summary	3	M	M	1/2	M	M
Contract Progressive Estimate	3	M	L	1/2	M	L
Payroll	1	-	-	-	-	-
Vehicle Control	5	L	L	1/2	L	L
Requisition	5	M	H	1	H	H
Inventory	3	M	H	1/2	H	H

M - Mode of use:
1 = No automation recommended
2 = Local dedicated CPU
3 = Local DBMS with data transfer
4 = Local CPU with data access
5 = Remote data input/access

B - Backup & Recovery:

S - Security:

T - Time of use: (hours per day)

A - Auditability:

I - Integrity of data:

L - Low concern

M - Medium concern

H - High concern

3.3 Automating Existing Information Systems

One approach to the automation of information handling and management at remote IDOH office locations would be to develop software for each system identified in the previous section consistent with the guidelines provided by the profiles for each system presented in the Appendix of this report and with input from those individuals within IDOH responsible for those areas. As a demonstration of this concept and for purposes of this report, the CREW DAY CARD information system has been automated using only the computer technology presented earlier in Table 1 of this report. Input for system design was provided by individuals from the LaPorte and Fort Wayne district offices for this system that was developed using the PARADOX relational DBMS software provided by IDOH Computer Services to each district office. For a complete discussion of the development and intended use of that system see:

> Stukel, Gregory R., *Computer Prototype for the Maintenance Management System Crew Day Cards,* MS Thesis, School of Civil Engineering, Purdue University, December, 1986.

Based on the experience gained through this exercise and a previous familiarity with the software provided by this configuration (Table 1), it is suggested that virtually all of the information systems presented in this study could be automated in a fashion similar to that used in the above reference.[3]

3.4 Major Problems With Automating Existing Systems

The strategy of automating existing information systems presents some severe problems, both practical and philosophical. The following discussion raises some of these problems. The final chapter of this report—Chapter 4—recommends against such an approach to automation in favor of a more modern and realistic method to achieve more efficient remote-office automation.

1. **Many existing systems may be difficult or inefficient to automate.** Most systems were designed out of a non-automated environment and do not lend themselves to efficient automation. For instance, automating each inventory separately would be inefficient and difficult. Similarly, a separate winter transfer employee report would be inefficient as data entry would be duplicated by crew day card data entry and maintenance management data entry.

2. **Automating existing information systems would result in an overall system that would be difficult to support and maintain.** Presently central office computer services is frequently overwhelmed by user questions and requests. By

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3 One small omission in the selection of software provided to each district that might be required in the future if such a course of action is taken would be an adequate terminal emulation program for the personal computers and, depending on the condition of communication lines, a modem and requisite communications software.

increasing the number of diverse systems, the task of maintaining and these systems would be impossible. Several instances of similar applications being supported by different programs and data sets were encountered during the initial interviews for this study.

3. **Such an approach might result in distributed data as well as distributed processing.** Distributed processing may result in too broad a range in the distribution of data, particularly if different districts or divisions provide specifications for their own program elements.

4. **Such a system would be difficult to expand in the future.** A concerted upgrade of IDOH systems would require a much more arduous effort. Programmers and engineers would be required to be familiar with several systems, and coordinating these systems might also be difficult.

5. **Such a system would be difficult to monitor and control.** Data residing within different systems would be difficult to aggregate into simple, clear computer system reports. Decisions that might be clear with a complete system report would be veiled when system data are disjoined. Likewise, it would be difficult to find and fix system security breaches with many different systems.

6. **Training of personnel would be difficult and would probably not be possible in any systematic fashion.** Creating many diverse systems would necessitate that district personnel learn several unrelated systems. The high turnaround of district and subdistrict clerks would require frequent retraining classes and create a void in the position as the new employee would be forced to learn and master many systems.

7. **The system would require very high start-up costs.** Designing each information system separately would require duplicate programming as well as data entry. If systems are not combined much time and effort would be wasted re-programming basic program modules.

These are but a few of the problems that might be encountered in attempting to use existing non-automated systems as designs for their automated counterpart. To make matters worse, many individuals interviewed during the course of this study questioned whether those systems actually worked as they should and expressed the concern that automating those systems would make things considerably worse. Even choosing a few major systems would require a great deal of effort and input on the part of a few key engineering personnel and it would not be clear how their normal workload might be covered during such an exercise.

Thus far, we have attempted to show that the benefits from automating remote-office information management can be enormous, but that using existing information systems as goals of such an effort might prove futile or, at least extremely expensive. In a more theoretical vein, there is no reason to expect that information systems that have evolved over time without automation technology would be even close to optimal in a fully automated environment. It is fair to say that drastic changes in this type of thinking

are necessary to bring the level of office automation within IDOH up to today's standards. The final chapter presents some recommendations to help achieve this goal.

4. FURTHER RECOMMENDATIONS

While the scope of this research has been limited to remote office locations, it has become clear that a comprehensive analysis of information systems in those offices requires a detailed look at the role of central office information and data requirements is needed as well as an understanding of the physical and logical interface between the two systems. In addition, it is important to understand to what degree the present capital investment in compute capability at the central office imposes constraints on remote office automation. As a result, the recommendations that follow must be qualified by the fact that revolutionary changes to the present protocols for data storage, handling and management might not be possible in view of these constraints. The analysis of central office computing was beyond the mandate of this study and is best left to the IDOH staff responsible for that system.

It has, however, also become clear that revolutionary changes in the way that information is managed throughout IDOH would result in significant improvements in the level of service offered to the residents of Indiana. Indeed, if all of the activities discussed in the previous chapter were automated to the appropriate level, the increase in overall operations efficiency and quality of service would be dramatic. As important, revolutionary changes are needed to bring IDOH remote office information management practices to the point where they can benefit from future advances in office automation technology that are sure to come.

This chapter offers some ideas for this type or radical change throughout IDOH both in terms of the physical computer support system and, to a much lesser degree, the administration of that system. While the recommendations might seem drastic at first glance, it is suggested that much of the hardware and software required to achieve many of these changes are presently in place within IDOH. The most difficult obstacles to overcome would be resistance to change on the part of those who would benefit most from that change!

Three major recommendations are offered: 1) consolidate the 84 separate information systems discussed in the previous chapters of this report into a smaller number—nine are suggested—of more comprehensive information systems each having a distinct data structure; 2) increase the staff of the Data Services Division to include computer systems administrators at remote offices to handle hardware and software issues and conduct user training; 3) promote a base of user support by offering mechanisms for user

input to software design and future system expansion. Each of these recommendations is discussed below.

4.1 Consolidating IDOH Information systems

The most important recommendation of this report is that the IDOH work toward a goal of a high level of remote office automation. To promote this, the present information systems should be both automated and also redesigned. This redesigning effort should be directed toward data structures that encompass the present information systems as well as new ambitious systems to assure that valuable information that could be utilized to support statewide decisions is not wasted. Nine separate but related data base systems are proposed:

1. Accounting[4]
2. Communications
3. Engineering
4. Equipment Management
5. Maintenance Management and Planning[4]
6. Personnel
7. Project Management and Planning
8. Resource Management and Inventory
9. Roadway Inventory and History

The considerations outlined in the information system tables are still relevant, and should be designed into these new systems, as most information from the former systems will still be required. Other design requirements are:

- All systems should be user friendly and menu driven.
- Use of codes (such as material and vendor codes) should be avoided.
- The design of every system should be an interactive process between the system users and software engineers.
- Each system should have automatic data entry error checking.
- Whenever possible, data being sent to the central office computer should be entered locally, and transmitted during slower evening hours. This would alleviate

4 Significant systems exist, or are being developed in these areas presently at the IDOH central office but the degree to which these systems (particularly the Administration system) incorporate distributed processing or data management is unknown.

the problem of slow entry screens, and lighten the central office computer load.

- An appropriate level of distributed data should be achieved together with distributed processing. Insuring that delays in using information are due to processing rather than data access should be the guiding goal in determining the appropriate level of distributed data storage.

1. The Accounting System

A single accounting system should be created and automated with utility bill management, payroll records and vouchers, petty cash, requisitions, and claim vouchers incorporated. Information should continue to flow as it does now; district and subdistrict requisition requests should be routed to central office via district administration. These requests should be automated with district administration checking and compiling the requests and forwarding these to central office.

As a result of this effort, the subdistrict office, the district office, and the central office should be able to generate running budget updates, and general accounting reports, as well as the ability to perform complex database queries.

2. The Communications System

The planning and scheduling of highway projects need to be integrated with the many ongoing highway activities. Road paving and repainting need to be coordinated, as an example. What is required is a highway "project calendar" and electronic "mail and message" program. Communications are very easily automated, and would be a great benefit of overall office automation.

A complete inter/intra office communications network could be designed. Included in this network would be an electronic mail/message and calendar system. It will be important that a protocol for updating this system be enforced, as every district and subdistrict activity should be entered in the calendar and consulted regularly. With this system in place and actively employed, conflicting projects can be successfully scheduled, and the problem of, say, repaving a road soon after painting, or installing expensive raised pavement markings may be avoided. This would be a sound IDOH investment.

A direct application of this system would be in the area of oversized/overweight permits. Road closure announcements could be mailed through the Communication System from central office and stored locally in the subdistrict office. This would speed up the issuance of permits, as verification of safe routes could be made locally.

3. The Engineering Library

A library of engineering software should be available to all personnel in the district offices. There should be an avenue open to request the purchase of new software; and any new software purchased should be globally available to all district personnel. Several engineering systems were requested by district personnel. These

include:

- A comprehensive surveying package
- Signal timing optimization software
- A complete material expert system and calculation package
- Land parcel acquisition optimization software
- Snow plow routing optimization software
- Paint vehicle routing software
- Barrow pit calculation software
- Software to retrieve traffic counts from electric counting boards
- Traffic sign upgrade scheduler
- General purpose CAD/CAE software

4. The Equipment Management System

The Preventive Management System should be expanded to include all equipment that requires regular maintenance. This system should also be controlled at the district Maintenance Division, so that system performance is improved and information more timely. As communication is important to this system, it would be wise to use this system as an input to the Communications System. Maintenance notices can be sent via electronic mail to the responsible department in the district or subdistrict, and regular system reports can be made to central office.

5. Maintenance Management and Planning

Each of the many maintenance management systems need to be consolidated into a single comprehensive automated system. Careful attention should be given to the relationships between information required and provided by the Crew Day Card System, the Bridge Log, the Paint Record System, the Winter Transfer Reporting System, the Highway Improvement Program, the Pavement Management System, and the present Maintenance Management System.

This consolidated system would take as input information from all crew day cards, paint records, fatal accident reports, the trouble call log, and pavement management to plan the next years schedule. subdistrict planning would be improved by automated reports that would allow the check of scheduled progress versus actual progress for daily activities. As with other systems, complex database queries could be made on a routine basis, even across databases.

6. The Personnel System

Presently, the State Personnel system limits district and subdistrict administrators to information of primary interest to the central office. All information is carried

on a single sheet of computer output. Furthermore, the present system information is updated using a courier and the preprinted computer form. With additional district automation it would be possible to create a personnel "inventory", owned and controlled by each district office. This system could be customized to include payroll information, safety records, affirmative action reports, as well as special training information. Each administrator should be allowed to personalize his system, and perform complex database queries.

7. Project Management and Planning

A complete Project Management and Planning System should be designed to encompass many of the Construction and Material and Test Systems. Included in the Project Management and Planning System would be the Daily, Weekly, and Monthly reports, all contract and subcontract systems, Inspector Assignment, Contract Correspondence, Material Test Reports, the Highway Improvement Program, Material Sample Management, Material Test Reports, Aggregate Certification, and the Contractor Performance (and insurance) Reports. This system would allow fingertip access to any project information required by the IDOH Offices.

Ideally, this system would allow a user to retrieve information such as; a list of all ongoing projects; the monthly, weekly or daily reports for any project; the materials and suppliers being used on any project; the contract and subcontracts; the H.I.P. schedules; contractor insurance and performance reports; and the expected schedules for any projects; and other more complex queries.

8. Resource Management and Inventory

The Resource Management and Inventory System would serve to manage expendable resources, such as gasoline, spare parts, paint, and other materials.

9. Roadway Inventory and History

A most important addition to IDOH systems would be the Roadway Inventory and History System. Properly automated, this system would allow maintenance personnel keystroke access to information on all aspects of present and past roadway conditions. This capability would provide a quantitative basis for the planning and managing of maintenance activities and would contribute to future pavement management programs.

Included in the inventory would be the description and the locations of all state highways, bridges, billboards, driveways, signals, overpasses, road markings, signs, etc. This data would be supplemented with the history of the roadway, including;

- Major Construction and Maintenance Contracts
- Fatal Accident Reports

- Road Test Data
- Daily Traffic Signal Maintenance
- Daily Roadway Maintenance

At present all information required for such a system is being collected and stored, in some form. While automating these systems it will be important to allow for the extraction of relevant information so that the data can be sent to the Roadway Inventory and History.

The single greatest source of information into this system will be the Crew Day Card. This source of information is a "diary" of maintenance and traffic activities; they record all maintenance activities as they occur and feed all maintenance planning systems.

Similar to the Maintenance and Traffic Crew Day Cards, is the Construction and Maintenance contract histories, in that all construction activities are being recorded through the Daily Reports. Included in the present system is the progress of the project as well as materials and equipment used. Channeled properly, this information would be invaluable to the Roadway Inventory and History.

There does not presently exist any comprehensive means for storing or retrieving this information or tying this information to road segment location. This problem will need to be addressed, as the previously discussed benefits of this system far outweigh any startup or maintenance costs.

4.2 Systems Administration

There is a need for a person knowledgeable in computer hardware and software development in each district. This system administrator would be responsible for:

- Becoming familiar with district and subdistrict hardware and software systems.
- Educating district and subdistrict personnel in the use of these systems.
- Becoming familiar with every district and subdistrict Information System.
- Software development of district and subdistrict systems.
- Monitoring and controlling all district and subdistrict hardware and software systems.

The system administrator should always be available for questions from district and subdistrict personnel. With this source close to the system users, learning a new system would take less time and would be more easily mastered. similarly, as the System administrator becomes more familiar with how district and subdistrict tasks are performed, new efficient systems can be recommended and developed with more informed district and subdistrict input.

It will be necessary that each System Administrator report directly to the District Engineer, and not central office or the district Administrative Manager. The System Administrator should be both the district and subdistrict "advocate" to central office, and also be above the confines of district "politics".

It will also be important to schedule periodic, say bi-weekly, meetings of all System Administrators. These meetings would serve to standardize all new systems, as well as organize possible shared development. Time should be spent discussing upgrades to system hardware configurations, and new developments in computer technologies.

4.3 User Community

The IDOH should work toward a goal of having a computer educated work force. District and subdistrict employees should be encouraged to educate themselves in computer software and hardware, and to learn the capabilities of any system, so that they can suggest or implement improvements to these systems.

The benefits of a "computer education program" would be great. district personnel could play a vital role in shaping the new systems, as well as the systems of the future. By allowing district and subdistrict input into new system designs, computer hesitancy would be erased and systems would be better designed.

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APPENDIX

DIVISION: Administration

SYSTEM: Inventory Management

PURPOSE:

The purpose of the inventory management system is to control and record all equipment assets in the districts and subdistricts. This information is used for central office audits. Information included in the inventory are the status of maintenance and construction equipment, furniture, vehicles, spare parts, etc...

DESCRIPTION:

The inventory listing is a computer generated printout containing the expected inventory of each division within the district and subdistrict. A new inventory listing is usually distributed annually and is often long, not accurate and not timely.

INFORMATION FLOW:

The computer generated print-out is sent to the district from the central office every year. District administration divides and distributes the inventory to the corresponding district division or subdistrict for comparison with actual inventories. The administration collects and sends the inventory corrections to the central office.

CENTRAL OFFICE INTERFACE:

The central office uses this information to keep an up to date record of the inventory for each of the districts and subdistricts. The central office keeps the official inventory.

EXISTING FORMS: None.

REMARKS:

DIVISION: Administration

SYSTEM: Affirmative Action Reports

PURPOSE:

Affirmative action reports are completed for federal and state government agencies. These reports monitor all affirmative action programs in the district and are used for statistical information and to ensure compliance with state and federal hiring guidelines.

DESCRIPTION:

Affirmative action reports are originated by the administrative manager every year. The report details in-house minority grievances and complaints, as well as logs minority construction contracts awarded. Each instance a minority is interviewed for possible employment must be logged and must include all details of the interview, such as who performed the interview and the outcome of the interview.

INFORMATION FLOW:

The affirmative action reports are compiled by the administrative manager and forwarded to the central office.

CENTRAL OFFICE INTERFACE:

The central office receives the reports and forwards them to the federal and state equal employment agencies.

EXISTING FORMS: None.

REMARKS:

DIVISION: Administration

SYSTEM: Utility Bill Management

PURPOSE:

The purpose of the utility bill management system is to process and monitor all utility bills (eg. gas, phone, water, etc...)

DESCRIPTION:

The district administrative manager receives bills from the utilities, checks the bills for mistakes and rationalizes long distance phone calls. The bills are then paid through the Requisition System.

INFORMATION FLOW:

The administrative manager receives a copy of the bill from the utility company. He may contact any section heads to verify any questionable bills. After the bill is reviewed, a requisition form is sent to the central office to cover the cost of the bill. The central office then issues the check.

CENTRAL OFFICE INTERFACE:

The central office receives and reviews the utility bill and rationalizes any extraordinary bill. They will issue the checks for payment of the bills.

EXISTING FORMS: None.

REMARKS:

DIVISION: Administration

SYSTEM: Safety Records

PURPOSE:

The purpose of the safety record is to keep an accurate account of all employee accidents or injuries. This information is recorded for insurance investigations, proper awarding of compensation, future training, policy corrections and possible litigation.

DESCRIPTION:

The safety records are primarily recorded on two forms. For vehicle and equipment accidents State Form 39697 is used. The information included on this form is a description of the accident, parties involved, equipment or vehicle involved, date, location, weather conditions, time of day, damage estimate, property damage if any, insurance company and witnesses.

For job injuries, State Form 34401 is used. This form includes information regarding the nature of the accident, cause of the injury, time, place, employee, employer, estimated time off for compensation, lost workdays, etc.

INFORMATION FLOW:

The injured worker fills out the report and sends it to the unit foreman for review. A copy of the report is circulated to the general foreman, the sub-district clerk, the district safety director, the administrative manager, insurance representatives, and finally the central office.

CENTRAL OFFICE INTERFACE:

The central office compiles all reports and makes a yearly report by district.

EXISTING FORMS:

State Form 39697 -
vehicle & equipment
accident report
State Form 34401 - report of injury to employee

REMARKS:

DIVISION: Administration

SYSTEM: Personnel Records

PURPOSE:

The purpose of the personnel record is to keep a concise, up to date file of each employee.

DESCRIPTION:

Employee information is kept in an alphabetized individual file. The file contains employee addresses, salary action, job description, date of employment, emergency information, accident reports, etc... Access to the personnel file is controlled and usually consists of the district engineer, administrator and administration secretaries.

INFORMATION FLOW:

Any additions to the file can be made at the district or central office. Merit raise lists are sent to the district from the central office to be checked. Updates in the personnel record are performed using state form 25616, and by sending this form to the central office.

CENTRAL OFFICE INTERFACE:

The central office keeps the records updated by communicating via state form 25616. Note that this system is used for all state employees and is not limited to the IDoH.

EXISTING FORMS: State Form 25616 Employee Profit Non-merit

REMARKS:

Administrators feel additional information should be added to the file and could be kept with the district administrator.

DIVISION: Administration

SYSTEM: Fuel Inventory

PURPOSE:

The purpose of the fuel inventory system is to administer the dispensing of fuel at the districts and subdistricts. This information is used for central office audits and to check pumping equipment. For example, if the morning tank reading is off from the previous day's reading, there may either be a leak in the tank or unauthorized usage.

DESCRIPTION:

When fuel is dispensed, the pump operator logs the amount dispensed, and this total should correspond with periodic pump readings. Mileage is monitored for each vehicle and checked for reasonable usage. The administration director uses this information for semi-annual inventory updates and central office audits.

INFORMATION FLOW:

As the employee fills up their vehicles' fuel tank, the gallon amount of fuel, the vehicle type, the vehicle number and the employee, are recorded. Tank outflow is measured and rationalized with tank inflow by a maintenance staff member. Fuel required is sent to the central office via a PTD form and the district IBM 3276 terminal.

CENTRAL OFFICE INTERFACE:

After receiving the information from the PTD forms, via the IBM 3276 terminal, a computer printout of the information is made and checked for errors. This printout is then sent back to the district where it is used to check input of errors.

EXISTING FORMS:

State Form 38851R
PTD Form

REMARKS:

DIVISION: Administration

SYSTEM: Petty Cash Reports

PURPOSE:

The petty cash report serves to monitor petty cash expenditures.

DESCRIPTION:

The petty cash report lists petty cash expenditures along with the reasons for the purchases. Petty cash purchases are limited to $50.00.

INFORMATION FLOW:

The reports are mailed to the central office.

CENTRAL OFFICE INTERFACE:

Central office reconciles costs and reimburses the subdistrict so the $200 petty cash fund is always filled.

EXISTING FORMS: None.

REMARKS:

DIVISION: Administration

SYSTEM: Payroll Records

PURPOSE:

The purpose of the payroll record is to maintain an accurate record of employee payroll and pay status, and also to keep track of benefits such as sick days and merit raises. This information is used by administration to give merit raises and also to answer employee questions involving vacation time, sick days, and next raise consideration.

DESCRIPTION:

Employees fill out their individual pay vouchers. These are collected and reviewed by the general foreman in the subdistricts and division clerks in the districts. Pay voucher information includes hours worked and vacation or sick days taken.

INFORMATION FLOW:

The vouchers are reviewed and compiled by the administrative secretary then mailed to the central office. The central office issues checks which are hand carried to the district offices.

CENTRAL OFFICE INTERFACE:

The central office is responsible for issuing all pay checks, and for keeping a record of employee sick, vacation, and personal days.

EXISTING FORMS: None.

REMARKS:

DIVISION: Construction

SYSTEM: Monthly Project Report

PURPOSE:

The monthly project report is a record of the progress of the contracted construction project. Its purpose is to inform the central office of the monthly progress of the construction project.

DESCRIPTION:

The monthly project report is compiled for each contracted project. The report contains general information such as the location of construction, the general progress, weather conditions, reasons for delays, and an estimate of the completion date.

INFORMATION FLOW:

The monthly progress report is compiled by the project engineer. A copy of the monthly progress is mailed to the district from the project engineer. The original is sent to the central office.

CENTRAL OFFICE INTERFACE:

All monthly progress reports are reviewed at the central office.

EXISTING FORMS: Form I.C.117 State Form 2323

REMARKS:

This form is important to track the progress of the contract and to document the different stages of construction as well as any unusual problems. The monthly progress report should also note the anticipated starting dates of major operations and document road openings and closing.

DIVISION: Construction

SYSTEM: Final Construction Record

PURPOSE:

The purpose of the final construction record is to document the history of the contracted job. The final construction record is used for updating road and bridge logs and for documenting the closing of the contract. The final construction record also documents all material sample tests, communications, and extensions in case of future legal matters.

DESCRIPTION:

The final construction record is compiled by the project engineers and includes an accounting of all project expenditures based upon a unit price basis. The record documents all results of material sample tests as well as material used. The record also contains the contract extensions and remarks and the Contract Completion Report.

INFORMATION FLOW:

The project engineer keeps all pertinent information involving the contract during the lifetime of that contract including daily, weekly, and monthly reports. At the completion of the project, the project engineer will compile this information into the final construction record which is reviewed by the district construction engineer. The reviewed final construction record is submitted to the Central Office for their review and preparation of the final payment to the contractor.

CENTRAL OFFICE INTERFACE:

The original final construction record is sent to the central office.

EXISTING FORMS: CRz, PR47, IC733, IC639, IC686, IC126, M232, M232A, IC225, IC644, IC608, IC115, IC626, IC642, IC654, IC632, IC601

REMARKS:

DIVISION: Construction

SYSTEM: Contract Correspondence

PURPOSE:

The purpose of the contract correspondence system is to keep a permanent record of all communication with contractors for each project.

DESCRIPTION:

Contract Correspondence is a written record of all communications and contact between the contractor, state, subcontractor, and vendors, etc... It includes important telephone notes, letters, etc...

INFORMATION FLOW:

All correspondence concerning the project are sent to the district office. This includes any correspondence between project engineer and contractor, project manager or district head. It also includes information concerning material testing and subcontractors. The correspondence is kept in the open contract file and later is incorporated into the Final Construction Record.

CENTRAL OFFICE INTERFACE:

None

EXISTING FORMS: None

REMARKS:

DIVISION: Construction

SYSTEM: Extra Work Agreements

PURPOSE:

The extra work agreement is a contract for necessary work that was not included in the original contract.

DESCRIPTION:

The extra work agreement is a description of what the extra work is, an estimate as to what extra materials will be needed, and a projected cost.

INFORMATION FLOW:

If a contractor or the project engineer feel there is warrant for additional work, or a contract change, the district construction engineer is notified, and a contract may be written. The contract is then sent for approval to the central office.

CENTRAL OFFICE INTERFACE:

The central office reviews all extra work agreements. The review process may be lengthened by the amount of the additional work.

EXISTING FORMS: None.

REMARKS:

DIVISION: Construction

SYSTEM: Daily Reports

PURPOSE:

The purpose of the daily report is to give a daily account of the progress on every project. It is the diary of the project.

DESCRIPTION:

The daily report records information concerning employee hours and personnel for the project. It describes what equipment was used on the construction project, the weather conditions, and all pay items for the project for that day.

INFORMATION FLOW:

The daily report is compiled by the project engineer and sent to the District Construction Engineer via the mail or hand delivery. This information is then stored in the open construction project file. The original daily report is retained in the District file indefinitely and the project engineer's file copy is sent to the Central Office with the final construction record.

CENTRAL OFFICE INTERFACE:

Project engineer's copy is sent to Central Office with the final construction record.

EXISTING FORMS: IC103 and IC224

IC103 for construction contracts
IC224 for bridge construction contracts

REMARKS:

DIVISION: Construction

SYSTEM: Contract Completion Reports

PURPOSE:

The contract completion report documents the completion of a contracted construction project. The report signifies acceptance of the project and serves as impetus for final payment to the contractor.

DESCRIPTION:

The contract completion report is a record of a completed contracted construction project.

INFORMATION FLOW:

Upon the satisfactory completion of a project, the project engineer completes the contract completion report and sends it to the district office. The district review officer reviews the form and prepares a cover letter for the district construction engineer and the district engineer. Copies of the report go to the district file and are entered into the final construction record. Final payment is made after District and Central Offices review the contract completion report.

CENTRAL OFFICE INTERFACE:

The central office receives and reviews a copy of the contract completion report. They then may issue a letter of acceptance, thereby relieving the contractor of site maintenance.

EXISTING FORMS: IC639 & IC686

REMARKS:

DIVISION: Construction

SYSTEM: Subcontracts

PURPOSE:

There is a standard procedure for approving subcontractors. This system serves to enforce this procedure.

DESCRIPTION:

The standard specifications, article 108.01 state that the contractor have written authority to sublet a portion of the work. Form IC730 serves as approval notification and is issued out of the central office.

INFORMATION FLOW:

The prime contractor submits the request to the district for subcontractor approval. The district reviews the request and forwards it to the Central Office for approval.

CENTRAL OFFICE INTERFACE:

The Central Office may request information from the districts or vice versa. The Central Office reviews all subcontractor requests.

EXISTING FORMS: IC730, CM32-34, MBE-2

REMARKS:

DIVISION: Construction

SYSTEM: Contractor Performance

PURPOSE:

The purpose of the contractor performance list is to maintain a record of all IDoH certified contractors.

DESCRIPTION:

This list includes a history of previous contracts, and maximum liability and the insurance expiration date, for every IDoH certified contractor. The prequalification engineer uses this information as an acceptable contractor list.

INFORMATION FLOW:

The form is prepared by the project engineer, reviewed by the area engineer and district construction engineer and sent to the prequalification engineer in the Central Office. Only one form is made - no copies kept. One form is prepared for each contractor and subcontractor.

CENTRAL OFFICE INTERFACE:

EXISTING FORMS: CR-2

REMARKS:

This is an extremely important document to aid in establishing a contractors ability to perform certain types of work.

DIVISION: Construction

SYSTEM: Inspector Assignment

PURPOSE:

The purpose is to assign inspectors to appropriate inspection sites.

DESCRIPTION:

Construction is responsible for assigning site inspectors to the project sites. The criteria is usually based on the proximity of the site to the inspector's home.

INFORMATION FLOW:

All information is maintained by the district or area engineer.

CENTRAL OFFICE INTERFACE:

none

EXISTING FORMS: None

REMARKS:

The inspectors need to be assigned where they will be used to the best advantage to the state. Consideration must be given to home location, work location, transportation, type of work, type of experience of inspector, reliability of inspector, and location of other qualified inspectors.

DIVISION: Construction

SYSTEM: Weekly Project Reports

PURPOSE:

The purpose of the weekly project report is to maintain a convenient estimate of the project's current status for the district construction engineer.

DESCRIPTION:

The weekly project report is usually one page long and briefly describes the activities at a project site. The weekly project report is compiled by the project engineer, and is a general overview of the week's daily reports. It is reviewed by the district engineer and documents time remaining on the contract.

INFORMATION FLOW:

The weekly project report is compiled by the project engineer from the daily reports. These weekly reports are reviewed at the construction engineer's leisure as a general overview at a contracted projects progress. The original is sent to the contractor for his disposition and information.

CENTRAL OFFICE INTERFACE:

Central Office receives a copy.

EXISTING FORMS: Weekly Project Reports IC124

REMARKS:

DIVISION: Development

SYSTEM: Roadlife Log

PURPOSE:

The purpose of the road life is to maintain a current history of the roadway. The information in this log is used for design investigations, interogatories, and general historical information. The log records each large repair or major maintenance construction contract. This contract information can then be used for follow up studies, contractor performance, and any future litigation.

DESCRIPTION:

The road life log is a file kept in the district office. A separate file is kept at the central office. The district's file is categorized by county & road. A section of roadway is displayed and a chronological history of all major improvements on any part of that section are defined and noted. Other parameters included in the log are the date finished, project number, major material, surface type, cost and geographical limits of the project. Typically, the roadway history dates back to when the road was incorporated into the state highway system, or when the road was originally constructed.

INFORMATION FLOW:

After the final construction record is completed, a copy is loaned to the development area for proper updating of the road life log. The information is then stored in the log until needed.

CENTRAL OFFICE INTERFACE:

None, unless litigation dictates a need for the information. The central office compiles their own history of the roadway.

EXISTING FORMS:

REMARKS:

The present roadway log is not complete or detailed. By creating a complete comprehensive roadway history that includes all small roadway or signal maintenance, accidents, and sign maintenance, IDOH could have a powerful pavement management, inventory, and legal tool.

DIVISION: Development

SYSTEM: Bridge Log

PURPOSE:

The purpose of the bridge log is to keep a record of bridge inspections. This includes the bridge's location, the next scheduled inspection, a description of the latest maintenance and contracts. This information system is mandated by the Federal government, and is also used in the possibility of litigation.

DESCRIPTION:

The bridge log is categorized by state road and county, and is currently kept in a file. The bridge log records all structures over 20 feet long. Copies of all bridge inspections are kept in the file. Bridge inspections are administered through the maintenance department.

INFORMATION FLOW:

All maintenance work must be recorded by the development engineer who then records the information into the bridge file. Bridges are maintained and inspected by the maintenance division, who report all maintenance activities to the development engineer.

CENTRAL OFFICE INTERFACE:

The central office administers their own bridge log, through the bridge inspection reports.

EXISTING FORMS: None.

REMARKS:

DIVISION: Development

SYSTEM: Permits

PURPOSE:

The permit office at the district office issues all commercial and private driveway permits.

DESCRIPTION:

The permit engineer approves all private drives in the district, while commercial driveways are jointly approved by the district permit engineer and the central office. The permit inspector physically reviews plans and submits information to the traffic engineer to be cooordinated with other IDoH improvements.

INFORMATION FLOW:

The permit inspector physically reviews all plans and, after consulting with the traffic engineer, may recommend issuance of the permit. The recommendations are sent to the central office for final approval.

Some projects require review by federal and state agencies. These agencies may request any information concerning the project including plans and drawings. All permits issued are stored at the central office.

CENTRAL OFFICE INTERFACE:

Central office may review larger projects and send copies of these projects to federal agencies.

EXISTING FORMS: None.

REMARKS:

DIVISION: Development

SYSTEM: Billboard Inventory

PURPOSE:

The billboard inventory is mandated by the federal government in accordance with the Highway Beautification Act. The purpose of the billboard inventory is to have an updated list of all billboards on state roadways.

DESCRIPTION:

The billboard inventory is a list of each billboard that is erected within federally mandated regulations. The list is in the form of a computer printout generated at the central office. The inventory is categorized by state road.

INFORMATION FLOW:

Twice a year the central office sends a computer generated list of what billboard is located on each state road. Development physically checks the accuracy of this printout by sending a crew to each billboard location. Additions and deletions are made to the inventory. Any additions to the inventory are checked to ensure the billboard is within regulations. If the billboard is not, the district sends a notice to the owner requesting the structure be dismantled. If the owner does not act within 14 days, the central office will issue a notice. After the inventory has been checked, the corrections are sent to the central office.

CENTRAL OFFICE INTERFACE:

Two copies of the printout are sent to the district development office. One copy is used in the field where updates are made. Those updates are then transferred to the second copy and sent to the central office. The information is manually copied off the printout and put onto individual computer forms. These forms are them given to the computer operator to be typed onto the system.

EXISTING FORMS: None.

REMARKS:

DIVISION: Development

SYSTEM: Railroad Crossing Inventory

PURPOSE:

The purpose of the railroad crossing inventory is to monitor the physical condition of each railroad crossing.

DESCRIPTION:

The railroad crossing inventory is done yearly. Information included in the inventory are a history of the crossing, the type of railroad crossing, advanced warning signs, pavement markings and their condition, signal lights, and number of tracks.

INFORMATION FLOW:

The railroad crossing inventory originates at the central office. This inventory is sent to the district development office once a year. At the district, the inventory is updated and sent back to the central office for distribution.

CENTRAL OFFICE INTERFACE:

Two copies of the printout are sent from the central office to the district. One copy is updated in the field, then these updates are carefully transferred to the second printout. It is this second printout that is sent to the central office.

EXISTING FORMS: None

REMARKS:

DIVISION: Development

SYSTEM: Survey Operations

PURPOSE:

The purpose of having a survey party in the district development office is for staking construction projects, checking deeds, reestablishing right of ways, preparing parcels of state owned property for public sales, etc...

DESCRIPTION:

Survey operations are conducted by a licensed surveyor and one survey crew. The crew is controlled through the development office, and work is scheduled by project priority. The crew has a backlog of projects, that require both field work and courthouse research.

INFORMATION FLOW:

The district development office is notified by the central office of parcels that may be bought or sold and that require surveys. Also construction or maintenance may notify development that a project may require a survey. Surveys are performed and the the survey information is sent to the interested parties.

CENTRAL OFFICE INTERFACE:

Central office requests surveys be done, and appropriate information returned.

EXISTING FORMS: None

REMARKS:

DIVISION: Development

SYSTEM: Design Operations

PURPOSE:

The districts perform design within development. This usually is small designs such as turning lanes etc. Draftsmen are used by development for intersection design and layout.

DESCRIPTION:

The design and drawing is carried out by a development design engineer and draftsmen.

INFORMATION FLOW:

If the design of a project is within the District's capabilities, central office will OK the design. Development coordinates these new projects with input from the other district sections and the subdistricts.

CENTRAL OFFICE INTERFACE:

The central office approves all projects.

EXISTING FORMS: None

REMARKS:

DIVISION: Development

SYSTEM: Public Information

PURPOSE:

There is a need to inform the public and utilities of upcoming scheduled construction projects and road closures. This information is required for schools, emergency vehicles, news agencies, and public utilities.

DESCRIPTION:

Information is sent via letter or telephone. The development engineer keeps a list of all newspapers, radio stations, agencies that must receive this information. All the impending detours and road closings resulting from projects planned in the H.I.P., and regular maintenance are closely monitored.

INFORMATION FLOW:

The project engineer should give the development engineer and traffic engineer a two week notice as to what projects will require road closures. It is development's responsiblity to notify the news agencies and radio stations within the immediate area. The information is also sent to the Central Office.

CENTRAL OFFICE INTERFACE:

Central office usually keeps this information for issuing permits.

EXISTING FORMS: None

REMARKS:

DIVISION: Development

SYSTEM: Right of Way Control

PURPOSE:

The purpose for right of way control is to maintain an active inventory of right-of-way documents, to prepare documents and plats for road relinquishments and surplus property, and to provide an inventory of elevation benchmarks throughout District.

DESCRIPTION:

The maintenance of files and release of requested documents is the responsibility of the development engineer.

INFORMATION FLOW:

If the data requested is available in the district office, the development engineer may release the information. If additional data is needed, a request may be submitted to the central office for the information.

CENTRAL OFFICE INTERFACE:

The central office keeps information of interest to the district development engineer, and may be asked to provide such information.

REMARKS:

DIVISION: Maintenance

SYSTEM: Preventive Maintenance

PURPOSE:

The purpose of the Preventive Maintenance system is to equip and force regular maintenance on all vehicles in the IDOH.

DESCRIPTION:

The system keeps track of mileage on vehicles, and hours on equipment. When regular maintenance is required, the responsible employee is notified to take the equipment to the maintenance shop.

INFORMATION FLOW:

Monthly, employees fill out the equipment usage log with relevant information (mileage, usage,...). These are sent to Indianapolis and entered into the computer. When it is time for regular maintenance (oil change, tune up, etc.) a PM work order is sent to the responsible employee who takes the equipment to the shop.

If during maintenance further work is required, a repair work order form is filled out and the work completed.

CENTRAL OFFICE INTERFACE:

Central office monitors all vehicles and manages all information.

EXISTING FORMS: None.

REMARKS:

DIVISION: Maintenance

SYSTEM: Crew Day Card

PURPOSE:

The purpose of the crew day card is to compile and put into readable form daily subdistrict activities and productivity.

DESCRIPTION:

The District acts as the compiler of all crew day cards. They have little input, but act as the central office keypunch.

INFORMATION FLOW:

The subdistricts send the crew day cards and monthly reports to the District. The district clerk compiles all relevant information and enters this into the Central Office Computer.

CENTRAL OFFICE INTERFACE:

Central office uses this information to plan for the next year's work.

EXISTING FORMS: None.

REMARKS:

DIVISION: Maintenance

SYSTEM: Winter Transfer Report

PURPOSE:

This report is a legal document which outlines precautions taken by the IDOH for snow plow route coverage.

DESCRIPTION:

At the end of each month, maintenance compiles this report and files it with the Central Office. The report contains a daily log of which employees were assigned to each snowplow route. This changes daily when employees quit/are hired. The report takes a lot of time and is very thorough.

INFORMATION FLOW:

The maintenance engineer keeps a close daily tab on employee coverage of routes in the district, and fills out the report daily. At the end of the winter the report is sent to the Central Office.

CENTRAL OFFICE INTERFACE:

Central office store the reports.

EXISTING FORMS: None.

REMARKS:

DIVISION: Maintenance

SYSTEM: Building & Grounds Inventory

PURPOSE:

The purpose of the inventory is to keep a record of all IDOH owned structures.

DESCRIPTION:

The building and grounds superintendent inspects and inventories all structures (excluding bridges) and contracts building maintenance. The inventory includes the worth of the structure, the condition of the structure, and necessary improvements.

INFORMATION FLOW:

The building and grounds superintendent inspects all structures (parks, weigh stations included) and reports the inventory to the central office yearly.

CENTRAL OFFICE INTERFACE:

Central office collects information.

EXISTING FORMS: None.

REMARKS:

DIVISION: Maintenance

SYSTEM: Bridge Inspection Log

PURPOSE:

The purpose of the bridge inspection log is to keep an updated report of the condition of all the bridges in the district.

DESCRIPTION:

The bridge inspection log is kept on a standardized "report card" with relevant information about the condition of each bridge. At each inspection photographs are taken and sent to Indianapolis for developing. A copy of the latest photos are kept in the log.

INFORMATION FLOW:

The bridge inspection team (one in every district) must inspect every bridge at least once every 2 years. A copy of the report is sent to Indianapolis. This file is used to recommend bridge maintenance for the HIP.

The central office will remind the district if inspections exceed the 2 year period. The bridge inspection report is used to verify compliance with federal guidelines.

CENTRAL OFFICE INTERFACE:

The central office monitors the system.

EXISTING FORMS: 1,2

REMARKS:

DIVISION: Maintenance

SYSTEM: Management System

PURPOSE:

The purpose of the maintenance management system is to plan and monitor the yearly maintenance activities of all Districts and Subdistricts.

DESCRIPTION:

The maintenance management system plans acceptable levels of work one year in advance. This plan is specific and generally accurate. The plan is sent to the districts and monitored through completed Crew Day Cards.

INFORMATION FLOW:

One year in advance, subdistrict superintendents and District Maintenance engineers estimate expected activity time requirements based on the previous year's performance and knowledge of roadway expansion. This is discussed with Central Office engineers and compared with the Crew Day Cards. From these meetings, the Central Office budgets the following year's maintenance and gives guidelines to acceptable levels of work via Crew Day Cards. The Crew Day Cards are filled out daily by the subdistricts and compared with the estimated performance. Large discrepancies are discussed.

CENTRAL OFFICE INTERFACE:

The central office compiles all data for planning next year's activities.

EXISTING FORMS: MM-103, MM-109, MAMMs-180, MM-311

REMARKS:

DIVISION: Maintenance

SYSTEM: Pavement Management

PURPOSE:

The purpose of the pavement management system is to plan for the repavement of the district's roads.

DESCRIPTION:

When the subdistrict superintendent notices excessive maintenance on a section of road (i.e. potholes), the road will be put in the H.I.P. for a resurfacing contract.

INFORMATION FLOW:

The district will voice the problem via the H.I.P.

CENTRAL OFFICE INTERFACE:

The central office decides which projects are to be funded.

EXISTING FORMS: None.

REMARKS:

None

DIVISION: Subdistrict

SYSTEM: Crew Day Cards

PURPOSE:

The crew day card is part of the maintenance management system. Crew day cards serve as a record of daily crew activity information such as equipment used, location of activity, work accomplished, personnel involved, and their hours. A remarks section is included on the cards for any extraordinary information. These cards are used for compiling the daily summary sheets and the monthly productivity list.

DESCRIPTION:

The maintenance management system is a planned schedule that originates at the central office. The subdistrict superintendent, the general foreman, the unit foreman, and district maintenance personnel help devise the details of this schedule every two weeks. The result of this plan is the issuance of preprinted crew day cards. Each card comprises one specific planned activity such as mowing and patching. This card is taken by the crew leader on each activity assignment in the field, and the appropriate information is recorded.

INFORMATION FLOW:

Each crew generates one or more crew day cards per day. The units pass the completed cards to the subdistrict where it is passed to the district and, finally, to the central office. At the subdistrict the crew day card information is transferred to a mm-331 sheet and posted every week. This information is then transferred to a maintenance and management control work sheet every month. This work sheet shows the subdistricts' progress compared with their semi-annual schedule. At the district, information is taken off the crew day card and entered into the IBM 3276 terminal. After approximately one year, the crew day cards are sent back to the district where they are stored.

CENTRAL OFFICE INTERFACE:

The crew day card information is sent to the central office via the IBM 3276 terminal, and is used for scheduling future work. The central office receives information from the terminal, as well as the crew day cards themselves.

EXISTING FORMS: Crew Day Cards

REMARKS:

The subdistrict at Vincennes process an average of eight to ten cards a day. After a year, the central office sends the cards back to the district where they are stored for approximately five years. Crew day cards are administered through the maintenance department crew day cards.

Most district maintenance engineers do not need to see the crew day cards. The district office serves only to keypunch the cards and check activity codes, etc...

DIVISION: Subdistrict

SYSTEM: Daily Summary Sheet

PURPOSE:

The purpose of the daily summary sheet is to keep a daily record of all maintenance activities. This information is used for compiling a monthly report (mm-311) which acts as a summarization of all subdistrict work.

DESCRIPTION:

The daily summary is compiled from crew day cards and includes personnel, equipment, location of activity, etc...

INFORMATION FLOW:

The monthly summary is required to gage the productivity of the subdistrict, and the daily summary is used primarily to compile this report. Generally, only the subdistrict secretary uses the daily summary and only for compiling the mm 311 report.

CENTRAL OFFICE INTERFACE:

This information is later transferred to the maintenance and management control worksheet.

EXISTING FORMS: Work Control Worksheet

REMARKS:

DIVISION: Subdistrict

SYSTEM: Monthly Report

PURPOSE:

The purpose of the Monthly Report (or Productivity List) is to compare completed activities versus scheduled activities. This information can then be used for future scheduling (scheduling is planned every two weeks), to rate a subdistricts progress, or expose any problems.

DESCRIPTION:

The monthly report is processed at the subdistrict every month, and is compiled using information from the daily summary sheets. The list compares the subdistrict's work progress with the monthly plan and annual goals. If requested, this information can then be reviewed by the subdistrict superintendent, district maintenance personnel, central office personnel, subdistrict crew leaders and workers.

INFORMATION FLOW:

The information from the daily summary sheets are put onto the monthly report (mm 311 sheet). This information can then be posted and accessed by any employee. A copy of this report is sent to the central and district offices.

CENTRAL OFFICE INTERFACE:

The central office uses this report to monitor subdistrict service.

EXISTING FORMS: Work Control Worksheet

Maintenance Management System
Form No. MM-329 State Form 2052
(Division of Maintenance Semi-Monthly Schedule)

REMARKS:

DIVISION: Subdistrict

SYSTEM: Permits

PURPOSE:

The purpose of the subdistrict permit system is to allow the public a convenient site for oversize/overweight permits, and to route these vehicles safely through the state highway system.

DESCRIPTION:

Oversized vehicles must have a permit to use the state highways. The permit includes a route that the vehicle must take, and the hours and date allowed for the trip.

INFORMATION FLOW:

If a oversized vehicle is to be driven in the state, a permit must be requested at the subdistrict office. The subdistrict clerk will check if the proposed route is acceptable by contacting central office, where an update of statewide road closures is kept. Central office will check for road closures and give a new route if the proposed route is unacceptable. The clerk will accept payment and issue the permit.

CENTRAL OFFICE INTERFACE:

Central office keeps account of all road closures for the state on the central office computer. They accept and reject all permits through the subdistrict clerk.

EXISTING FORMS:

REMARKS:

Permits are issued while the permitee waits. This process can take time as the central office gets bogged down with requests. Subdistrict personnel feel that speeding up this process would lead to better public perception of the IDOH.

DIVISION: Subdistrict

SYSTEM: Claim Vouchers

PURPOSE:

The claim voucher is a means of paying bills. When the subdistrict gets a utility bill, they send in a claim voucher to the central office. The central office replies by sending payment for the bill.

DESCRIPTION:

The claim voucher is no more than a form requesting payment of a bill.

INFORMATION FLOW:

The utility will send the subdistrict a bill. The subdistrict will then send out a claim voucher to the central office to request payment. The central office will then issue the check.

CENTRAL OFFICE INTERFACE:

All claim vouchers go to the central office and all checks come out of the central office for payment of these bills.

EXISTING FORMS: Claim Voucher

REMARKS:

DIVISION: Subdistrict

SYSTEM: The Central Garage Book

PURPOSE:

The purpose of the central garage book is to maintain a catalog of available items in each subdistrict stockroom.

DESCRIPTION:

The central garage book is issued through the central office. The book contains the minimal number of inventory stock items that each subdistrict stockroom may requisition from the central garage.

INFORMATION FLOW:

The compilation of the central garage book is made jointly by district and central office personnel.

CENTRAL OFFICE INTERFACE:

The central garage book is a product of the central office.

EXISTING FORMS: Central Garage Book

REMARKS:

DIVISION: Subdistrict

SYSTEM: Highway Improvement

PURPOSE:

The Highway Improvement Program is a means to explore possible avenues for highway improvement and to assign and fund approved projects for the program.

DESCRIPTION:

The HIP is a ten year highway improvement schedule. Improvements are recommended and accepted based on need and budget. This schedule is in a constant state of flux as the roadway conditions and traffic patterns change.

INFORMATION FLOW:

Each district and each subdistrict makes recommendations for possible roadway improvements. The recommended projects are described and prioritized. Central office reviews all projects statewide and enters many into the ten year plan based on need and budget limitations. Once accepted and scheduled, the means are provided to fund and construct the project.

CENTRAL OFFICE INTERFACE:

Central office takes care of all budgeting and letting of contracts.

EXISTING FORMS: None.

REMARKS:

DIVISION: Subdistrict

SYSTEM: Inventory for Parts and Gas

PURPOSE:

This system keeps track of the parts and the gasoline inventory at the subdistrict.

DESCRIPTION:

This inventory is constantly monitored via the PTD (parts transition documents). Parts requested from the stockroom at the subdistrict are entered on a PTD Form. Gasoline is allotted at the subdistrict and again the information is recorded on a PTD Form.

INFORMATION FLOW:

Since the gasoline and equipment inventories change rapidly, the daily flow of parts are monitored using the PTD Forms. The PTD Forms are keypunched into the central office computer at the districts. Monthly physical inventories are performed to verify the PTD generated central office inventory.

CENTRAL OFFICE INTERFACE:

The central office monitors via the IBM terminal and the district office. Every year a complete parts inventory is sent from the central office to every subdistrict to verify the expected subdistrict stock.

EXISTING FORMS: State Form 2639R3

REMARKS:

DIVISION: Materials & Testing

SYSTEM: Aggregate Certification

PURPOSE:

The purpose of aggregate certification is to maintain a consistent and quality source of materials for all state highway projects.

DESCRIPTION:

There are four types of certifications. The first type of certification test is an annual test and certifies the potential quality of a stone quarry.

The second type of certification is also for stone quarries, however, these tests are performed every three months, and the test certifies the quality of materials of regularly used sites.

The third aggregate certification for stone quarries is performed when needed on seldomly used quarries. This is similar to the three month certification and also certifies the quality of materials.

The fourth type of certification is for gravel slag and sand sources. These tests are performed every year as a certification of the sites.

INFORMATION FLOW:

For all certifications, information flow is similar to the sample management system.

CENTRAL OFFICE INTERFACE:

The central office receives all information from each of the four types of tests and uses this information to document the quality of the aggregate supply.

EXISTING FORMS: IT-530, IT-601

REMARKS:

DIVISION: Materials and Testing

SYSTEM: Material Sample Management

PURPOSE:

The purpose of the Material Sample Management system is to keep track of all construction samples and test reports. Accurate and timely record keeping is of prime importance, as construction can be delayed until the material is certified. Sample test data are incorporated into the final construction record, and serves as legal documentation in the case of a lawsuit. Test sample information can be incorporated into a pavement management system.

DESCRIPTION:

The information generated from the test reports includes the tests performed, and whether the sample passed specifications. After the testing and calculations are completed, the information is compiled into a report format and stored at the district office and the central lab.

INFORMATION FLOW:

A request for a test is usually initiated by the contractor by notifying the producer and the proper area lab. The inspector assigned to the site will fill out an IT-530 form, and either perform the test or send it and the sample to the district office for testing. An inspector will then test the sample and enter the results on an IT-576-H form. This form then goes to the project engineer. The results are entered on the IBM 3276 terminal by the Material & Testing secretary and transferred to the central office. As the secretary inputs the information into the terminal, she makes sure the information is as accurate as possible. Information flows the same for concrete and asphalt inspections (Forms IT-600 (asphalt) and IT-652 (concrete)).

CENTRAL OFFICE INTERFACE:

Some samples cannot be tested at the district due to the complexity of the test. In this case, the sample is sent to the central office. Also information concerning samples tested at the district office are sent via the IBM 3276 terminal to the central office.

EXISTING FORMS: IT-530, IT-576-H IT-600, IT-652, TD-497, IT601, IT613E

REMARKS:

DIVISION: Materials & Testing

SYSTEM: Independent Assurance

PURPOSE:

The independent assurance system serves as a independent check of the inspectors, test procedures, equipment, and materials. It is to ensure quality and accuracy in the inspection and testing methods for sources of aggregates, asphalts and concrete.

DESCRIPTION:

An independent assurance inspector samples and tests materials used on all projects at a frequency established in the "Manual for Frequency of Sampling and Testing and Basics of Use of Materials". The independent assurance representative will run the same test as the inspector and record all results on the IT-576-H , IT600 and IT652. Test discrepancies are compared and appropriate action is taken.

INFORMATION FLOW:

The information is passed between the inspector's supervisor, the central offices, and the project engineers.

CENTRAL OFFICE INTERFACE:

Central office monitors the system and receives copies of all reports.

EXISTING FORMS: IT-576-H, IT-601, TD-467, TD-465, IT-600, IT652, TD-320C

REMARKS:

DIVISION: Materials and Testing

SYSTEM: Site Inspector Assignments

PURPOSE:

The purpose is to assign inspectors to appropriate inspection sites.

DESCRIPTION:

The materials and testing area is responsible for assigning site inspectors to the different labs, processing plants, and work sites. The criteria is usually based on the proximity of the site to the inspector's home.

INFORMATION FLOW:

All information is maintained by the district testing engineer.

CENTRAL OFFICE INTERFACE:

None.

REMARKS:

Each District approaches this task differently in regards personnel responsible for site assignment.

DIVISION: Materials & Tests

SYSTEM: Test Reports

PURPOSE:

The purpose of test reports is to have uniform criterion and uniform reporting of all test reports.

DESCRIPTION:

Test reports are generated whenever any material is tested. The type of test report is dependent upon the material being tested and the material usage. Test reports are used as a legal document for compliance with material codes and specifications. Tests are performed on prescribed volumes of materials, according to a frequency schedule.

INFORMATION FLOW:

The test report is generated while the test is performed. The test results, as well as the raw data are sent to the Central Office where they are recorded and stored. A computer generated formal report is sent to both the project engineer and the district office.

CENTRAL OFFICE INTERFACE:

The central office acts to collect test data and to generate the formal test report.

EXISTING FORMS:

REMARKS:

DIVISION: Materials & Tests

SYSTEM: Material Analysis

PURPOSE:

The purpose of material analysis is to certify the quality of all construction materials.

DESCRIPTION:

Material analysis is performed in conjunction with every test report. Outside of data collection and material identification, the analysis makes up the body of the report and is considered to be the most important and time consuming. Each type of material requires uniform tests and calculations. These calculations can be readily automated as they are repetitious in nature and uniform for each material.

INFORMATION FLOW:

Test reports are sent to the central office, the district office, and the project engineer.

CENTRAL OFFICE INTERFACE:

Central office receives and monitors all test reports.

EXISTING FORMS:

REMARKS:

DIVISION: Traffic

SYSTEM: Trouble Call Log

PURPOSE:

The purpose of the trouble call log is to keep a legal document that details the response of IDOH to problems on the highway.

DESCRIPTION:

The trouble call log is a simple notebook filled in with relevant information about each call. This information includes the location, problem, the time of the call, the response and time of response.

INFORMATION FLOW:

The information is logged at the time of the call whether the call originates from the police or a civilian. The problem is relayed to the responsible contractor, or the appropriate district employee. The trouble call log stays at the district.

CENTRAL OFFICE INTERFACE:

The central office may require this information in the case of a lawsuit. Otherwise it is not of interest to the central office.

EXISTING FORMS: Trouble Call Sheet

NEW FORM APPROVED: State Form 31868

REMARKS:

DIVISION: Traffic

SYSTEM: Crew Day Cards

PURPOSE:

The purpose of the crew day cards is to monitor and budget day to day maintenance activities.

DESCRIPTION:

The crew day card is sorted by pre-printed activities, such as sign repair, painting, etc. At the end of a work day the crew leader fills in the appropriate information. This information includes the personnel involved, the work accomplished, the location of the work, the equipment used, the time spent on the activities, and any comments.

INFORMATION FLOW:

The crew day card is initiated at the subdistrict and/or unit level. These are sent to the district office where the information is compiled. The cards are then sent to the central office. The districts use the information to complete daily summary sheets and monthly productivity reports. At the district level each crew day card is keypunched into the central office computer.

CENTRAL OFFICE INTERFACE:

The central office uses this information to schedule future work, and to compare work progress with that scheduled.

EXISTING FORMS: None.

REMARKS:

DIVISION: Traffic

SYSTEM: Signal Inventory

PURPOSE:

The purpose of the signal inventory is to keep an up to date report on the location and condition of all signs.

DESCRIPTION:

Signals are entered into the log by type, date installed, and location. The signal inventory also includes maintenance and contractual information.

INFORMATION FLOW:

When a new signal is added, or when a signal is repaired the relevant information is added to the log. The log stays within the District.

CENTRAL OFFICE INTERFACE:

None.

EXISTING FORMS: None.

REMARKS:

DIVISION: Traffic

SYSTEM: Paint Records

PURPOSE:

The purpose of the paint record is to provide an inventory of where and when a road was last painted, and the composition of the paint used.

DESCRIPTION:

The paint record is kept on a map of the district. The map is marked according to the status of the road; whether the road has or hasn't been painted that year, and when it was last painted.

INFORMATION FLOW:

The paint record stays in the district.

CENTRAL OFFICE INTERFACE:

The central office can monitor painting, but only through the crew day cards.

EXISTING FORMS: Crew Day Cards

REMARKS:

DIVISION: Traffic

SYSTEM: Roadway Investigations

PURPOSE:

The purpose of the roadway investigation is to monitor changes in traffic patterns and to adjust signal timing, road conditions, speed limits, etc...

DESCRIPTION:

In each district there are several investigation teams with the sole task of analyzing and upgrading traffic flow. They must be aware of roadway changes, business development, and community expansion.

INFORMATION FLOW:

The team will investigate flow changes from any development as well as responding to public traffic complaints. If change is warranted, a report is filed and mailed to the central office.

CENTRAL OFFICE INTERFACE:

The central office reviews major roadway changes.

EXISTING FORMS: None.

REMARKS:

DIVISION: Traffic

SYSTEM: Road Closure Log

PURPOSE:

The purpose of the road closure log is to maintain a history as to what steps were taken to inform the public of road closures.

DESCRIPTION:

The information includes which roads were closed, between which intersections, and the length of time the road was closed, and what steps were taken to notify public agencies.

INFORMATION FLOW:

The project engineer sends the information to the development engineer who contacts the media via press release. They aim for two week notice of all road closures.

CENTRAL OFFICE INTERFACE:

None.

EXISTING FORMS: None.

REMARKS:

DIVISION: Traffic

SYSTEM: Illumination Outage Summary

PURPOSE:

The purpose of the Highway Illumination Outage Summary is to record highway illumination outages discovered by surveillance inspectors.

DESCRIPTION:

Outages are entered by pole identification number and are cross referenced to a highway illumination inventory as a validity check. The recorded outages will generate various report summaries.

INFORMATION FLOW:

Outages are logged following scheduled surveillance by district traffic. Reports are forwarded to the following:

1. Maintenance Agency (frequency may vary)
2. Electrical Utility (monthly)
3. Central Office (monthly)
4. TM contract project engineer (monthly)

CENTRAL OFFICE INTERFACE:

Monthly summaries are sent to the central office for tabulation and review of outages on state wide basis.

EXISTING FORMS: Highway & Sign Lighting Outage Report

REMARKS:

Presently this task is done manually and is very time consuming. The value in continuing this process has resulted in obtaining credits from electrical utilities and maintenance contractors. The use of a computer would widen the margin between benefits vs. costs. This system could be further sub-divided or related to other inventories such as:

1. Tm Contract Progressive Estimate
2. Utility Agreement Inventory
3. Highway Illumination Inventory

DIVISION: Traffic

SYSTEM: TM Progressive Estimate

PURPOSE:

The purpose of the TM Contract Progressive Estimate is to log contract items used by the contractor.

DESCRIPTION:

TM contracts consist of maintenance for traffic signals or highway illumination. Reports for each location worked are received monthly from the contractor. Each report is logged by location, date, and contract items/quantities. A monthly summary is produced to substantiate billing and prepare monthly estimate for payment. Records are maintained through project completion to generate final construction record.

INFORMATION FLOW:

The project engineer maintains all records.

CENTRAL OFFICE INTERFACE:

None

EXISTING FORMS: None

REMARKS:

This can be interfaced with traffic signal and highway illumination inventory to generate maintenance records/costs on a unit or inventory type basis for evaluation of maintenance techniques, product dependability, flag re-occurrence of problems, etc.

At the present time, one TM contract for traffic signals generates over 2000 reports submitted by a contractor. A computer system would provide access to information presently not available.

DIVISION: All

INFORMATION SYSTEM: Payroll Voucher

PURPOSE:

The purpose of the payroll voucher is to keep a record of the employees' work hours.

DESCRIPTION:

Pay vouchers are weekly or bi-weekly "time cards", and are used to account for all IDOH work hours.

INFORMATION FLOW:

Prior to payday, all IDOH employees fill out a pay voucher with hours worked, account numbers, vacation days, supervisor's signature, etc... These are collected at the district and sent to the central office by courier. Paychecks are issued out of the central office.

CENTRAL OFFICE INTERFACE:

The pay vouchers are sent to the central office for processing employee paychecks. The paychecks are then sent from the central office via personal carrier to the district and distributed from there.

EXISTING FORMS: State Form 3756R2

Indiana Department of Highways
Payroll Voucher

REMARKS:

DIVISION: All

SYSTEM: Vehicle Control

PURPOSE:

The purpose of a vehicle control system is to keep track of vehicle usage for preventive maintenance and for the vehicle inventory.

DESCRIPTION:

The vehicle control system consists of the vehicle usage logs, parts transaction documents for fuel, and maintenance logs. The usage logs are filled out by the individuals who are assigned state vehicles. These keep track of mileage and fuel and are collected monthly.

INFORMATION FLOW:

Personnel assigned state vehicles turn in usage logs every month to their division secretary. The secretary checks over this information and sends it to the district administration office to be sent to the central office. Any information regarding maintenance done on the vehicle is also sent to the district administration office and to the central office. This information is used by the preventive maintenance system for scheduling vehicle maintenance.

CENTRAL OFFICE INTERFACE:

All information is sent to the central office as part of the preventive maintenance system.

EXISTING FORMS: None

REMARKS:

DIVISION: All

SYSTEM: Requisition Forms

PURPOSE:

The purpose of the requisition is to allow for procurement of needed equipment/materials.

DESCRIPTION:

There are three procurement systems, the requisition system, the confirming requisition system, and the petty cash system. Each system is defined to handle procurement of increasing expense.

The petty cash system allows for procurement of goods with a price under fifty dollars. This system is informal and administered through the district administrative manager.

The confirming requisition system is for the procurement of goods with a price tag of fifty dollars to $500. Goods are purchased when needed, but payment is issued out of central office.

The requisition system is for procurement of items costing more than $500. The items are purchased through central office and through an open bid process.

INFORMATION FLOW:

Every district and subdistrict has a material/equipment budget. For petty cash items (eg. a hammer, nails, etc...) the district administrator is notified and the item is purchased. The DAM reimburses the purchaser in cash, and a petty cash report is sent to the central office with the receipt. The central office will "refill" the petty cash fund.

For confirming requisition items, the materials are purchased and payment charged to the central office. All confirming requisition purchases must be within the division's budget. Confirming requisition forms are sent to the central office and payment is issued to the vendor directly from central office.

Requests for materials through the requisition system is made to central office. Again this must be within the quarterly budget. At Indianapolis, if they approve the requisition, then the requisition goes out for bids, or if the material is stored, it will be sent to the district.

CENTRAL OFFICE INTERFACE:

All requisitions have to go to the central office for bidding or for issuance.

EXISTING FORMS: State Form 2638R3

REMARKS:

DIVISION: All

SYSTEM: Inventory

PURPOSE:

The purpose of the inventory is to keep track of all assets of the IDOH. This includes furniture, vehicles, equipment, etc...

DESCRIPTION:

IDOH inventories all assets twice a year. The expected inventory is logged in a computer generated printout consisting of all items listed in the last inventory. Each division compares this printout with their actual physical inventory.

INFORMATION FLOW:

The printout is sent to the district administration office and distributed among each division. In each division the inventory is updated and then sent to the central office via the district administrator.

CENTRAL OFFICE INTERFACE:

The central office will receive the updated inventories from the district administration office.

EXISTING FORMS: None

REMARKS:

The inventory process is long and tedious for districts personnel. This could be alleviated by keeping a running inventory in the district offices.

COVER DESIGN BY ALDO GIORGINI