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PERFORMANCE STANDARDS FOR
ELECTRONIC BENEFIT TRANSFER
SYSTEMS

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Evaluation of the Extended
Alternative Issuance Demonstration

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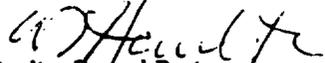
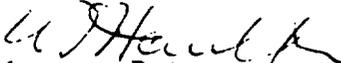
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EXECUTIVE SUMMARY

Electronic Benefit Transfer (EBT) systems use electronic-funds-transfer and point-of-sale computer technologies to perform benefit issuance and redemption functions in the Food Stamp Program. Recipients' program benefits are maintained in computerized accounts, and their benefits are electronically credited to retailers' system accounts when recipients buy groceries. Retailers, in turn, are reimbursed for EBT credits when a system's clearinghouse bank initiates an electronic funds transfer through the Federal Reserve System's Automated Clearing House (ACH) network. The transfer results in EBT credits being deposited to retailers' regular bank accounts.

Electronic Benefit Transfer systems offer many potential advantages for benefit issuance and redemption in the Food Stamp Program. The application of electronic-funds-transfer and point-of-sale technologies eliminates the need for Authorization-to-Participate (ATP) documents and food stamp coupons. Such changes offer some potential for greater administrative efficiency and benefit security. Furthermore, an ongoing demonstration of an EBT system in Reading, Pennsylvania, has shown that recipients and grocers find EBT systems easy to use. Recipients, grocers and banks all prefer the Reading EBT system to the previous coupon issuance and redemption system.

THE NEED FOR SYSTEM PERFORMANCE STANDARDS

If EBT systems are to be a successful alternative to the coupon-based issuance and redemption system, they will need to meet high standards of performance. Whenever recipients attempt to buy groceries, for instance, all system components must be working properly to support transaction processing. In addition, slow system response times at store checkout counters will not be accepted by grocers or recipients. Furthermore, all system functions must operate accurately to avoid errors in system accounts, and EBT systems will need to maintain high levels of system security to protect program funds against theft or diversion.

To support state initiatives to introduce EBT systems in other locations, this report presents a set of recommendations for EBT system performance standards. It also provides recommended procedures for monitoring

system performance. The recommendations are based on experience gained during the Reading EBT demonstration and on recognized performance capabilities of commercial point-of-sale (POS) systems, which are similar in basic design and operation to the Reading system.

The performance standards and monitoring procedures recommended herein are designed to facilitate the successful implementation of future EBT systems. As state welfare agencies consider the possible application of these technologies to benefit issuance and redemption, they should keep these recommendations in mind during discussions of system design and operations. The recommendations are especially pertinent when state agencies reach the point of establishing performance standards for vendor-supplied POS services. If state agencies instead choose to design and operate their own EBT systems, the recommended performance standards provide guidance in setting levels of system performance that will be acceptable to system users. The recommended monitoring procedures will assist states in ensuring that system performance standards are being met.

The report's recommended performance standards pertain to "on-line, real-time" EBT systems. Such systems require that the system process many system functions (especially purchase transactions) while the system user waits for a response. Most commercial POS systems in the United States today are based on this design, and it is expected that most EBT applications in the next few years will be on-line, real-time systems. If state agencies select other system designs, they will have to develop a separate set of performance standards for their systems. Even if other designs are selected, however, the information in this report can serve as a useful basis for developing other standards.

Finally, it is likely that potential performance capabilities of POS systems will improve over time as advances are made in available system hardware, software, and telecommunications components. Because the standards provided in this report are based on current system capabilities, these standards may need to be updated in the future. For at least the next several years, however, they should continue to represent valid measures of acceptable and attainable system performance.

MAJOR AREAS OF RECOMMENDED PERFORMANCE STANDARDS

An EBT system will perform or interact with many different Food Stamp Program benefit issuance, benefit redemption and administrative support functions. These functions include:

- posting benefits to recipients' computerized EBT accounts;
- issuing identification cards which enable authorized recipients to access the system;
- electronically processing purchase and refund transactions;
- settling retailers' EBT credits;
- responding to recipients' account balance inquiries and retailers' queries for deposit information;
- updating and maintaining retailers' and recipients' computerized accounts;
- reconciling the flow of benefits through the system; and
- providing management information to system operators, the state agency, and the Food and Nutrition Service of the U.S. Department of Agriculture.

Six key characteristics of system design and operations affect how well an EBT system can perform these program functions. The six areas are:

- 1) system processing speeds,
- 2) system reliability,
- 3) system capacity,
- 4) system security,
- 5) system ease of use, and
- 6) system management information.

System processing speeds, for instance, directly affect how much time is needed at store checkout counters for program recipients to buy groceries.

System reliability reflects the likelihood that an EBT system will be available to process purchase transactions. The security of the system affects the financial integrity of all program functions dealing with benefit issuance and redemption.

Because these six system design and operating characteristics affect the performance of program functions, the report's recommended performance standards are presented in terms of these six key areas. Detailed performance standard recommendations and monitoring procedures are presented throughout the report. The following sections provide a summary of the nature and rationale for these standards.

System Processing Speeds

The Reading EBT system is an on-line, real-time POS system. Such systems require immediate processing of purchase transactions and other functions. Slow processing speeds will cause delays at checkout counters and local welfare office workstations, leading to user dissatisfaction with the system.

To avoid excessive delays, the report presents recommended processing speed standards for various system functions. Standards are presented in two different formats ("average time" and "99 percent time") for three different time periods. The three time periods (peak hours, prime hours, and all hours of system operations) correlate with expected monthly and daily fluctuations in system processing demands. Because system processing speeds are likely to be somewhat slower during periods of heavy system usage, the time standards are somewhat less stringent during peak and prime processing periods. The average time standards reflect recommended maximum average system processing times during any given time period. The 99 percent standards provide an upper bound on processing times. That is, no more than one percent of all system transactions during a given time period should exceed the 99 percent time standards.

Some program functions have a greater need for fast processing than other functions. Rapid processing of purchase transaction messages, for instance, is more critical for the successful operation of an EBT system than the processing of local welfare office updates of file information. The report, therefore, presents separate processing speed standards for different

program functions. These standards differentiate among the four major points of message origination in an EBT system: store checkout counters, local welfare office workstations, retailers' or recipients' telephones, and workstations at the system's operations center.

System Reliability

Many different system components must work properly if an EBT system is to successfully process purchase transactions. These components include recipients' and retailers' EBT cards, store equipment (i.e., POS terminals, PIN-pads and printers), the communications network connecting store terminals and the system's computers, and the system's computers and associated peripheral equipment.

Failure within any single system component will prevent use of the system. Because problems with the system's computers will affect all system participants, the most important performance standard for system reliability is the percentage of time the system is available to process EBT functions. System availability is reduced whenever the system's computers are not running or when peripheral equipment (e.g., the system's operating console, modems for telecommunications lines, tape drives or disk packs) are not functioning. A single performance standard for system availability is presented, and this standard should be met during periods of peak system usage as well as during all hours of system operations.

Performance standards for the reliability of other system components focus on maximum acceptable service times to repair or replace faulty EBT equipment. The report also presents performance standards for a system's ability to process all system functions accurately.

System Capacity

Limited capacity of an EBT system can lead to problems accessing the system, to slow processing speeds, and -- in extreme situations -- to prolonged periods of system downtime. To avoid these problems, the report presents standards for three areas of system capacity: communications, processing throughput, and data storage.

Communications capacity refers to the number of telephone lines available for transmitting transaction requests to the system's computers. If a sufficient number of lines is not available, store terminals will not be able to call the system to transmit purchase transaction requests, thereby causing delays at checkout counters.

Processing throughput refers to the number of transactions which the system can process in a given amount of time. Inadequate processing capacity will increase processing times, and the performance standards for processing speeds may not be met.

An EBT system needs to maintain a number of different system files on data storage devices (e.g., tapes or disks). If sufficient space is not allocated on data storage devices for all system files, file capacity will be exceeded and further processing cannot continue.

Required system capacity for communications and data processing will depend on peak volumes of processing demand on the system. Data storage requirements depend on the number of recipients and retailers using the system. The system developer, therefore, must estimate peak processing loads and the number of system users when designing an EBT system to ensure that sufficient capacity will be provided. Because demands on system capacity can change over time as more recipients or retailers are added to the system or as recipients use the system more frequently, the system developer needs to monitor capacity usage after system implementation to prevent the occurrence of capacity-related problems. As a system nears its capacity limitation for either communications, processing throughput or data storage, the system developer will need to expand that area of system capacity to ensure that performance standards continue to be met. Because plans to expand system capacity may take some time to implement (i.e., new equipment may need to be ordered and installed, and system software may need to be revised to accommodate new equipment or procedures), system developers need to monitor changes in capacity utilization closely to ensure that expansion plans are initiated well before capacity problems develop.

System Security

An EBT system will be responsible each month for processing thousands of dollars of Food Stamp Program benefits. A very high level of system security must be maintained to protect these benefits from accidental loss and intentional theft or diversion.

System security involves measures to both prevent errors and loss or diversion of benefits, and to detect any such problems when they occur.

Preventive measures include controls on physical access to the system, controls on communications access, message validation, and sound administrative and operational procedures. These measures should allow the system to avoid accidental errors and to recognize and reject any attempts to intentionally divert funds.

To detect problems which may occur, all system accounts and flows of benefits through the system should be reconciled each day to ensure the proper accounting of all program funds. The system should record all transactions which involve the transfer of funds to provide an auditable trail of changes to each system account.

System Ease of Use

Successful implementation of an EBT system requires that retailers and recipients be able to use the system easily, both to transact purchases and to accomplish other necessary functions (e.g., keeping track of account balances and reconciling store sales against deposits to stores' bank accounts). An EBT system will become easier to use as:

- the number of separate actions needed to accomplish a given function is minimized,
- the number of commands or codes which must be memorized is minimized,
- clear and comprehensive in-process prompts and training are available, and
- procedures for resolving problems are clearly identified.

Even if the above operating procedures are integrated into the design of an EBT system, the system will not be easy to use if processing speeds are slow, if the system is often unavailable for transaction processing, if the system fails to process all transactions accurately, or if security problems lead to accidental or fraudulent loss or diversion of program benefits. Thus, the performance standards recommended throughout the report for these other characteristics of system operations are just as important for ensuring system ease of use as the procedural factors listed above.

System Management Information

System managers need accurate, timely and comprehensive information about system operations and performance. Information should be available about levels of system use, system performance, specific problems encountered during daily operations, system costs, and changes in system design or operating procedures.

Information about levels and trends in system use is needed to monitor capacity utilization and to identify possible needs for expansion of system capacity. This information also will be useful to other state agencies as they begin to plan for EBT systems in their jurisdictions.

Measures of system performance should be related directly to the performance standards specified for the system. Using the monitoring procedures recommended in the report as an example, system managers should receive information on many different performance factors, including:

- average processing speeds for various system functions,
- the percentage of time the system is available for transaction processing,
- the percentage utilization of the system's processing resources,
- the percentage of time all lines to the system are in use,
- the incidence of processing errors,
- any problems with system reconciliation, and

- a summary of complaints received about system operations from retailers or recipients.

In addition to summary information about system performance, system managers need detailed information about the nature and cause of any problems affecting system operations or performance. System managers can use this information to design corrective measures to resolve the problems.

To assess the administrative efficiency of system operations, system managers should receive ongoing information about the full costs of operating an EBT system. These costs include labor costs, data processing costs, telecommunications charges, charges for equipment purchase and leasing, software purchase or lease costs, and service contract charges.

Finally, as with any computer system, any changes in system design or operating procedures should be thoroughly documented. Such documentation will facilitate the identification and resolution of any system problems that may develop at a later date.

Chapter One

INTRODUCTION

The Food Stamp Program provides benefits to needy households to help them purchase food items authorized under the program. The U.S. Department of Agriculture, Food and Nutrition Service (FNS), is responsible for federal administration of the program. State welfare agencies administer the Food Stamp Program within each state. Although state agencies must adhere to federal regulations governing program eligibility requirements, benefit levels and issuance procedures, they have considerable latitude in deciding how to administer the program within the framework of the federal regulations.

With respect to benefit issuance procedures, nearly all program recipients receive benefits in the form of food stamp coupons with specified face values. Mechanisms for issuing these coupons vary both within and among states. Recipients use the coupons to purchase groceries at authorized retail food outlets, and retailers deposit these coupons at their local banks for full reimbursement from the federal government.

For several years, FNS has sought alternative benefit issuance and redemption systems for the Food Stamp Program that are more efficient, less costly to administer, and less vulnerable to fraud and abuse than the current coupon-based systems. One alternative system being tested is the Electronic Benefit Transfer (EBT) system, which uses electronic-funds-transfer and point-of-sale (POS) technologies to change the manner in which benefits are issued to recipient households and redeemed by food retailers. Experience with a demonstration of the EBT system, however, indicates that system performance is a critical element in the successful implementation of an EBT issuance and redemption system. If EBT systems are to be implemented by other state agencies, therefore, these systems must meet a minimum set of performance standards.

1.1 THE READING, PENNSYLVANIA, EBT DEMONSTRATIONS

The Food and Nutrition Service has sponsored two EBT demonstrations in Reading, Pennsylvania. For the first demonstration, a systems engineering firm -- Planning Research Corporation (PRC) -- designed and operated an EBT system in Reading from October 1984 through December 1985. The evaluation of

that demonstration showed that recipients, retailers and financial institutions preferred the EBT system to the coupon system it replaced by wide margins. Demonstration participants did complain about some performance-related problems, however, and the EBT system's administrative costs were higher than the administrative costs of the coupon issuance and redemption system.¹

In response to widespread support for the system from the Pennsylvania Department of Public Welfare (PDPW); from Reading retailers, financial institutions, and demonstration recipients; and from Pennsylvania's congressional delegation; FNS extended the EBT demonstration in December 1985. In an effort to reduce system operating costs and to test state agency operations of an EBT system, PDPW assumed operating responsibility for the system after the system's computers were moved to PDPW's data processing center at Harrisburg State Hospital in March 1986. PDPW operated the "relocated" EBT system until June 1987, when it implemented a totally redesigned EBT system for the Reading area. With the implementation of the redesigned system, which uses new system software and operates on PDPW's regular computer facilities, PDPW plans to further reduce operating costs and to improve system performance.

Despite the changes in system administration and the redesigned system's new hardware and software, all three EBT systems (i.e., the original, relocated and redesigned systems) tested in the original and extended EBT demonstrations perform the same basic issuance and redemption functions. Benefit issuance functions include:

- posting benefits to recipients' computerized EBT accounts;
- issuing magnetic-stripe identification cards to recipients;
- responding to recipients' account balance inquiries;

¹William L. Hamilton et. al., The Impact of an Electronic Benefit Transfer System in the Food Stamp Program, Cambridge, Massachusetts; Abt Associates Inc., June 1987.

- processing purchase and refund transactions electronically; and
- manually authorizing EBT sales when stores' EBT equipment is not working or when the system is otherwise not available for processing.

Benefits are posted to recipients' accounts using the issuance file normally created to print Authorization-to-Participate (ATP) documents for program recipients. The system processes purchase transactions when demonstration recipients use their identification cards (called EBT cards) to access the benefits in their accounts to buy groceries. The cards are used at special POS terminals at store checkout counters to authorize the transfer of benefits from recipients' accounts to retailers' EBT accounts. If the system is inaccessible or if store terminals are not working, retailers can call PDPW staff for manual authorization of EBT sales (up to \$35 per recipient each day).

Recipients can check their remaining balances either by checking the EBT receipt printed after each transaction, by using stores' regular POS terminals or special balance-only terminals (located at the local welfare office and in the larger stores), or by calling a special telephone number which connects to a Voice Information Processing System (VIPS) which accesses the requested information from the recipient's account file.

The three basic benefit redemption functions in the EBT system include:

- settlement of retailers' EBT credits;
- reimbursement of the system's clearinghouse bank's Federal Reserve account; and
- providing information to retailers on the amount of credits settled.

Settlement occurs when the EBT system totals retailers' credits each day and transfers this information to the system's clearinghouse bank, currently Commonwealth National Bank (CNB). The bank processes this information and submits it to the Federal Reserve's Automated Clearing House (ACH) network. The ACH network uses electronic funds transfers to credit retailers' deposit

accounts at their banks, debiting CNB's Federal Reserve account by the total amount of the funds transfer. Commonwealth National Bank then submits a wire funds request to the U.S. Treasury to receive reimbursement for all daily retailer credits from a special Department of Agriculture letter-of-credit account maintained at the Treasury for the EBT demonstration.

Retailers desiring daily deposit information can call a special VIPS number which responds with the value of their EBT deposits credited through the ACH network the previous day.

In addition to the above issuance and redemption functions, the EBT system performs the following three major administrative functions to support benefit issuance and redemption:

- update and maintain retailers' and recipients' computerized accounts;
- reconcile all flows of benefits and funds through the system each day; and
- provide daily, weekly and monthly management reports on system activities and funds flows.

Retailers' and recipients' accounts are updated immediately by the system as benefits are posted or as purchase and refund transactions are processed. Local welfare office staff update non-financial information (e.g., name, address, identifying codes, account status) in these accounts on an as-needed basis.

System reconciliation involves the balancing of each account each day to discover any errors or other problems with system processing. Reconciliation also verifies the accuracy of the system's processing of benefits entering the system (through benefit issuance) and leaving the system (through ACH deposits or conversion of EBT benefits to ATP documents for recipients leaving the demonstration).

The EBT system in Reading works very much like commercial point-of-sale systems currently being implemented in merchant locations throughout the country. The system offers many potential advantages over the Food Stamp

program benefits (e.g., trafficking, theft). The Reading demonstration also has shown that recipients and retailers find the EBT system easier to use than coupons. Finally, although administrative and operating costs for the EBT system were quite high during the original EBT demonstration, in a non-demonstration setting these costs might be no higher than the costs of administering the coupon-based issuance and redemption system. Integrating EBT system operations with a State Agency's other data processing requirements (as PDPW has done with the redesigned EBT system), for instance, should reduce both labor and equipment costs. Enlarging the base of participating food stamp recipients also could reduce unit costs by spreading fixed costs (e.g., data processing equipment, time spent monitoring system operations) over a larger group of system users.

1.2 PURPOSE OF THE REPORT

Given the potential advantages of an EBT system, FNS anticipates that other state welfare agencies may be interested in implementing EBT-like systems for their Food Stamp Programs. To support states' EBT initiatives, this report provides a set of recommendations for EBT system performance standards. System performance is a critical element in the successful implementation of an EBT issuance and redemption system. Poor performance can increase costs to both the state agency and primary user groups (e.g., recipients and retailers). Recipients and retailers also may fail to support the introduction of a new issuance and redemption system if that system does not meet performance expectations. Thus, the recommended performance standards are designed to help states avoid problems with system performance that could deter the successful implementation of an EBT system.

The recommended performance standards presented in this report are based on an expectation that EBT systems in the near future will be "on-line, real-time" systems. Such systems (of which the Reading EBT system is an example) require that purchase information be transmitted immediately to the system over telephone lines and processed upon receipt. The purchase cannot be completed until the system informs the user that information about the purchase has been processed. Although other system designs are possible, most commercial POS systems in the United States at this time are on-line, real-time systems. If state welfare agencies select an alternative design, they

will have to develop performance standards which are appropriate for that design.

1.3 THE NEED FOR SYSTEM PERFORMANCE STANDARDS

The report recommends performance standards for six key characteristics of system design and operations:

- system processing speeds;
- system reliability (including both accessibility and processing accuracy);
- system telecommunications, processing and file capacity;
- system security;
- system ease of use; and
- system management information.

Poor performance in any one of these design and operating characteristics can negatively impact one or more of the benefit issuance, benefit redemption and administrative support functions described in the previous section. Exhibit 1-1 shows which program functions are affected by each system design and operating characteristic, as well as an assessment of the relative importance of specifying performance standards for each area of potential impact.

Specifying the relative importance of different performance standards is necessarily a subjective exercise. Nevertheless, the information in Exhibit 1-1 is based on experience gained from the Reading EBT demonstrations and on an assessment of the services provided by on-line POS systems and how such systems interact with system users.

Individual chapters of the report present a more detailed discussion of why performance standards are needed for each of the six system design and

Exhibit 1-1

PROGRAM FUNCTIONS AND SYSTEM CHARACTERISTICS AFFECTING PERFORMANCE:
RELATIVE IMPORTANCE OF PERFORMANCE STANDARDS

Program Functions	System Characteristics Affecting Performance								
	Processing speed	Reliability		Capacity			Security	Ease of Use	Mgt Infor- mation
		Access- ibility	Accuracy	Tele- comm	Process- ing	File size			
<u>Benefit Issuance</u>									
Post benefits	L	M	H		L	H	H		H
Issue card	M	H	H	M	M		H	M	M
Provide balance information	H	H	H	H	H		H	H	
Process transactions	H	H	H	H	H	H	H	H	M
Authorize manual sales			H		M		H	M	M
<u>Benefit Redemption</u>									
Settle retailer accounts	L	M	H		L		H		H
Reimburse clear- inghouse bank			H				H		H
Provide deposit information	H	H	H		H		H	H	
<u>Administrative Support</u>									
Maintain files	M	M	H	M	M	H	H	M	
Reconcile system	L	M	H		L		H		H
Provide manage- ment reports	L	L	H		L		H		H

Legend: H - high need for performance standard
M - medium need for performance standard
L - low need for performance standard

operating characteristics.¹ In judging the relative need for specific performance standards, several general rules were followed, which are reflected in Exhibit 1-1:

- the greatest need for processing speed performance standards occurs in functions requiring real-time processing (especially functions involving retailers or recipients);
- performance standards for system accessibility are most needed for functions requiring real-time processing, unless an occasional slight delay in access does not severely impact system operations or system users (e.g., routine updates of file information);
- all system functions require a very high standard for processing accuracy;
- the need for telecommunications capacity is greatest for functions generating a large number of simultaneous demands for access to the system;
- all system functions require a very high standard for system security;
- standards for system ease of use are most needed for functions requiring direct interaction between the system and retailers or recipients; and
- performance standards for the timeliness and content of management information is greatest for those functions affecting flows of benefits through the system and for reports which present measures of system performance.

The importance of establishing performance standards for an EBT system is reinforced by some of the problems which developed during the Reading EBT demonstration. The Reading system experienced problems with processing speeds, system reliability and system capacity, especially during the first nine months of operations. Because performance standards had not been specified for the Reading EBT system, there was some difference of opinion when the problems developed as to whether or not PRC had met its contractual

¹For a detailed discussion of the issues surrounding EBT system performance, see John A. Kirlin and William L. Hamilton, Performance Issues in an Electronic Benefit Transfer System for the Food Stamp Program, Cambridge, Massachusetts: Abt Associates Inc., February 1987.

obligations to provide an EBT system for the Food Stamp Program. If performance standards had been established, negotiations over system adequacy and how to resolve the problems could have been reduced. In addition, the presence of performance standards might have avoided some of the system problems which did develop.

It should be noted that FNS did not specify performance standards for the Reading EBT system because -- at the time FNS awarded the contract to design and implement the system -- few POS systems were operating in this country. Without sufficient experience from POS operations, FNS believed that reasonable performance standards could not be established. Instead, FNS specified a detailed list of functional requirements which any proposed system would have to meet.¹

Fortunately, the system problems which occurred during the Reading demonstration were not so severe that recipients and retailers failed to support its implementation and continuation. Nevertheless, future applications of EBT technology to the issuance and redemption of food stamp benefits may not be received as well as in Reading if system performance fails to meet recipients' and retailers' expectations. Because retailers participate in the Food Stamp Program on a voluntary basis, their acceptance of an EBT system is crucial to future efforts to introduce this technology.

Finally, because the basic design of an EBT system will affect its performance capabilities, performance standards should be specified before system design work begins. If state welfare agencies decide to contract for system design services, they should include the system's performance standards in the original Request for Proposals. If state agencies instead decide to design and implement their own EBT systems, performance standards should be clearly established before agencies begin designing the system.

¹See John A. Kirlin, Developing an Electronic Benefit Transfer System for the Food Stamp Program, Cambridge, Massachusetts: Abt Associates Inc., August 1985, for a description of these functional requirements.

1.4 ORGANIZATION OF THE REPORT

As indicated below, the remainder of the report is divided into six chapters, each covering one of the key system design and operating characteristics described in Section 1.3:

- system processing speeds (Chapter 2)
- system reliability (Chapter 3)
- system capacity (Chapter 4)
- system security (Chapter 5)
- system ease of use (Chapter 6)
- system management information (Chapter 7)

Every chapter begins with a brief discussion of that chapter's area of system performance and why performance standards are needed. The report then presents one or more specific performance standards which an EBT system needs to meet. Each chapter then concludes with a description of mechanisms by which performance can be monitored after system implementation. Monitoring mechanisms are just as important to successful implementation of an EBT system as performance standards. Without an established monitoring system, state welfare agencies will be unable to determine whether or not a system is meeting its specified performance standards.

The report also provides in Appendix A an example of a Service Level Agreement (SLA) which can be used as a contractual agreement between a state welfare agency and a system developer or operator. The SLA presented uses the performance standards recommended in this report. State agencies seeking a different set of performance standards can modify this SLA to meet their own needs.

Finally, Appendix B presents procedures for estimating expected transaction volumes in an EBT system. Expected transaction volumes are a key parameter in designing a system's communications and data storage capacity, as explained in Chapter 3.

Chapter Two

SYSTEM PROCESSING SPEEDS

An electronic benefit transfer (EBT) system is a highly automated computer system which maintains recipients' and retailers' account balances and which processes the transfer of program benefits from one account to another as recipients purchase groceries. In an on-line, real-time system like the Reading EBT system, many computer operations must take place while a system participant (e.g., recipient, retailer, local welfare office worker) waits for a response. Thus, processing speeds for an on-line, real-time system are more critical for system performance than they are for off-line systems, in which some information (especially information about purchases) is stored for subsequent processing and settlement.

Because on-line, real-time systems are the predominant design for commercial POS systems in the United States, it is expected that EBT applications in the near future will be based on on-line, real-time designs. For this reason, the performance standards for system processing speeds presented in this chapter are relevant for on-line, real-time systems.

We refer throughout this chapter to performance standards for "system processing speeds." The standards, however, actually encompass more than just the system's time to process an EBT transaction message. They include the time required to transmit messages over the telecommunications network, time spent in the system's processing queue, and sometimes other components of the overall transaction sequence. Because the chapter present standards for different EBT functions (and these standards vary in terms of which transaction components are included), we use the "processing speed" terminology as a general reference for the performance standards.

2.1 THE NEED FOR PROCESSING SPEED PERFORMANCE STANDARDS

As indicated in Chapter 1, system processing speeds affect the performance of several basic EBT issuance and redemption functions in the Food Stamp Program. The successful performance of functions requiring real-time processing (e.g., transaction authorization, provision of balance information, file maintenance, and -- in some system designs -- card issuance) is very vulnerable to slow processing speeds. Other program functions requiring the

batch processing of large amounts of data (e.g., deposit settlement, system reconciliation, and the generation of management reports) may be adversely affected if processing speeds are slow. To ensure an acceptable performance level for these program functions, therefore, standards are needed for both real-time and batch processing functions.

Rapid processing of real-time functions is crucial to the successful implementation of an EBT system. Retail stores are particularly sensitive to delays at the checkout counter because all customers standing in line are affected. Slow processing of EBT purchases will generate customer dissatisfaction and may lead to a loss of business. Similarly, customers making balance queries and welfare office employees will soon become dissatisfied with a system which does not respond quickly to their requests for information or for account processing.

Many different factors affect system processing speeds. Choice of computer hardware and peripheral equipment (e.g., tape drives, disk drives, modems) and software design affect how quickly a transaction is processed once it reaches the system. Peak system usage levels and their relationship to system capacity (discussed in Chapter 4) also affect processing speeds. For these reasons performance standards for processing speeds need to be established before system design begins. Once a specific hardware and software configuration is selected for the system, performance standards for processing speeds may not be attainable without expensive redesign of the system.

In addition to processing real-time functions like purchase authorizations and balance queries, an EBT system will have numerous functions requiring batch processing of large amounts of data. Although these batch functions do not directly affect real-time processing functions, they require access to system files and use of computer resources. If system processing of batch functions is slow, real-time processing may be delayed. These delays can be avoided if functions requiring real-time processing have priority access to system resources, but batch functions then may take a long time to complete. In this situation, schedules for completing batch functions may not be met, disrupting normal system operations. Thus, batch processing speeds also need to be considered by system designers.

2.2 PERFORMANCE STANDARDS FOR PROCESSING SPEEDS

An EBT system must process several different types of functions. Processing speeds for some functions are more critical to successful operations than processing speeds for other functions. Furthermore, an EBT system can be designed so that specified functions receive higher priority for system processing. It is therefore appropriate to establish different processing speed standards for different functions. Exhibit 2-1 lists the major functions in an on-line, real-time EBT system. The functions are classified according to where they originate. If an EBT system assigns processing priorities to different program functions, the functions originating from store terminals should receive the highest priority, followed by functions originating from the local welfare office and real-time functions originating from the system's operations center. Functions originating from telephones should receive the next highest processing priority, and batch processing functions should receive the lowest processing priority.

FUNCTIONS ORIGINATING AT STORE TERMINALS

Two EBT functions always are initiated at store terminals -- purchases and refunds. Depending on system design, recipients' requests for account balances and stores' requests for daily deposit totals also may be initiated at store terminals. Regardless of which function is requested (i.e., purchase, refund, balance query), there are six components which can affect the total time required to complete the request:

- 1) Transaction set-up, which includes the time to pass the EBT card through the card reader of the terminal and to enter the PIN. If PIN verification occurs at the terminal rather than at the system's computers, time to verify the PIN is included in transaction set-up.
- 2) Connect time, the time required to establish a communications link with the system's computers. Connect time includes time to dial the system's telephone number (if dial-up lines are used) and time for the terminal's modem and the system's modem to prepare for message transmission.
- 3) Transmission time, the time required to transmit messages back and forth between the store's terminal and the system's computers.

Exhibit 2-1

MAJOR SYSTEM FUNCTIONS

Functions Originating at Store Terminals

- requests for purchase authorizations
- requests for refund transactions
- recipient requests for account balances
- store requests for daily deposit totals

Functions Originating from Local Welfare Office

- card encoding
- updates of information in an account
- queries for an account balance and entry of manual sales information
- queries for an account's recent activity

Functions Originating from Telephones

- recipient requests for account balances
- store requests for daily deposit levels

Functions Originating at System Operations Center

- updates of information in an account
 - queries for an account balance and entry of manual sales information
 - queries for an account's recent activity
 - batch programs
 - posting benefits to accounts
 - settling retailer deposits
 - system reconciliation
 - generating management reports
-

- 4) Queue time, the time between the moment the system first receives a message from the terminal and the moment the system's computers are ready to process the message.
- 5) Processing time, the time spent processing the message.
- 6) Print time, the time spent at the checkout counter printing a receipt for the transaction.

Of the six components, only two -- queue time and processing time -- are directly affected by system processing speeds. System design decisions and equipment choice, however, can affect connect time, transmission time and print time. We therefore present recommended time standards for the sum of these five components. We do not include transaction set-up in the recommended time standards because transaction set-up includes the cardholder's time to swipe the EBT card through the card reader and time to enter the PIN. The system designer has no direct control over how long these actions will take, and it is therefore inappropriate to include transaction set-up times in the time standards. Average time required to swipe cards and to enter PINs, however, can be reduced by thoroughly training recipients on how to use the card reader and PIN-pad.

Exhibit 2-2 presents our recommended time standards for functions originating at store checkout counters. The standards are presented in two formats and for three separate (but nested) time periods. The two formats are "average time" and "99 percent time." These two formats are defined below. The three time periods are "all operating hours," "prime operating hours," and "peak operating hours." Based on experience with the Reading EBT demonstrations, peak operating hours are 10 a.m. to 7 p.m. each regular issuance day and the two days thereafter (excluding Sundays). Prime operating hours are 10 a.m. to 7 p.m. each day of the month. In the extended Reading EBT demonstration, approximately 77 percent of all purchase transactions are occurring during prime operating hours and about 28 percent are occurring during peak hours.

The average time and 99 percent time formats are defined as follows. Average time is the arithmetic mean of the sum of the five transaction components for all transactions during any given time period. The 99 percent time format defines an upper bound for transaction times for indivi-

Exhibit 2-2

RECOMMENDED TIME STANDARDS (IN SECONDS) FOR FUNCTIONS
ORIGINATING AT STORE CHECKOUT COUNTERS

Period	Average Time	99 Percent Time
Overall	20	23
Prime	21	24
Peak	22	25

Notes:

Prime hours are 10 a.m. to 7 p.m. each day of the month.

Peak hours are 10 a.m. to 7 p.m. on regular issuance days and the two days thereafter (excluding Sundays).

Recommended time standards assume that 1200-baud modems are used for transmitting transaction messages and that terminals use touch-tone dialing to connect with the system. If 300-baud modems are used, add 8 seconds to each time standard. If rotary dialing is used, add 6 seconds to each time standard. If dedicated lines are used instead of dial-up lines, subtract 6 seconds from each standard.

dual transactions. No more than one percent of all transaction times during a given period should exceed the 99 percent time standard.

The average and 99 percent time standards in Exhibit 2-2 show little variation across the three time periods. The lack of variation, 20 to 22 seconds for average time and 23 to 25 seconds for 99 percent time, arises because queue time and system processing time -- the only components affected by the level of processing demand -- contribute only about three seconds to the total time for a transaction. Thus, even a large percentage change in the time required for these two components will affect total transaction time by a relatively small amount.

We have not presented individual time standards for each of the five components of the transaction because system users will be concerned only with the total time to process a transaction. Exhibit 2-3, however, presents our expectations of approximately how much time each component will contribute to overall transaction times. State agencies can use these expected values as a guide when designing an EBT system or when reviewing the design plans of the system's design contractor. The following paragraphs provide additional detail on each of the five transaction components.

Connect Time. Required time for the store's terminal to connect with the system will depend upon whether dedicated or dial-up lines are used and -- for dial-up lines -- whether the store's telephone uses rotary or touch-tone dialing. Connect time will be fastest with dedicated lines because dialing time is eliminated. Dedicated lines are more expensive to install and use than dial-up lines, however, and are usually cost-effective only in very high-volume operations. The time standards presented in Exhibit 2-2 therefore assume that dial-up lines are used between stores and the EBT system's computers. If dedicated lines are used, the recommended time standards should be reduced by about six seconds, based on observed dial-up times in the Reading demonstration.

For dial-up lines, touch-tone dialing is considerably faster than rotary dialing. As shown in Exhibit 2-3, expected connect times (with touch-tone dialing) should be about eight or nine seconds. This estimate includes both a dialing time of about six or seven seconds and one or two seconds for the terminal's and system's modems to prepare for message transmission. The recommended time standards in Exhibit 2-2 assume the use of dial-up lines with

Exhibit 2-3

APPROXIMATE TIME REQUIRED (IN SECONDS) FOR EACH
TRANSACTION COMPONENT

Component	Time
Connect time ^a	8 - 9
Transmission time ^b	3 - 5
Queue time	0 - 1
Processing time	1 - 2
Print time	6 - 7
Total time	18 - 24

Notes:

^aAssumes use of dial-up lines with touch-tone service. If dedicated lines are used, subtract six seconds from connect time. If dial-up lines with rotary service are used, add six seconds to connect time.

^bAssumes use of 1200-baud terminals. If 300-baud terminals are used, add approximately 7 to 10 seconds to transmission time.

touch-tone dialing. If a store uses rotary dialing, the recommended standards should be increased by about six seconds. Because of the large increase in needed dialing time, we recommend that an EBT system not use rotary dialing. If rotary dialing is allowed, it should be used only in stores expected to have relatively few EBT transactions each month.

Transmission Time. Five factors affect total transmission time: 1) the number of messages within each transaction which must be communicated back and forth between the terminal and the system's computers, 2) the amount of information included in each message, 3) the distance of transmission (i.e., local or long distance), 4) the speed of transmission, and 5) the quality of the communications line.

The recommended transaction time standards in Exhibit 2-2 assume that approximately three to five seconds will be required to transmit messages back and forth between store terminals and an EBT system's computers. The expected three- to five-second transmission time is based on several assumptions, as described below.

We expect that each transaction originating at store terminals will require the transmission of only two messages: the transaction request and the system's response. This is known as a "single-commit" protocol. Some types of point-of-sale transactions require a "double-commit" protocol, in which two additional messages are sent. The third message confirms the receipt of the system's response, and the fourth message confirms the receipt of the confirmation message. Purchase, refund, and balance inquiry transactions for an EBT system, however, should require only the single-commit protocol.

In terms of the amount of information to be included in transaction messages, the following information needs to be sent from the terminal to the system:

- terminal, store and clerk identification numbers;
- recipient's identification number;
- recipient's PIN (encrypted);
- transaction type (i.e., purchase, refund, balance query);
- transaction amount (for purchases and refunds); and

- message authentication code.

The response message must contain the following information:

- system response code (e.g., transaction accepted, insufficient balance, account on hold, invalid PIN), and
- remaining balance amount.

For an EBT system operating within a single state, the distance of transmission should have very little impact on transmission times. Transmission times can increase, however, if the message has to pass through several links of the telecommunications network. In commercial POS systems, for instance, transaction messages frequently pass through one or more routing nodes (switches), and each node adds approximately one second to total transmission time. Unless an EBT system uses a commercial POS system's telecommunications network, additional time for routing transaction messages should not be required.

The three- to five-second expected transmission time in Exhibit 2-3 assumes the use of a 1200-baud transmission rate between terminals and the system. Most POS terminals on the market today use either 300-baud or 1200-baud modems. Terminals with 1200-baud modems are generally more expensive than 300-baud terminals, and the state agency and system designer will have to decide which type of terminal to purchase and deploy. (The Reading EBT system uses 300-baud terminals.) If 300-baud terminals are used, the expected transmission time will increase to about 10 to 15 seconds, adding about 7 to 10 seconds to the total transmission time. Thus, when selecting terminals for an EBT system, the state agency and system designer will have to weigh the additional cost of 1200-baud terminals against the substantial increase in total transaction time if 300-baud terminals are used.

Finally, the quality of telephone lines will affect transmission times if messages need to be retransmitted because an original message is corrupted during transmission. Performance standards for line quality are presented in Chapter 3 (System Reliability). The system developer, however, will have no control over the quality of the telecommunications network. If line quality problems are encountered, the system developer will have to work with the local telephone company to resolve the problems.

Queue Time. If an EBT system is designed to allow parallel processing of transaction messages, less than one second should be needed to build a transaction message in the system's processing queue and to wait for system processing. Parallel processing allows the system to act on more than one transaction message at a time. If serial processing is used (i.e., only one transaction can be processed at a time), queue time may increase dramatically during periods of heavy system usage. For this reason, we recommend that an EBT system support parallel processing of transaction messages.

Processing Time. Once a message reaches the bottom of the processing queue, the system should require only one to two seconds to process the message. Shorter processing times will reduce the queue time component of the overall transaction as well as the processing time component, especially if the system relies on serial processing of transaction messages.

Except during periods of heavy processing demands, transaction messages should be processed in about one second. During periods of heavy processing demands, system processing time for a single transaction message still should be no greater than about two seconds.

Print Time. The time required to print a receipt for an EBT purchase or refund will depend upon how much information needs to be printed and the print speed of the selected printer.

The American Bankers Association (ABA) has issued draft guidelines for the operations of online, debit card point-of-sale systems in which transactions are routed through multiple networks.¹ The guidelines specify that a receipt must contain the following information:

- client's account number,
- account type selected (i.e., savings or checking),
- transaction date and time,
- merchant name and address,
- transaction amount,

¹"Implementation Guidelines for Online Debit Card Systems at the Point of Sale (Draft)," American Bankers Association, Payment Systems Policy Board, Retail Payments Task Force, Ad Hoc Committee, July 1986.

- transaction type (i.e., purchase or refund),
- terminal identification number,
- system response,
- acquirer identification number,
- retrieval reference number, and
- authorization identification response.

The last three data elements in the above list would not be needed in an EBT system unless the system uses a commercial POS network when transmitting transaction messages. An EBT system's transaction receipt also would not need to specify which account type had been selected by the client, because only one account -- the recipient's computerized EBT account -- is available for transaction debiting.

Instead of printing the merchant's name and address, the Reading EBT system prints only the merchant's EBT identification number on recipients' receipts, and it does not print the system's response to the transaction request because receipts are printed only if the transaction is approved. The Reading EBT system also prints the recipient's remaining EBT balance on each EBT receipt.

Based on timing studies of the NCR printers used in the Reading demonstrations, about six to seven seconds is needed to print an EBT receipt. Slower print times should be avoided. If print times are too slow, faster print times can be attained either by selecting faster printers (which may be more expensive) or by designing the system to print some information (e.g., recipient's account number; merchant name and address, or identification number; transaction amount, and terminal identification number) while the terminal waits for the system to process the transaction request.

FUNCTIONS ORIGINATING FROM THE LOCAL WELFARE OFFICE

Local welfare office personnel will need to interact with an EBT system to investigate recent transaction activity for specific accounts, to check current account balances (especially for authorizing manual transactions), to update account information, and to encode new EBT cards. Communi-

cation with the system will be performed via workstation terminals that connect directly to the system, eliminating connect time except at the beginning of each work session.

Once a work session begins, the workstation's monitor screen should display a menu of system functions which can be performed from the workstation. The workstation operator can then select the appropriate function and enter the requisite information to initiate the function. For instance, if the operator wishes to check a recipient's remaining balance, he or she would select that function from the menu and enter the recipient's account identification number. If the operator wishes instead to check transaction activity against an account, a different function would be selected from the menu and the time period in question, as well as the account's identification number, would be entered.

Once the appropriate information is entered with the terminal's keyboard, the operator will press an "Enter" key and wait for the system's response. After the system processes the request, the system's response will be displayed on the workstation's monitor.

Exhibit 2-4 presents our recommended time standards for how quickly an EBT system should respond to a request initiated at a local office workstation. The average time standards vary from five to six seconds, depending on time of day and day of month. The 99 percent time standards vary from eight to nine seconds. These standards are based on known capabilities of interactive computer systems and the realization that even five to nine seconds can seem like a very long time to wait when the terminal operator has nothing else to do in the interim.

The time standards in Exhibit 2-4 cover the time required to transmit the request and response messages between the workstation and the system, queue time, and system processing time. Print time is not included because -- in most situations -- the workstation operator will not need a printed copy of screen information.

For transmission time, we assume that a 1200-baud transmission rate is used and that two to five seconds is needed to transmit the information. Many functions will require very little data to be transmitted, and two seconds should be sufficient to transmit the information. Other functions will

Exhibit 2-4

RECOMMENDED TIME STANDARDS (IN SECONDS) FOR FUNCTIONS
ORIGINATING AT THE LOCAL WELFARE OFFICE

Period	Average Time	99 Percent Time
Overall	5	8
Prime	5	8
Peak	6	9

Notes:

Prime hours are 10 a.m. to 7 p.m. each day of the month.

Peak hours are 10 a.m. to 7 p.m. on regular issuance days and the two days thereafter (excluding Sundays).

Recommended time standards assume that 1200-baud modems are used for transmitting messages back and forth between the local office workstation and the system's computers.

require more data to be sent in the system's response (e.g., a listing of all account activity in a specified period of time), but even these responses should take no longer than about four to five seconds to transmit. (The amount of data that needs to be transmitted immediately can be limited to the amount of data that can be displayed in a single screen. If more data needs to be sent, the transmission can occur when the workstation operator requests an additional screenful of information.)

If the EBT system assigns processing priorities to different system functions, functions originating at local office workstations will likely be assigned a lower priority than functions originating at store checkout counters. Even with the lower processing priority, however, processing should take no longer than two to three seconds unless a large amount of data needs to be read from system files. Queue time should be no longer than one to two seconds, reflecting the lower processing priority for workstation functions.

FUNCTIONS ORIGINATING FROM TELEPHONES

The only functions envisioned for an EBT system which originate from regular telephones are recipient requests for account balances and store requests for daily deposit totals. It is assumed that the system's computers are configured to respond automatically to these requests.

Of all functions requiring real-time processing by the system, functions originating from telephones warrant the lowest priority for system processing. Although these functions should occur only on an intermittent basis, when they occur they should not interfere with operations at the check-out counter or the local welfare office.

Functions originating from telephones will require a slightly different sequence of operations than EBT functions originating at store terminals or local office workstations. Rather than setting up a single transaction message and transmitting it to the system's computers, requests for balance information or deposit totals will involve more interaction between the caller and the system. In the Reading EBT demonstrations, for instance, the recipient or retailer calls a special telephone number which connects to the system's VIPS (Voice Information Processing System) unit. The system prompts the caller for his or her account number, and the recipient or retailer enters the information on the telephone's keypad. The system then prompts for the

caller's PIN, and the PIN is entered. The system then responds with the requested information.

Because the system designer has no control over the caller's time to enter the required information, the recommended time standards in Exhibit 2-5 include only transmission time, queue time and processing time. As shown in the exhibit, the recommended average time standards vary from three to four seconds. Transmission time should be well below one second, because very little information needs to be transmitted. An EBT system should require only about one second for processing because the system needs only to access and read the appropriate record in the relevant file. Unlike many other system functions, no processing time is needed to write new data to a file. The remaining time (i.e., two to three seconds) reflects queue time. Expected queue time for functions originating from telephones is longer than queue time for other functions because requests originating from telephones may receive the lowest priority (among real-time functions) for system processing.

The time standards in Exhibit 2-5 pertain to the system's response to each entry of information by the caller. If an EBT system requires the separate entry of an account number and a PIN (as in the Reading EBT system), there are two separate system responses. First, the system must verify that the entered account number is valid before prompting for the PIN. Second, once the PIN is entered, the system must verify the PIN and access the requested information from system files. Although we recommend that an EBT system not require PIN entry for requests originating from telephones,¹ other system designs may require separate entry of other identifying information. In this situation, the recommended time standards apply to each entry/response interaction.

¹To protect the security of selected PIN numbers, PINs should not be transmitted without encryption. When entering a PIN on a telephone's keypad, there is no mechanism for encrypting the PIN prior to transmission over the telephone line.

Exhibit 2-5

RECOMMENDED TIME STANDARDS (IN SECONDS) FOR FUNCTIONS
ORIGINATING FROM TELEPHONES

Period	Average Time	99 Percent Time
Overall	3	4
Prime	3	4
Peak	4	5

Notes:

Prime hours are 10 a.m. to 7 p.m. each day of the month.

Peak hours are 10 a.m. to 7 p.m. on regular issuance days and the two days thereafter (excluding Sundays).

If the function requires more than one entry/response interaction between the caller and the system, the recommended time standards apply to each entry/response interaction.

FUNCTIONS ORIGINATING AT SYSTEM OPERATIONS CENTER

Functions originating at an EBT system's operating center include real-time functions like queries for account activity and updates of information in retailers' or recipients' accounts, and batch functions requiring processing of entire computer files or substantial subsets of files.

Real-time functions originating at the system's operating center are quite similar to those functions originating at the local welfare office. For these real-time functions, the standards presented in Exhibit 2-6 are recommended. These standards are one to three seconds faster than the standards recommended for local office workstation functions (Exhibit 2-4). The increased speed arises because we assume that the operating center's workstation will be wired directly to the system's computers. With direct wiring, 9600-baud transmission rates can be used instead of 1200-baud rates, thereby cutting transmission times significantly. The local welfare office cannot use 9600-baud transmission rates because telephone lines cannot handle high-speed transmission rates.

We present no specific processing speed standards for batch functions in an EBT system. The time required to perform batch processing will depend upon many factors, including what function is being processed (e.g., posting issuances to recipients' accounts, retailer settlement, system reconciliation, generation of management reports), the efficiency of the application software, the size and organization of the file or files to be processed, the data storage media involved (i.e., tape, disk, diskette), and the demands on system processing resources from other higher-priority functions. Thus, a set of standards which is applicable to one system may be irrelevant for another EBT system.

Despite the absence of specific time standards for batch functions, the system developer cannot ignore the need for efficient and timely processing of batch programs. Slow processing of batch functions may delay the completion of time-critical batch functions. Early in the original Reading EBT demonstration, for instance, retailer settlement had to occur each day between 2:00 p.m. and 6:00 p.m. Problems with batch processing speeds delayed retailer settlement on several occasions. Thus, the system's daily production schedule really becomes the standard for determining whether or not batch processing speeds are acceptable. If batch processing speeds are too slow to

Exhibit 2-6

RECOMMENDED TIME STANDARDS (IN SECONDS) FOR FUNCTIONS
ORIGINATING FROM SYSTEM'S OPERATIONS CENTER

Period	Average Time	99 Percent Time
Overall	4	5
Prime	4	5
Peak	5	6

Notes:

Prime hours are 10 a.m. to 7 p.m. each day of the month.

Peak hours are 10 a.m. to 7 p.m. on regular issuance days and the two days thereafter (excluding Sundays).

Assumes use of 9600-baud transmission rate.

meet the system's planned production schedule, the system developer must increase processing speeds by modifying the application software or file structure or by installing a faster computer.

Finally, if the same computer is used to process both on-line and batch functions, the system developer must ensure that slow batch processing speeds do not delay processing of on-line functions. This was a problem in the original Reading EBT system. The redesigned EBT system in Reading circumvents any possibility of a similar problem by using a separate computer for all batch processing.

2.3 MONITORING PROCESSING SPEEDS

Time standards have been recommended for program functions originating at four different locations: terminals at store checkout counters, local welfare office workstations, recipients' and retailers' telephones, and workstations at the system's operations center. This section describes procedures for monitoring processing speeds at each of the four locations.

Store Terminals

The recommended standards for transaction times at store terminals include all five components of the overall transaction: connect time, transmission time, queue time, processing time and print time. To monitor overall transaction times, the state agency or system operator must arrange for observers to station themselves at store checkout counters to measure a sample of transaction times.

We recommend that observers use stopwatches to measure the total elapsed time between the start of the transaction (defined as when the store clerk presses the "Enter" key on the terminal to begin the system dial-up sequence) and the completion of receipt printing. Although the time standards pertain only to the overall transaction time, observers may want to measure some of the individual components of the transaction as well. Measurement of individual components can help identify the source of transaction delays if overall transaction times exceed the recommended standards. In the Reading EBT system, approximate measures of connect time and transmission time can be made by listening to audible signals generated by the terminal. Print times, of course, can be measured by direct observation of store printers.

Observers should monitor transaction times during peak hours, prime hours, and other times of the day and month. As defined earlier in this chapter, peak hours are 10:00 a.m. to 7:00 p.m. on regular issuance days and the two days thereafter (excluding Sundays). Prime hours are 10:00 a.m. to 7:00 p.m. each day. Because system processing demands are heaviest during peak hours, this is the period when transaction times are likely to be slowest. It is important, therefore, that most of the transaction timings occur during this period. We suggest that at least 30 separate transactions be timed during peak hours, that 15 transactions be timed during other prime hours, and that 15 transactions be timed during non-prime hours. Although these are fairly small samples, they should be sufficient for determining whether or not the system is meeting the recommended time standards.

Transaction times may vary somewhat at different stores and store terminals. Although it is probably not necessary to try to select a representative sample of store terminals for the transaction timings, the state agency or system operator should spread the timing observations over at least a few stores and store terminals each month.

Stopwatch observations are intrusive to store operations, labor-intensive and expensive to conduct. Nevertheless, a complete sample of at least 60 transactions should be timed during each of the first three months of system operations to ensure that the time standards are being met. Once the state agency is assured that transaction times meet the recommended time standards, observations can be conducted on a less frequent basis, perhaps every four to six months. If system processing times begin to slow down or if retailers or recipients begin to complain about transaction times, however, more frequent transaction timings should be performed. In addition, if monthly system processing demands increase substantially, transaction timings should be made to monitor the system's continuing ability to meet the recommended time standards.

Of the five transaction components, system queue and processing times are the components most susceptible to changes over time. That is, problems with system processing may slow processing speeds, as may changes in system processing demands. Some computer systems support a capability to timestamp messages as they enter and pass through the system. Such timestamping provides an easy way to monitor system queue and processing times, and we

recommend that EBT systems include timestamping whenever possible. Incoming messages should be timestamped as they enter and as they leave the processing queue. System responses should be timestamped when they are transmitted back to the point of message origination.

If system queue and processing times are timestamped, the system operator should monitor these times periodically during peak, prime and other hours throughout each month of system operations. If measured system queue and processing times increase, observers should begin monitoring transaction times at store terminals to ensure that the recommended time standards are still being met.

Local Office Workstations

Because the recommended time standards for functions originating at local welfare office workstations include transmission time as well as system queue and processing times, the total time to complete these three components must be monitored at the point of origination. Observers should again use stopwatches to measure the total time which elapses between a workstation operator's pressing of an "Enter" (or "Return") key on the keyboard and the time the system responds by filling the workstation's screen with requested data.

Because different workstation functions may require more or less system processing time, system response times should be timed for a variety of workstation functions. Local office personnel can do the timings as they perform their routine workstation functions. We suggest that at least 15 to 20 timings be made each month during each time period (i.e., peak, prime and non-prime hours). If the system encompasses more than one local welfare office, timings should be made at each office, and the results should be submitted to the state agency or the system operator for review.

Telephones

To monitor system response times to telephone requests for recipients' balance information or stores' deposit information, the system should include at least one recipient and one retailer dummy account in its master

file. Each month, system personnel should use regular telephones to request information about these dummy accounts. Calls should be made to both accounts during peak, prime, and non-prime hours.

Because very little information needs to be processed for functions originating from telephones, we expect that system response times will show little variation within a given time period (i.e., peak, prime, or non-prime hours). Therefore, a sample of only 10 to 15 timings within each time period should be sufficient for monitoring response times. System personnel should use stopwatches to measure the time from when they enter the last digit of required information to when the system responds with the requested information.

Operations Center Workstations

Procedures for monitoring system response times for functions originating at workstations located at the system's operations center are quite similar to those for functions originating at local office workstations. Again, at least 15 to 20 timings should be made during each time period (peak, prime and non-prime). As with local office workstations, the timings should cover a variety of different workstation functions. System operating personnel can measure system response times while performing routine workstation functions.

Chapter Three

SYSTEM RELIABILITY

System reliability is broadly defined for the purpose of this report. It covers the proper functioning of all elements affecting system accessibility and the ability of system software to process all system functions without error. System accessibility refers to a system's ability to accept and process program data and to transmit response messages to the user without interruption.

3.1 THE NEED FOR SYSTEM RELIABILITY PERFORMANCE STANDARDS

System reliability is a very important factor in the overall performance of an EBT system. As described below, an unreliable system can create many problems for system users. The potential severity of problems with functions requiring real-time processing (e.g., transaction processing) is greater than for other functions (e.g., generating management reports), however, and the need for performance standards is directly related to the severity of problems caused by an unreliable system.

SYSTEM ACCESSIBILITY

During the course of daily EBT system operations, a diverse set of individuals need to access the system's computers to perform different program functions. System operators need to post benefits to recipients' accounts, settle retailers' EBT credits, reconcile the system, and produce management reports. Local welfare office staff need to access the system to issue new or replacement EBT cards and to update information in account files. Recipients and retailers need to access the system to process purchase transactions and to receive balance or deposit information.

Prolonged periods of system inaccessibility will severely disrupt all of the above program functions. Even short periods of inaccessibility, however, can create hardships for system participants. Recipients waiting at the local welfare office for identification cards to be issued, for instance, may have to return to the office at a later time if the system cannot encode required information on the cards' magnetic stripes. Recipients or retailers calling the system for information about account balances or deposit

information will have to call again if the system is not available. Most importantly, any period of system inaccessibility can disrupt recipients' ability to purchase groceries.

System processing of purchase transactions is the most frequent and important program function performed by an EBT system. For reasons described below, it is also the function for which problems with system accessibility can create the greatest problems for recipients and retailers. By setting performance standards for all factors affecting system access during transaction processing, therefore, system accessibility for other program functions should be adequate.

Recipients need access to their food stamp benefits to purchase

recipient reaches the checkout counter, it is quite possible that the recipient will not have sufficient cash to complete the entire purchase. The recipient then will have to use cash to buy a much smaller set of groceries or wait until the system is repaired to purchase any groceries. Either situation may impose a hardship on the recipient.

To ensure that a recipient does not go without groceries because of system failure, an EBT system should incorporate procedures to manually authorize at least a minimum purchase when the system cannot electronically process a purchase transaction. To protect against possible overdrafts, however, the system may need to impose a maximum daily limit for manually authorized purchases (see Chapter 5). Thus, even with manual backup procedures, recipients may be unable to purchase the full amount of groceries

PROCESSING ACCURACY

As mentioned in Chapter 1, performance standards for processing accuracy are critical for all program functions performed by an EBT system. Even though system reconciliation should detect any processing errors which do occur (unless reconciliation processing is itself in error), program staff and the affected system participants will have to spend time and effort correcting the error and researching and correcting the problem that caused the error.

Errors may cause other problems as well. For example, if benefits are incorrectly posted to recipients' accounts, some recipients may spend benefits which are not authorized by Food Stamp Program regulations. The program may incur a permanent loss of these benefits if they cannot be recouped before the recipient leaves the program. Another example of a problem caused by processing errors is incorrect processing of purchase amounts. If a processing error leaves fewer benefits in a recipient's account than actually should be there, the recipient's planned purchase may be rejected by the system, causing both embarrassment and the problem of not being able to purchase intended groceries.

Finally, if reconciliation does not successfully detect all processing errors involving benefit posting, transaction processing and retailer settlement, either recipients, retailers, or the Food Stamp Program may incur a permanent loss of benefits or funds. Thus, processing accuracy affects not only how smoothly an EBT system operates, it has the potential for affecting the fiscal integrity of the Food Stamp Program as well.

Any complex computer system will inevitably encounter some problems with system accessibility, and perhaps with processing errors as well. Severe problems with an EBT system, however, will not only affect the parties involved at the time, but they may lead to an overall assessment within the retail or recipient communities that the system is not trustworthy. Overcoming these perceptions may be more difficult than solving the original problems causing poor system performance. Reliable system performance is therefore very important to the successful implementation of an EBT system.

3.2 PERFORMANCE STANDARDS FOR SYSTEM RELIABILITY

Purchase transactions cannot be successfully completed if any one of the following system components is not working properly: the system's computers and peripheral equipment, including modems, tape drives, disk drives and operating console; recipients' or stores' EBT cards; stores' EBT equipment, including PIN-pad, card reader, terminal and printer; and communication lines from the retail store to the system's computers. Local welfare office staff will not be able to access the system if either the system's computers or its workstations are not functioning properly. Performance standards for each of the above components should be specified when designing an EBT system, along with a standard for processing accuracy.

SYSTEM COMPUTERS AND PERIPHERAL EQUIPMENT

Regardless of the reliability of other system components, no program functions (except manual authorization of EBT sales) can be performed when the system's computers are not available for processing. Many functions cannot be performed if peripheral equipment (e.g., modems, tape or disk drives, system workstations) is not working. A stringent performance standard for the processing availability of the system's computers and peripheral equipment, therefore, is needed to ensure the successful operation of an EBT system. We recommend a performance standard of 99.5 percent for system processing availability. That is, an EBT system's computers and peripheral equipment should be available for processing at least 99.5 percent of the time the system is scheduled for operations. Because some retail stores remain open 24 hours each day, this standard effectively requires the system to be available 99.5 percent of the time.

Some systems may need to be down at scheduled intervals for normal system maintenance (e.g., backing up files or implementing software revisions). Such routine maintenance activities should be scheduled during periods of low system usage and should not exceed about two hours per week. System downtime for normally scheduled maintenance should not be counted against the recommended 99.5 percent accessibility standard.

System inaccessibility during periods of heavy transaction processing creates more problems for retailers and recipients than system inaccessibility during other periods. During a 30-day month, for instance, an

EBT system could be inaccessible for 3.6 hours and just meet the 99.5 percent performance standard. If all this inaccessibility occurred during a period of heavy system demand, retailers and recipients probably would not regard the system as very reliable. We therefore recommend that the 99.5 percent accessibility standard apply to peak and prime periods of system usage as well as to all scheduled operating hours. The Reading EBT demonstration indicates that peak periods of system demand are 10 a.m. to 7 p.m. on regular issuance days and the two days thereafter (excluding Sundays). Prime periods of system usage are 10 a.m. to 7 p.m. each day of the month.

EBT CARDS

The recipient's EBT card is needed to initiate a purchase transaction because information encoded on the card's magnetic stripe is used to verify the identity of the recipient and to instruct the system which account to debit during the purchase. A damaged card, therefore, will prevent the recipient from buying groceries until a replacement card is issued. If similar cards are used to sign store equipment onto the system at the beginning of the day or shift (as in the Reading EBT demonstrations), a damaged card will prevent the store from processing any EBT transactions until the card is replaced.

Reliability problems with EBT cards are caused by the card's magnetic stripe being susceptible to wear or scratching and by cracking of the card itself. No industry standards exist for card durability, although card vendors and clients sometimes negotiate standards for manufacturing defects. For instance, the purchase contract may specify that no more than five cards per 1000 (0.5 percent) be rejected at issuance because of problems with the card or its magnetic stripe. Once cards are placed in use, however, card manufacturers offer no warranties for their resistance to damage.

To ensure that magnetic-stripe cards can be used in different manufacturers' card readers, the International Organization for Standardization (ISO) has developed detailed standards (ISO 7810) for the physical characteristics of credit and debit cards and their magnetic stripes. Standards cover such characteristics as the material used in manufacturing the card; the card's resistance to deformation and deterioration from light or heat; the dimensions of the card; the placement of the card's

magnetic stripe and signature panel; and the resistance of the magnetic stripe to abrasion and contamination. Although adherence to these standards should reduce problems with card durability, they are clearly manufacturing standards rather than explicit durability standards.

STORE EQUIPMENT

Stores' EBT equipment must function properly if EBT transactions are to be processed. There are no general industry standards for maximum failure rates of terminals, card readers, modems, PIN-pads and printers, so performance standards for equipment reliability must focus on how quickly inoperable equipment must be repaired or replaced.

Although equipment manufacturers will not guarantee the reliability of EBT equipment, they will offer warranty periods (usually between three months and one year) for their equipment. Once a piece of equipment is out of warranty, the equipment owner assumes full responsibility for its maintenance. If state agencies deploy EBT equipment in grocery stores, therefore, they will be responsible for repairing or replacing the equipment once warranty periods expire.

Equipment owners have three options for how to handle equipment servicing. They can negotiate with either the equipment manufacturer or a third party for a service contract after warranty periods expire, or they can perform service work themselves. Equipment owners, of course, can select different options for different types of equipment or for equipment deployed in different areas. Regardless of which option is selected by a state agency for its EBT equipment, performance standards should be specified for equipment servicing.

Performance standards for equipment servicing should specify how quickly faulty equipment must be repaired or replaced. If the state agency contracts with the equipment manufacturer or a third party for equipment servicing, the cost of the contract will increase as maximum service time requirements decrease. Because the relationship between contract costs and maximum service times will vary for different manufacturers and third party service providers, we cannot make an explicit recommendation for a maximum service time standard. Indeed, a state agency may discover that short response times can be negotiated in densely populated areas at reasonable

cost, but that similar response times cannot be negotiated at reasonable cost in areas located far away from service providers.

Based on experience gained from the Reading EBT demonstrations, we suggest that state agencies try to negotiate a two- to three-hour maximum response time standard for equipment servicing. The Pennsylvania Department of Public Welfare's current service contract (with a third party) for the Reading EBT equipment requires that faulty store equipment be repaired or replaced within two hours of a request for service. (Service calls are not required, however, between 8:00 p.m. and 9:00 a.m.) Retailers have been very satisfied with this level of service, and they have not complained even though some service calls have exceeded the two-hour standard.

Based on conversations with terminal deployers, we note that a two- to three-hour standard for equipment servicing is a relatively stringent standard. State agencies, therefore, may need to relax this standard in some situations. Unlike users of regular point-of-sale equipment, however, food stamp recipients using EBT equipment may have no other payment option available (except manual sales authorizations) when buying groceries. Relatively stringent standards for equipment servicing, therefore, are justified in an EBT system.

Equipment servicing costs will increase as the number of required service trips increases. If a certain model of EBT equipment is particularly unreliable, therefore, long-term equipment costs (including both purchase and maintenance costs) may decrease if all units of that model are replaced. In the Reading EBT demonstration, less than one percent of store modems and PIN-pads needed on-site servicing each month, about four percent of the printers required on-site servicing, and about two percent of the terminals needed on-site servicing. The Pennsylvania Department of Public Welfare considers the frequency of required on-site servicing for the printers in Reading to be excessive. Because printers are more prone to mechanical failure than other pieces of EBT equipment, however, state agencies can expect that printers will be the least reliable piece of deployed equipment.

Finally, we note that the HONOR point-of-sale network in Florida uses a performance standard that essentially combines a reliability and a service-time standard. Store equipment in Florida must operate 98 percent of the time the store is open for business. Frequent equipment breakdowns or

slow service responses will cause this standard to be exceeded. Because equipment manufacturers will not guarantee equipment reliability, we do not recommend such a performance standard for an EBT system. Rather, as discussed above, problems with equipment reliability should be addressed by assessing the cost implications of continuing to service the equipment versus buying newer, more reliable equipment.

COMMUNICATION LINES

Poor quality telephone lines will delay system operations by requiring the retransmission of degraded EBT messages. We recommend that no more than one out of every 100 transmitted messages should require retransmission as a result of poor quality lines. If this standard is exceeded repeatedly over a period of time, the telephone company should provide a more reliable telephone line.

Downed telephone lines will prevent any EBT transactions from being transmitted. These problems, however, are infrequent and beyond the control of either the telephone company or the system developer. Standards for maximum time to repair downed lines are not recommended because telephone utilities are usually very efficient in responding to reports of downed lines.

MANUAL TRANSACTIONS

When store equipment is not working or the system's computers are not available for transaction processing, EBT sales can be completed with manual authorizations. The relative incidence of manually authorized transactions to electronically processed transactions, therefore, serves as an indicator of these components of system reliability.

Commercial POS networks usually do not manually authorize sales when stores' equipment or the POS network is not working. Consequently, there is no base of experience -- beyond the Reading EBT demonstrations -- for specifying a performance standard for the incidence of manual transactions.

During the original EBT demonstration, the ratio of manually authorized sales to electronically processed sales was 0.385 percent. Thus, approximately 1 of every 260 EBT sales was manually authorized. The ratio has dropped to 0.217 percent, or 1 in every 460 sales, during the extended

demonstration. During some months, however, the ratio has been as high as 0.4 percent.

We recommend that an overall performance standard of 0.2 percent be established for the ratio of manually authorized sales to electronically processed sales. This standard assumes that future EBT applications can improve somewhat upon the reliability of the original and relocated EBT systems. (The redesigned EBT system has not been operating long enough to generate accurate information on the ratio of manual and electronic purchases.) For any given month of operations, the ratio should not exceed 0.3 percent.

The Pennsylvania Department of Public Welfare has experienced a situation recently that warrants an exception to the above standard. Some retailers in Reading have requested that manual sales be authorized while they wait for their EBT equipment to be installed. (Installation usually takes about four weeks because telephone lines have to be installed.) If state agencies decide to offer similar support to stores starting to participate in an EBT system, manual sale authorizations for these stores should not be counted against the overall performance standard of 0.2 percent or the monthly standard of 0.3 percent.

PROCESSING ACCURACY

The developer of an EBT system should strive for 100 percent accuracy in processing all EBT functions. Processing activities are controlled by the system's application software, and application software can be tested prior to system implementation to ensure that processing will be accurate.

Even with thorough software testing, however, unique instances may occur which will lead to processing inaccuracies. In Reading, for instance, some transactions interrupted by system failures were not processed accurately. That is, the recipient's account was debited, but the retailer's account was not credited. System failure during preparation of the daily ACH tape also resulted in a couple of retailers receiving double credits for some EBT sales. Finally, infrequent problems with the system's procedures for identifying specific account records on the transaction file led to some issuances being credited to the wrong recipient accounts.

Situations leading to inaccurate processing should be very infrequent in a well-designed system, and we recommend a performance standard of 99.98 percent for the accurate processing of all EBT functions. Thus, for every 5,000 processed transactions (including purchases, benefit issuances and deposits to retailers' ACH accounts), no more than one transaction should be processed incorrectly.

An EBT system must be capable of identifying and correcting any processing errors. To meet this requirement, all system accounts and transfers of funds must be reconciled periodically to ensure that the system balances. Standards for system reconciliation are presented in Chapter 5 (System Security).

3.3 MONITORING SYSTEM RELIABILITY

Some of our recommended performance standards for system reliability can be monitored from the system's operating center or the local welfare office. Monitoring the reliability of stores' EBT equipment may require contacts with store managers, the vendor providing service for the equipment, or both.

SYSTEM COMPUTERS AND PERIPHERAL EQUIPMENT

Some computer hardware may be able to internally document when the computer itself is not functioning. These internal timings can be used to document system uptime.

In many situations, however, the system's computers may be running when other system components are not operating. For instance, a software problem may prevent system processing, or the modems to the computer may not be working. System operators should be instructed to document when events which prevent system processing occur. This documentation should be used to calculate the total time and the percentage of time the system is not functioning properly.

EBT CARDS

Recipients with damaged EBT cards will need to return to the local welfare office to receive new cards. Depending upon system design, damaged

retailer cards could be replaced either at the local welfare office or the system's operating center.

The local welfare office and the system's operators should maintain records on how many EBT cards need to be replaced each month and the reason replacement is needed (i.e., to replace a damaged card or a lost or stolen card). Records also should be maintained on the total number of cards issued and, if possible, on the month each card was issued. This information will allow calculation of average card life or card failure rates.

Damaged cards should be recovered by local welfare office personnel so that the source of the damage (e.g., cracked card, scratched magnetic stripe, worn magnetic stripe) can be determined. This information can be used to guide future decisions about card selection.

STORE EQUIPMENT

An EBT system's regular operating procedures should include instructions to retailers about whom to call when service is needed for their store's EBT equipment. During the original EBT demonstration in Reading, retailers called the system's operating center to request assistance. Under the Pennsylvania Department of Public Welfare's operation of the Reading EBT system, retailers call the local welfare office during the office's normal business hours and the operating center in Harrisburg during weekday evenings and weekends to report equipment problems. Local office or operating center employees inform the service vendor about malfunctioning equipment.

If state agencies act as terminal deployers in other EBT systems, we assume that similar procedures will be implemented. When retailers call the local welfare office or the operating center to report equipment breakdowns, employees at these sites should maintain records on the time each call is received, the nature of the reported problem, and the time the service vendor is notified of the problem. The service vendor should inform the local welfare office or the operating center when each problem is fixed. These records can be used to monitor the frequency of equipment breakdowns (by type of equipment) and the distribution of response time to repair or replace the equipment. Depending upon the structure of the negotiated service contract, these records also may be used for billing information.

If retailers call the service vendor directly when equipment breaks down, then the vendor will need to keep accurate records on when and where service calls are made and what work is performed. These records can be used to call retailers to confirm that work was performed. Retailers can be asked during these calls how much time elapsed between their call to the service vendor and the repair of the equipment.

COMMUNICATIONS LINES

If dedicated telephone lines are used between store terminals and an EBT system's computers, the availability and quality of lines to the system can be monitored periodically with a line level tester. If dial-up lines are used (as in the Reading demonstration), monitoring line quality is more difficult because transaction messages may be routed over different links of the telephone line network.

An EBT system's application software may be able to track which transaction messages need to be retransmitted after degradation of the original message. If the application software supports this function, the number of retransmissions should be monitored to determine if the system's line quality standard is being met.

All lines to an EBT system should be checked periodically to ensure that all lines are functioning. In a multi-line environment, identification of non-functioning lines can be easily missed because incoming messages will be switched to functioning lines. The non-functioning lines, however, will act to delay access to the system during periods of heavy system usage.

MANUAL TRANSACTIONS

The system's transaction file should record the entry of all manually authorized transactions as well as all electronically processed transactions. Data from the transaction file can be analyzed each month to calculate the ratio of manual transactions to electronic transactions.

PROCESSING ACCURACY

System operators or supervisors may need to adjust account records to correct processing errors. The system should record all adjustments on its

transaction file. When combined with information from the transaction file on the number of EBT functions processed, the percentage of all transactions incorrectly processed can be calculated.

In some situations, errors might be corrected without direct adjustment of system records. Errors in processing benefit issuances, for instance, could be corrected by posting a supplemental issuance to the recipient's account or by reducing the amount of the recipient's next regular issuance. Errors in retailer settlement might be addressed by the state agency or the retailer writing a check to the other party. In these situations the system's transaction file will not record the corrective action, and system supervisors will have to manually account for these adjustments when calculating how many transactions were processed incorrectly.

Chapter Four

SYSTEM CAPACITY

The capacity of an EBT system is an important factor affecting the overall performance of the system. Limited capacity can lead to difficulties accessing the system, to slow processing speeds or -- in extreme situations -- to prolonged periods of system downtime.

4.1 THE NEED FOR SYSTEM CAPACITY PERFORMANCE STANDARDS

An EBT system has three capacity characteristics -- communications capacity, processing throughput, and data storage capacity -- which affect the system's ability to perform program functions. Insufficient communications capacity, for instance, can delay user access to the system for purchase transaction processing, for balance inquiries, for card encoding and for file maintenance. Limited processing throughput slows system processing speeds for all program functions. Insufficient data storage capacity can affect system processing speeds and user accessibility by delaying system access to data files and, in extreme situations, by stopping all system processing until storage capacity is increased. System capacity characteristics, therefore, affect both system processing speeds and system reliability.

Each of the three system capacity characteristics is described in greater detail below.

COMMUNICATIONS

An on-line, real-time EBT system uses local or long-distance telephone lines to transmit messages between retailers' EBT terminals and the system's computers. Similarly, telephone lines are used to connect EBT workstations and card-encoding equipment at the local welfare office to the system. In the Reading EBT system, retailers and recipients also use telephone lines to request and receive information about recent deposits or remaining account balances.

An EBT system's computers will have a limited number of communications "ports" to receive messages transmitted over telephone lines. If the number of ports is not sufficient to handle demands for telephone line access

In the Reading EBT system, all dial-up lines from retailers' EBT terminals connect to a "rotor," which directs each transmitted message to one of six internal lines connecting to six communications ports. Although the EBT workstation at the Berks County Assistance Office (BCAO) also uses a dial-up line, the system has a reserved communications port for this line. Thus, local office access to the system is never restricted by communications capacity. This design is possible in the Reading system because only one office is connected to the system. In a larger system involving many local offices, dedicated lines and a communications controller would be needed to ensure continued communications access for all local office workstations.

When designing an EBT system, the system developer will need to estimate how many internal lines and communications ports are required to handle peak demands for dial-up access to the system. The number of lines and ports required for a system will depend upon (a) the number of messages to be transmitted to the system during periods of peak usage, and (b) how long a line will be occupied while the system processes the message. The system developer, therefore, must estimate expected peak communications loads and average time on line when designing the system. With this information the system developer can determine how many internal lines and communications ports are required to handle expected peak loads.

Procedures for estimating peak communications loads in an EBT system are presented in Appendix B. The data included in the appendix are based on purchase transaction activity during the Reading EBT demonstration, although the general procedures for estimating peak loads are used in designing communications capacity for commercial POS systems as well.

PROCESSING THROUGHPUT

Processing throughput is a measure of processing capacity. Throughput increases as a computer system either increases the speed with which it processes system functions or increases the number of functions which can be processed at the same time.

If an EBT system assigns processing priorities for different system functions, limited processing capacity will delay processing for functions having lower priorities for access to processing resources. During periods of very heavy demand for system processing, limited processing capacity may delay

processing of even the highest priority functions. Because purchase transaction processing and other real-time processing functions would receive the highest priorities for processing in an EBT system, insufficient processing capacity could reduce system response times for these time-critical functions.

If an EBT system does not assign processing priorities to different system functions, then processing requests are essentially handled on a "first-come, first-served" basis. Limited processing capacity in this situation would affect processing speeds for all program functions as soon as processing demands began to exceed processing capacity.

DATA STORAGE

An EBT system must create and maintain a number of different computer files to support operations. These files are maintained on data storage devices, such as magnetic tapes, disks or diskettes. Data storage capacity for files placed on magnetic tape is essentially limitless. A system can access data on disks or diskettes faster than data on tape, however, and system developers will try to maintain most active files on these devices to increase processing speeds.

For disk or diskette storage devices, storage capacity is controlled by the amount of space allocated on these devices for individual files. Available disk space, therefore, is the constraining factor for determining system data storage capacity and, consequently, maximum file sizes.

An EBT system will have, at a minimum, a master file and a transaction file. The master file will contain records for all retailers and recipients participating in the system. These records will contain participants' current account balances. Transaction files will maintain a log of all transactions processed by the system. Thus, file size will increase either as current participants use the system more frequently or as more participants are added to the system. If records of inactive participants are not deleted from the master file, the master file will grow in size even if the total number of active participants remains constant.

If a system fills all allocated space on a disk or diskette file, normal system processing cannot continue until either more space is allocated,

some of the information in the file is removed (e.g., by removing records of inactive participants), or the file is reorganized into a more efficient configuration. These operations require time for planning and implementation. Thus, limited data storage capacity can lead to lengthy periods of system unavailability in some situations.

4.2 PERFORMANCE STANDARDS FOR SYSTEM CAPACITY

This section specifies recommended performance standards for each of the three system capacity characteristics affecting program functions.

COMMUNICATIONS

Dedicated telephone lines provide unrestricted access to an EBT system. If the communications controller for the system is not appropriately sized for the volume of information to be transmitted and processed, however, system response times at EBT workstations may increase. Thus, the only performance standard needed for the communications capacity of a system's dedicated lines is that the recommended performance standards for response time in Chapter 2 be met.

For an EBT system's dial-up lines, we recommend that -- during periods of peak system usage -- no more than one percent of all attempted connects between store terminals and an EBT system should encounter busy signals. This standard corresponds to a telephone network's "P.01" level of service, and it is frequently used in POS applications throughout the country.¹ The one percent standard also should apply to non-peak processing periods. If the system's communications capacity is sized to provide a P.01 level of service during peak periods, however, the percentage of non-peak-period calls encountering busy signals will almost surely fall well below one percent.

If the above level of service is not met, the number of communications ports and internal lines to the system's computers should be increased, or system processing times for individual transactions should be

¹VISA International, for instance, recommends a P.01 level of service for members performing on-line credit card authorizations.

reduced. Either action will reduce the number of times busy signals are encountered.

PROCESSING THROUGHPUT

Some hardware vendors advertise that their equipment can process up to a specified number of transactions per second. At first glance, this measure of processing throughput seems well suited for a performance standard for an EBT system. The number of transactions processed per second, however, is directly affected by the amount of information to be processed, the number and location of system files needing to be accessed, the number of paths available to disk drives or tape drives, and the design of application software. Furthermore, because an EBT system will process many different types of transactions with different processing requirements (e.g., purchase authorizations, balance inquiries, account updates), processing throughput will be affected by the mix of transaction types to be processed. Vendor's claims for processing throughput, therefore, may be misleading for a specific system application of their hardware.

Rather than specifying a performance standard for processing throughput, we believe that the recommended performance standards for processing speeds presented in Chapter 2 are sufficient to ensure high levels of system performance. Limited processing throughput will lead to long queue and processing times. Therefore, if queue time and processing time standards are met, processing capacity is sufficient.

In most computer systems, response time performance begins to suffer well before processing capacity is reached. Response time in the Tandem-based system used in the redesigned Reading EBT system, for instance, begins to increase at rapid rates once the system reaches 60 percent utilization of total processing capacity. Thus, when designing an EBT system, the system developer needs to know the processing performance of the selected hardware at various levels of processing utilization. Many system developers design their systems so that expected utilization rates fall in the 40 to 60 percent range.

System processing capacity can be expanded after system implementation with the acquisition of larger or faster computers or peripheral equipment. Selecting, ordering and installing such equipment takes time. If system demand is expected to grow, therefore, we recommend that equipment

upgrades be initiated before system response times reach response time performance standards. If very high growth rates in system demand are anticipated, capacity upgrades should be initiated sooner.

Processing demands in an EBT system will increase primarily as more food stamp recipients are placed on the system. If an EBT system's computers are used to process non-EBT functions as well, however, increased processing demand from these other functions could reduce available processing capacity for EBT system functions. In this situation, system operators will need to forecast processing demands for both EBT and non-EBT functions when assessing the need for possible capacity upgrades.

DATA STORAGE CAPACITY

Sufficient space must be allocated for system files on data storage devices to ensure that system operations are not adversely affected by limited storage capacity. When estimating needed file space, the system developer must consider not only major system files like the master and transaction files, but also system application files, system utility files, and temporary work files.

Allocated space for the system's master and transaction files should allow for some growth in system use, for newly added households to the Food Stamp Program, and for some uncertainty over anticipated levels of system usage. As described below, evidence from the Reading demonstration can guide developers' estimates of needed file size.

The Reading system's master file contained about 4,100 recipient and retailer account records at the beginning of full system operations in February 1985. (Approximately 360 of the recipient accounts were never activated because these recipients did not attend scheduled EBT training sessions.) Twelve months later, the file had grown to about 6,250 records, even though the recipient caseload remained nearly constant at 3,600 to 3,700 households. By the time the Pennsylvania Department of Public Welfare implemented the redesigned EBT system in June 1987, the relocated system's master file had grown to 8,330 records with only a small increase in the active monthly caseload.

Although some new retailers were added to the system during the approximately 30-month life of the original and relocated EBT system, most of the growth in the master file was attributable to new Food Stamp Program recipients entering the demonstration. During the demonstration period, master file records for never-trained recipients and recipients who left the program were not deleted, causing the master file to grow by over 100 percent. To handle this increase, system operators expanded the allocated space for the master file several times before the implementation of the redesigned system. When system operators implemented the redesigned system, they deleted the account records of approximately 1,200 recipients who had no benefits left in their accounts and who had not used the system since October 1986.

For the original EBT system's transaction file, the system developer allocated space for 40,000 transaction records each month. With an active monthly caseload of about 3,700 recipients, this file operated nearly at full capacity. The 3,700 recipients made about 30,000 EBT purchases each month -- an average of over eight purchases per month. The 10,000 remaining transactions included records for benefit issuances, balance inquiries, entering and reconciling data from manually authorized purchases, account initializations for new recipients, and transfers of retailers' EBT credits to the ACH network. Thus, on average, the transaction file contained approximately 11 records per recipient household per month. Usage levels in other locales may be greater, so a system developer may want to allocate enough space in a transaction file for 14 to 15 records per recipient household per month.

4.3 MONITORING SYSTEM CAPACITY

The system operator should monitor system capacity to ensure that current capacity limits are not being approached. Because efforts to increase system capacity require time to order and install new equipment and, possibly, to update software to accommodate the installation of new equipment, the system operator should track utilization rates over time so that future capacity requirements can be estimated accurately.

COMMUNICATIONS

The Reading EBT system uses a Dacon Call Sequencer to monitor how often all internal lines to the system are in use. Developers of future EBT systems may wish to use similar equipment to monitor line usage.

Simple monitoring of line usage, however, will not indicate how often attempted connects to the system from store terminals cannot be made because all internal lines and communications ports are busy. Local telephone companies should be able to provide information on how often store terminals encounter busy signals when attempting to call the system. The system operator should request such reports soon after system implementation to ensure that a sufficient number of lines to the system is being provided. If levels of system usage increase thereafter, or if other data (e.g., retailers complaints or call sequencer reports) indicate possible problems with line capacity, further reports from the telephone company should be requested. Some commercial POS system operators periodically request such reports whenever they know their system will be heavily used (e.g., during holiday shopping periods). For an EBT system, the analogous time frame will be the two to three days following each regular food stamp issuance date.

PROCESSING THROUGHPUT

As previously suggested, processing capacity is assumed to be sufficient if performance standards for system processing speeds are being met. Thus, the suggestions in Section 2.3 for monitoring processing speeds are relevant for monitoring system processing capacity. Some computer systems also have special support software which can directly measure processing utilization over specified time intervals. If an EBT system's computers have similar support software available, this software should be used during periods of peak processing demand to provide information on the system's utilization of processing resources.

DATA STORAGE CAPACITY

The system operator should monitor the number of records written to the transaction file each month, as well as any growth trend in these records over time. Furthermore, the total number of records maintained on the system's master file should be monitored. If either of these files begin using

their total allocated space, the system operator should immediately make plans for increasing the space allocated for them. For the master file, the system operator may want to delete records of inactive or never-activated accounts. The state agency, in conjunction with the Food and Nutrition Service, should develop guidelines for when accounts can be deleted from a master file.

Chapter Five

SYSTEM SECURITY

An EBT system will be responsible each month for processing thousands of transactions involving Food Stamp Program benefits. The computerized account records of even a small system will represent hundreds of thousands of dollars of program benefits. To protect the fiscal integrity of the Food Stamp Program, therefore, an EBT system must maintain a very high level of security. Any security problems leading to a loss of benefits or the unauthorized release of program data will endanger the successful operation of an electronic issuance and redemption system for the Food Stamp Program.

5.1 THE NEED FOR SYSTEM SECURITY PERFORMANCE STANDARDS

Performance issues for system security fall under two major categories: prevention of security problems, and detection of problems when they occur.

PREVENTION OF SECURITY PROBLEMS

EBT system security is potentially threatened by three sources of vulnerability:

- 1) unintentional actions or design flaws that cause loss of funds or information,
- 2) crimes perpetrated by insiders (i.e., system or agency employees), and
- 3) crimes perpetrated by system users (e.g., retailers or recipients) or persons with no direct involvement with the system.

These three sources of vulnerability can affect any program function dealing with benefit issuance, benefit redemption or administrative support of an EBT system, as noted in Chapter 1. With respect to benefit issuance functions, for instance, unintentional or fraudulent actions can affect:

- the posting of benefits to recipients' accounts,
- card issuance,
- the provision of balance information to recipients,
- the electronic processing of purchase transactions, and
- the manual authorization of purchase transactions.

Similar actions can affect the following benefit redemption functions:

- the processing of grocer payments (settlement),
- the reimbursement of the system's clearinghouse bank,
and
- the provision of deposit information to retailers.

Finally, unintentional or fraudulent actions can affect the administrative support functions of file creation and maintenance and the provision of accurate system reconciliation and system management reports.

When designing an EBT system, therefore, the system developer should consider all possible vulnerabilities associated with each program function and devise security procedures which prevent or minimize the possibility of security lapses. The following paragraphs describe the types of vulnerabilities which must be considered during system design.

Posting Benefits to Recipient Accounts. Recipients' accounts in an EBT system are funded on a periodic basis as the state welfare agency transmits benefit issuance information to the system. Unintentional errors in the issuance process can lead to overissuances. If recipients use these non-authorized benefits and then leave the program (thereby preventing normal recoupment of overissued benefits), program funds may be lost.

In addition to unintentional errors, manipulation of the issuance file by system employees could result in the diversion of benefits to either false or valid recipient accounts. If benefits were diverted to a valid account, the employee would need to be acting in collusion with the appropriate recipient to share in any financial gain resulting from the diversion.

Benefits diverted to a false account could be accessed by the employee if a false EBT card had been encoded for the account.

Although more difficult to implement, persons outside the agency or system could attempt to access the issuance file before it is posted to recipients' accounts. If this were possible, benefits again could be diverted to selected accounts and subsequently accessed.

Card Issuance. The Reading EBT system requires that recipients use magnetically encoded identification cards to access their benefits. The cards are encoded and distributed to recipients when they go to the local welfare office to learn how to use the system. Before a card can be encoded, an account for the recipient has to have been created on the system's master file. During the encoding process, each recipient selects a Personal Identification Number (PIN), which is encoded (in altered form) on the card's magnetic stripe with other identifying information.

Local welfare office staff pose the greatest threat to card security. They have access to blank card stock and the system's card-encoding equipment. Office staff could access a recipient's benefits if they made a duplicate card and knew the recipient's PIN. (Although the Reading identification cards also include a photograph of the recipient, retailers are not required to verify a cardholder's identity before making a sale.) Office staff also could defraud the program if they made a false card for a recipient who failed to appear for training. Finally, office staff and system operators, acting in collusion, could try to create and fund a false recipient account and then access benefits in that account with a false identification card.

Because card-encoding equipment and knowledge of the system is needed to encode a card, persons outside a state agency would have difficulty creating false identification cards. Nevertheless, this threat to system security also should be considered.

Provision of Balance Information. Knowledge of a recipient's remaining account balance will not, by itself, enable those benefits to be fraudulently accessed. Nevertheless, to protect the confidentiality of program data, only authorized program staff and the recipient should be able to determine a recipient's account balance. Program staff will need to have

access to a recipient's remaining balance to perform system reconciliation and to resolve any problems a recipient might have with his or her account.

Electronic Processing of Purchases. An EBT system automatically debits a recipient's account and credits a retailer's account by the amount of a purchase when processing purchase transactions. Unintentional errors in this transfer process can occur if system software is incorrect or if transaction messages are garbled during transmission. Errors also can occur if hardware failures occur in the midst of transaction processing and recovery procedures are inadequate.

Program funds can be diverted by system employees if they can intercept and change a transaction message before it enters the system, or if they can change the system's transaction processing software.

Processing of transaction messages is a key system function which is potentially vulnerable to abuse by system users (i.e., recipients and retailers) or persons with no legitimate interaction with the system. Retailers could attempt to transmit false transaction messages, thereby diverting funds to their own EBT accounts. Recipients acting in collusion with retailers could transmit false messages (using regular purchase transaction procedures) and then split the false purchase amount with the retailers. (This would be an EBT analog to coupon trafficking.) Other persons could attempt to intercept and manipulate legitimate transaction messages, altering the message to divert funds to a different account.

Manual Processing of Purchases. When stores' EBT equipment is not working or when the system itself cannot process transaction messages electronically, manual backup procedures must be available to allow recipients to buy groceries. Because manual procedures bypass many of the transaction processing safeguards built into an EBT system, this is a major point of vulnerability for system security.

Unintentional errors can occur if information about the purchase amount or the appropriate retailer or recipient account is miscommunicated when store clerks request manual authorizations. Such errors also can occur when system employees check remaining balances before authorizing the transaction or when they subsequently enter information about the purchase into the system. These errors have the potential for either overcrediting retailers'

additional reimbursement could result in the withdrawal of more program funds from the Treasury than authorized.

Provision of Deposit Information. As with the provision of recipients' remaining account balances, knowledge of a retailer's EBT deposits cannot lead to the diversion of any program funds. Such data represent confidential financial information, however, and they should be available only to the retailer, the retailer's bank, and authorized program staff. Program staff need to know deposit information to initiate the ACH funds transfer, to reconcile the system, and to respond to any questions a retailer may have about his or her account.

File Creation and Maintenance. An EBT system includes computer files of information on all recipients and retailers participating in the system. The files contain identifying information on system participants, information on current balances, and information on all transactions which move program funds from one account to another. Because these files are typically accessible from computer terminals connected to the system, they are potentially vulnerable to both unintentional data entry errors and intentional acts of fraud.

Program funds can be lost if false or inaccurate accounts are created in the system's computer files or if invalid data are entered into valid account records. Loss of confidential information is possible if unauthorized persons can gain access to the system to read account files. Thus, file security is an important component of system security measures.

System Reconciliation. System reconciliation involves no transfer of benefits between system accounts or into or out of the system. Instead, as described later in this section, reconciliation acts to detect any problems with the accurate and secure processing of system functions. If system employees or outside parties attempted to divert any system funds, therefore, they would have to manipulate system reconciliation reports or software to prevent the detection of their actions.

Provide Management Information. System management reports provide information on levels of system activity and system performance. Although the reports are not necessarily designed to detect security problems, they may identify unusual patterns of activity that could indicate fraudulent

actions. For instance, an unusual number of manually authorized transactions or an unusually high number of purchase transactions at a given store could represent an ongoing attempt to process fraudulent purchases. Similarly, a high number of transactions rejected because an invalid PIN had been entered for a particular account might suggest that an unauthorized person was attempting to access a recipient's account with a lost or stolen card. To prevent the detection of such actions, system employees or outside parties might attempt to manipulate management reports or the software generating these reports.

DETECTION OF SECURITY PROBLEMS

Even a well designed and operated EBT system is potentially vulnerable to security breaches. An EBT system, therefore, should be able to detect and trace any security problems which occur. Reconciliation of system accounts and production of audit trail data should be used for these purposes. As mentioned in Chapter 3, system reconciliation also serves to identify any processing errors committed by the system.

Reconciliation of System Accounts and Flows of Funds. Flows of funds through an EBT system, together with current benefits and credits in recipient and retailer accounts, should always be in balance in a secure and reliable EBT system. For each individual retailer and recipient account, current benefits in the account should equal total benefits placed in the account minus total benefits deducted from the account. If each account is in balance, the overall system will be in balance. It is not necessarily the case, however, that individual accounts will balance if the system balances. For instance, a diversion of purchase credits from one retail account to another would not affect reconciliation of the total system, because errors in the two retail accounts would offset one another. Thus, reconciliation should concentrate on individual accounts, with total system reconciliation providing a second check on system security.

In addition to reconciling individual accounts, the system should reconcile all flows of funds into or out of the system. Total benefits received from the state agency, for instance, should be checked against the state's records of total benefits issued. Similarly, total retailer credits received by the system's clearinghouse bank for deposit to retailers' bank

accounts should be checked against total credits transmitted by the system. These checks will detect any errors in the transmission of benefits to or from the system.

Audit Trails. The reconciliation process will identify any recipient or retailer accounts which are not in balance and any funds flows which may be inaccurate or incomplete. To enable the identification of the source of any errors, an EBT system should provide audit trails of all system functions which can change an account balance. Examination of these audit trails also will inform the system operator which actions need to be taken to correct the identified errors.

5.2 PERFORMANCE STANDARDS FOR SYSTEM SECURITY

The previous section has noted a number of different points at which the security of an EBT system is potentially vulnerable. To meet these numerous and diverse points of system vulnerability, an equally diverse set of security standards are recommended below.

PREVENTION OF SECURITY PROBLEMS

Recommendations for system security are discussed in terms of four components of security control: physical access, communications access, message validation, and administrative and operational procedures. These four groups of security measures will act to prevent or minimize the security threats to the major program functions discussed in the previous section.

Controlling Physical Access. An EBT system's data processing center and local welfare office workstations need to be protected against unauthorized physical access. Thus, the data processing center and all workstations should be located in areas where entry can be restricted to authorized personnel. Entry can be restricted through use of guard desks (where proper identification must be presented before entry) or locked doors.

EBT system operations will require the storage of blank EBT cards, program listings, backup files, system documentation, computer printouts and other materials. If these materials are not stored within the above-mentioned areas of restricted physical access, they must be secured against theft or

unauthorized use. Materials like blank cards, program listings and backup files should be stored in vaults, locked cabinets or fire-proof safes.

Store terminals are the one major component of system hardware over which the system developer cannot ensure restricted access. Security controls for store terminals, therefore, must rely on controls for communications access to the system, described below.

Controlling Communications Access. Many EBT functions require the transmission of data messages over a communications network. Examples include purchase and refund transactions and operations at local welfare office workstations. Thus, even when physical access to the data processing center and workstations is controlled, outsiders can gain access to an EBT system through its communications links. Securing communications access involves both hardware and software controls for the system's computers, controls for the communications network, and controls for the system terminals and workstations. Each set of controls is described separately in the following paragraphs.

"Computer controls" involve steps taken to ensure that all incoming messages have been originated by an authorized terminal (or workstation) and terminal (or workstation) operator. We recommend that all messages from retailers to an EBT system include a retailer identification code, a terminal identifier, and a user identification code. Messages from workstations should include similar information, with the retailer identification code being replaced by a local welfare office code.

A list of all authorized retailers, terminals and workstations should be stored in separate control files in the system's application software. Upon receipt of any incoming message, the system should check the identifying codes in the message against its control files and reject any messages which do not contain valid identifiers. The control files should be updated whenever terminals or workstations are added to or deleted from the system. Each retailer and local welfare office should be given a list of valid identification codes for use by employees.

"Communications network security" can be enhanced through use of dedicated telephone lines rather than dial-up, public lines. Dedicated lines are more expensive than dial-up lines, however, and are likely to be used only

when large numbers of transactions will be transmitted (e.g., in large supermarkets), when transmitted data are particularly sensitive (e.g., the transmission of issuance data or grocers' deposit information), or when the line will be in more or less constant use (e.g., lines connecting local office workstations to the system).

With either dedicated or dial-up lines, communications security can be improved with data encryption. Data encryption prevents unauthorized persons from interpreting any data being transmitted. It also prevents the (unrecognized) transmission of false messages. Data encryption is expensive to implement, however, because data encryption and de-encryption hardware must be provided at points of message origination and destination. Encrypting and de-encrypting messages also will add to system response time.

If data are not encrypted, all messages transmitted over the communications network should include authentication codes. Authentication measures use a special algorithm at the point of origin to build a unique authentication code based upon the data values to be transmitted. An identical algorithm is included in the system's application software. When the system receives a message, it can compute the appropriate authentication code (based on data received in the message) and compare its code to the transmitted code. If the codes do not match, the message is rejected. Authentication codes protect against unintentional data errors due to garbled transmissions and fraudulent attempts to intercept and manipulate legitimate transmissions.

Check-sum digits are similar to authentication codes, but differ in their application. In the Reading EBT system, a check-sum digit -- based on other information encoded on a recipient's EBT access card -- is encoded on the recipient's card. When encoded information from the card is read by a store terminal, the terminal uses the check-sum digit to verify that the card information had been read correctly.

"Controlling access to the communications network through store terminals" usually involves the use of access cards and personal identification numbers. An EBT system should require recipients and retailers to use magnetically encoded access cards (or similar devices) to activate store terminals. Personal Identification Numbers (PINs) should be required to verify that the cardholder is an authorized system participant.

An EBT system should verify that a recipient's PIN is valid before processing either a purchase, refund or balance inquiry transaction. Initial verification can occur at the store terminal if the terminal is capable of identifying invalid PINs. Such verification is accomplished in the Reading EBT system by having the following information encoded on a recipient's EBT card:

- the recipient's food stamp account number,
- a PIN-offset code, and
- a check-sum digit.

The "PIN-offset" is based on the recipient's selected PIN and his or her food stamp account number. After the PIN is entered at the store terminal, the terminal computes a PIN-offset and checks this offset against the encoded PIN-offset. If the computed code does not match the encoded PIN-offset, the terminal will not transmit a transaction message to the system. Thus, the use of PIN verification at the terminal frees the system's computers from having to check and reject messages accompanied by invalid PINs.

Even if initial PIN verification occurs at the terminal, the system computers should recheck the PIN before processing a transaction to ensure that a lost or stolen card is not being used at the store terminal. Data on cards reported as lost or stolen should be maintained in the system's control files.

Requirements for PIN use at the point of sale are currently being debated within the banking and retail industries. The American Bankers Association's (ABA) draft POS standards require that a customer enter a valid PIN to authorize a transaction.¹ Implementing this standard requires that all terminals be equipped with PIN-pads. Some retailers, objecting to the additional costs of providing this equipment, argue that a customer's signature should be sufficient for authorizing a transaction.

¹"Implementation Guidelines for Online Debit Card Systems at the Point of Sale (Draft)," American Bankers Association, Payment Systems Policy Board, Retail Payments Task Force, Ad Hoc Committee, July 1986.

To protect against the unauthorized use of a lost or stolen EBT card, we concur with the ABA's draft standards and recommend that an EBT system require Food Stamp Program recipients to use a PIN.

Prior to the Reading EBT demonstration, some welfare client advocacy groups questioned whether recipients might have trouble remembering and using a PIN. The demonstration has shown that recipients have very few problems with their PINs. Recipients in Reading, however, were able to select their own PINs (some commercial systems generate a PIN for their customers). Self-selection may facilitate PIN use, and we recommend that future EBT systems also allow recipients to choose their own PIN codes. Furthermore, although the Reading system allows only four-digit PINs, it is probably desirable to allow recipients some flexibility in choosing the length of their PIN. If future systems allow, for instance, PINs between four and eight digits in length, recipients may be able to select PINs which are even easier to remember.

Notwithstanding the earlier discussion of the problems and costs associated with data encryption and de-encryption, all PINs should be encrypted before transmission over the communications network. The Reading system achieved this by transmitting the PIN-offset rather than the PIN. As previously mentioned, the encryption algorithm was based on the recipient's PIN and his or her food stamp account number. As an added security feature, a recipient's PIN should not be encoded directly on the magnetic stripe of his or her card. With this approach a recipient's PIN cannot be ascertained through a simple reading of information encoded on the card. Again, the Reading system encodes the PIN-offset rather than the PIN on a recipient's card.

Message Validation. Message validation provides an extra measure of security to ensure both the validity of transaction messages and their proper disposition by the system.

The system should check the format of all messages received to verify that the message contains all the information required for proper processing. Format validation includes checks for correct control characters, correct number and size of data fields, and adherence to message format standards dictated by the design of the system.

Message content should be validated through the use of range checks (e.g., is the dollar amount of the purchase within reasonable limits?). The system should check that date fields are correct and that account numbers are valid. Finally, the system should check that the information in the message has not been previously received and processed. This latter step will prevent the inadvertent processing of duplicate issuance files or the processing of legitimate transaction messages which have been fraudulently recorded and retransmitted.

Another aspect of message validation is the assurance that the system has fully processed and recorded each message. If system processing of a message is interrupted before processing completes, the system design should support a reversal of all processing up to the point of interruption. For instance, if a system failure or a terminal disconnect prevents full processing of a purchase transaction, the system should reverse any recipient debits or retailer credits which already have been posted. Similarly, if a batch update of recipients' monthly issuances terminates with an error message, the system should reverse all issuances already posted to recipients' accounts. All completed transactions and updates should be recorded on the system's transaction file for audit trail capabilities.

When manual authorizations are needed to complete an EBT purchase transaction, the authorization process should include safeguards to ensure that:

- the customer making the purchase is an authorized recipient,
- the retailer calling in the request is an authorized participant,
- purchase authorization will not result in an overdrawn recipient account, and
- transaction information is ultimately entered onto system files and reconciled.

To reduce the magnitude (but not the frequency) of possible overdrafts, the system should place a limit on the total amount of purchases that can be manually authorized for each recipient each day. The Reading system uses a \$35 daily limit. Although retailers complained that this limit was too low,

some limit is necessary to provide adequate system security. A state agency, however, may wish to consider a higher limit on the days immediately following issuance (when current balances will be higher, on average, and when desired purchase amounts are likely to be greater) and the \$35 limit during the rest of the month.

Administrative and Operational Procedures. Most of the security recommendations discussed so far can be integrated into system design so that -- once the recommendations are implemented -- the system will not operate unless they are followed. Examples include use of system control files, system checks for message format and content, and required use of access cards and PINs.

System security, however, also requires that sound administrative and operational procedures be followed by system managers and personnel to protect the system against unintentional errors and fraudulent acts. This section presents a list of recommended administrative and operational procedures designed to enhance system security.

Within the data processing center, operational responsibilities should be separated among different employees so that no one employee can access the whole range of system functions required to set up accounts, transmit funds to the accounts, access system files to change account records, and transmit retailer deposits to the ACH network. In situations in which separation of duties is not sufficient to prevent abuse, dual control should be utilized. That is, two employees (such as a computer operator and a system supervisor) can be required to accomplish certain functions.

As a corollary to the above recommendation, the duties and responsibilities of all system personnel should be clearly defined. System control files should list which system functions can be legitimately accessed by which employees, and employee attempts to initiate functions outside their responsibilities should be rejected by the system and recorded. Employee identification codes and passwords should be used to restrict access to system functions and files.

System reconciliation is a major tool for detecting attempts to divert program funds. Employees responsible for operating the system should not be responsible for system reconciliation as well.

An EBT system's application software controls all system functions. All changes to system software should be performed by persons whose duties are limited to system programming. Special programs can be used to compare operational software with (non-accessible) backup software to detect unauthorized changes in system software.

System supervisors should ensure that system reconciliation is done on pre-established schedules. Any discrepancies discovered during reconciliation should be investigated immediately.

Because of their ability to access the system and their knowledge of system operations, system employees typically pose the greatest threat to system security. Employee hiring practices, assignment of responsibilities and on-going oversight of system personnel, therefore, are important components of system security. Potential employees should be screened carefully before being assigned system duties, and -- as mentioned earlier -- there should be a strict separation of employee duties and responsibilities. The number of employees with authorized access to sensitive files and system functions should be minimized. Finally, all employees should be briefed periodically on the importance of system security and their responsibilities for maintaining security.

DETECTION OF SECURITY PROBLEMS

System reconciliation and audits are the primary mechanisms for detecting problems affecting system security.

System Reconciliation. All recipient and retailer accounts in an EBT system should be reconciled on a daily basis. For recipient accounts, the following accounting identity should be used for reconciliation:

$$\begin{array}{l} \text{Balance at beginning of day} \\ + \text{ Total issuances for the day} \\ - \text{ Total electronic food purchases} \\ \quad \text{for the day} \\ - \text{ Total manually authorized food} \\ \quad \text{purchases for the day} \\ + \text{ Total refunds for the day} \\ - \text{ Total ATP purchases for the day} \end{array} \left. \vphantom{\begin{array}{l} \text{Balance at beginning of day} \\ + \text{ Total issuances for the day} \\ - \text{ Total electronic food purchases} \\ \quad \text{for the day} \\ - \text{ Total manually authorized food} \\ \quad \text{purchases for the day} \\ + \text{ Total refunds for the day} \\ - \text{ Total ATP purchases for the day} \end{array}} \right\} = \text{Balance at end of} \\ \text{day}$$

To ensure that any problems with previous days' reconciliations have been addressed properly, system reconciliation each day also should perform the above calculations for a longer time period. System reconciliation in Reading, for instance, repeats the calculations for the beginning of the month to the current date. Thus, if a reconciliation error which occurred on the fifth of the month is not resolved, all subsequent daily reconciliations that month continue to show the error until it is corrected. Each day's reconciliation also repeats the above calculations from the date of system implementation to the current date. These latter calculations, however, are performed only for the aggregate caseload, not for individual recipient accounts.

Daily reconciliation of retailer accounts should use the following accounting identity:

$$\begin{array}{l}
 \text{Total credits at beginning of day} \\
 + \text{ Total electronic sales credits} \\
 \quad \text{for the day} \\
 + \text{ Total manual sales credits for} \\
 \quad \text{the day} \\
 - \text{ Total refunds for the day} \\
 - \text{ Total deposits transmitted to} \\
 \quad \text{ACH network for the day} \\
 - \text{ Total deposits on hold}
 \end{array}
 \left. \vphantom{\begin{array}{l}
 \text{Total credits at beginning of day} \\
 + \text{ Total electronic sales credits} \\
 \quad \text{for the day} \\
 + \text{ Total manual sales credits for} \\
 \quad \text{the day} \\
 - \text{ Total refunds for the day} \\
 - \text{ Total deposits transmitted to} \\
 \quad \text{ACH network for the day} \\
 - \text{ Total deposits on hold}
 \end{array}} \right\} = \text{Total credits at} \\
 \text{end of day}$$

"Total deposits on hold" refer to retailer credits which cannot be transmitted to the Automated Clearinghouse (ACH) network because the retailer's ACH account has not yet been established.

As with recipients' accounts, daily reconciliation of retailer accounts should perform the above calculations for a longer time interval to ensure that previous reconciliation problems have been addressed properly.

As an additional check on system accounts, total daily debits to recipients' accounts should be reconciled against total daily credits to retailers' accounts. Excluding debits and credits arising from manual sales, these two totals should be equal.

In the Reading EBT system, manually authorized sales are immediately debited from recipients' accounts. Retailers' accounts are not credited until the hard copy form for the sale is received at the EBT Center. Thus, the

system introduces a delay between the debiting and crediting of manually authorized sales. To ensure that all manually authorized sales are properly reconciled, the system should maintain a record of all sales which have been debited from recipients' accounts but not credited to retailers' accounts. If sales are not reconciled within a reasonable period of time (perhaps two weeks), the retailer should be contacted to determine why the hard copy documentation of the sale has not been received.

All transmissions of benefits into or out of an EBT system should be reconciled immediately after transmission. The purpose of this reconciliation is to ensure that the originating and receiving parties agree on the amount of benefits transmitted. To ensure that the processing of these data also is correct, reconciliation should not involve just a check on the data transmitted. For instance, when reconciling benefits issued to recipients' accounts, the system operator should post these benefits to the appropriate accounts and then run a program which sums the total amount of posted benefits. This total should be compared to the state agency's records of total benefits issued.

Audit Trail Capabilities. All transactions affecting system accounts (including manual adjustments to account balances) should be recorded on the system's transaction file. This file should be copied onto a history file for permanent retention. The history file then can be accessed to provide complete audit trails of all changes to system accounts. Any manual adjustments to system accounts should be fully documented as to why the adjustment was needed.

5.3 MONITORING SYSTEM SECURITY PERFORMANCE STANDARDS

Most of the security performance standards recommended in the previous section reference security procedures rather than the actual performance of the computer system. Examples include encryption of sensitive data, procedures for authorizing manual sales, and protecting access to the system. Other security standards (e.g., use of PINs and terminal control files) are automatically demanded of the system once the system is designed. Thus, monitoring system security performance standards largely becomes an issue of ensuring that security procedures are followed during all aspects of system operations.

We believe that the best means of ensuring compliance with EBT security procedures is to conduct security audits periodically during the life of the system. These audits should be performed either by employees of a separate division of the state welfare agency or, perhaps, by a separate state agency. The auditing agency should have a well-defined agenda covering all security elements which need to be audited. The system developer and state welfare agency should prepare this agenda during the design of the system, when system vulnerabilities are being identified and countermeasures are being designed. During the course of system operations, the agenda may need to be updated as new vulnerabilities are identified or as new security procedures are implemented.

choice but to use the system if they wish to continue to receive program benefits. If an EBT system is hard to use, training recipients to use the system will be more time consuming and expensive. Recipients also will have more difficulties at the checkout counter, which in turn will slow operations and reduce the efficiency of the system from the grocer's point of view. If recipients have trouble using the system, other customers in the store may begin to complain about delays incurred in processing food stamp purchases. Finally, if the system is very difficult to use, some recipients may leave the program, deciding that their monthly benefits from the Food Stamp Program are not worth the trouble of using the system.

Program staff will interact with an EBT system on a daily basis. In one sense, their continuing use of the system will reduce usage problems because proper procedures for performing necessary program functions will become ingrained. If specific procedures are cumbersome or difficult, however, the daily need to perform these functions may become irritating. Thus, although system ease of use may not be as critical for program staff as for grocers and recipients, it is nevertheless a factor to consider when designing an EBT system.

Experience with the Reading EBT system and information about other commercial POS systems provide a number of criteria for a "user friendly" EBT system. These criteria are noted below.

RECIPIENTS

The criteria for an easy-to-use EBT system are similar to those for any commercial POS system. An EBT system will become easier to use as:

- the number of separate actions required to complete a transaction are minimized;
- the number of codes or commands which must be memorized are minimized;
- clear and comprehensive account balance information is readily available;
- actions required to obtain account balance information are minimized;
- training and instructions are clear, and in-process prompts are available; and

- procedures for resolving problems are clearly identified.

Furthermore, unlike commercial POS systems, EBT system users will include a wide range of population subgroups who have little or no previous experience with sophisticated electronic debiting systems. For example, most food stamp recipients may never have used bank automated teller machines (ATMs), the closest analog in today's banking environment to point-of-sale direct debiting. Food Stamp Program recipients also include disproportionate numbers of the elderly, persons with physical or emotional disabilities, persons with little formal education, and non-English speaking persons -- groups which may have particular problems using an EBT system. To facilitate system use by these groups of recipients, it is reasonable to expect that an EBT system be easier to use than commercial POS systems.

RETAILERS

An easy-to-use EBT system, from the grocers' point of view, has characteristics very similar to those noted for recipients:

- minimum number of separate actions needed to perform a normal purchase transaction;
- minimum number of procedures for cashiers to remember;
- clear training, instructions, or in-process prompts;
- simple backup procedures when electronic purchases are impossible;
- timely information on bank deposits resulting from EBT purchases;
- deposit information readily comparable to information normally maintained in the store; and
- clear instructions on how to resolve problems with equipment and accounts.

As in the case of recipients, it is important to distinguish between the stores that will participate in an EBT system and the supermarket and convenience chains that have been the early participants in POS systems. Current Food Stamp Program rules allow virtually any establishment to participate if staple food items comprise over 50 percent of eligible food sales.

The bulk of the participating stores are small and medium independent groceries, including farm stands, milk routes, and various establishments in which retail food sales are a secondary activity. Thus, to encourage the continued participation of these stores in the Food Stamp Program, an EBT system must provide ease of operations in a broad variety of physical and economic environments.

PROGRAM STAFF

State and local Food Stamp Program staff will be responsible for training recipients and grocers to use an EBT system, and they will have to respond to any problems recipients or grocers have with the system. Thus, to the extent that an EBT system exhibits characteristics facilitating system use, state and local program staff will find their training and problem-resolution responsibilities easier to handle.

In addition to providing training and to responding to users' problems with the system, state and local program staff will interact with the system to perform many program functions. As the number of functions requiring interaction decreases, program staff will have to spend less time using the system. Maximum use of completely automated procedures, therefore, will make an EBT system easier to use by program staff.

For those functions requiring system interaction, workstation terminals will be used to communicate with the system. Program staff will find the workstations easier to use if they exhibit the following characteristics:

- the software controlling workstation functions allows quick access to desired system functions, with a clear and easy-to-read menu of available functions;
- terminal keyboard commands for performing workstation functions are displayed (or are displayable when needed);
- display of information on workstation screens is clear and legible;
- few keystrokes are required to access individual data elements on a workstation screen (for data editing);

- at least 60 days of recent transaction activity for any account is immediately accessible to facilitate investigation of account problems;
- requests for recent account activity can be limited to specified time intervals within a specified day; and
- when using workstations to review blocks of data too large to display in a single screen, data can be scrolled forward and backward without reinitiating the workstation function.

6.2 PERFORMANCE STANDARDS FOR SYSTEM EASE OF USE

Many of the performance standards presented throughout this report will help achieve the implementation of an EBT system that is easy to use. Examples include standards for processing speeds and system reliability. This section focuses on standards which affect more directly the procedures for using an EBT system.

SYSTEM USE BY RECIPIENTS

The key points of system use by food stamp recipients are: (a) purchasing groceries at participating stores, (b) keeping track of account balances and account use, and (c) resolving problems with account balances or system use.

Purchasing Groceries. The number of codes to memorize and the number of steps needed to complete an EBT purchase should be kept at a minimum. As mentioned in Chapter 5, an EBT system should require the use of Personal Identification Numbers (PINs) for improved security of recipients' accounts. The PIN should be the only code or command which needs to be memorized to complete an EBT purchase.

From the recipient's perspective, the essential steps for completing an EBT purchase are (1) passing the EBT card through the terminal's card reader, (2) entering the PIN, and (3) checking that the appropriate dollar amount has been debited from the account. The last step can be accomplished by inspecting the information printed on the EBT receipt. For greater control over how much is being debited from the account, EBT system procedures could require that the recipient check the amount being debited prior to transmitting the purchase message to the system. To implement this latter step, the

EBT terminal should display the desired purchase amount. Recipients then can verbally acknowledge that the amount is correct or verify that it is correct by pressing the "Send" button on the terminal themselves.

The Reading EBT demonstration has shown that recipients often try to "empty" their account before their next month's regular issuance is posted. These attempts sometimes resulted in requested EBT purchase amounts which exceeded the recipient's remaining balance. When this occurred in the Reading system, a new EBT purchase transaction (including a reswipe of the EBT card and re-entry of the PIN) had to be initiated. An EBT system would be easier to use if -- after receiving an "insufficient-funds" message from the system -- the recipient and cashier could immediately authorize a purchase request for the exact remaining balance without initiating a new transaction. This would be done, of course, only when the recipient had enough cash to pay for the remaining groceries.

Keeping Track of Account Balances. The printed receipt for each EBT transaction should include the recipient's remaining balance after the transaction. Recipients also should be able to check their account balances at other times, either by using the store terminal (or special "balance-only" terminals) or by calling the system for up-to-date balance information.

When recipients use a balance-only terminal or a telephone to request balance information, store personnel will not be available to assist them with the appropriate procedures for making an inquiry. To reduce recipients' need for memorizing balance-inquiry procedures, the state welfare agency or the system operator may wish to write these procedures on a card which recipients can carry with them. Displayed or verbal teleprompts also can facilitate balance inquires from balance-only terminals and telephones.

When program recipients use telephones to request balance information, an EBT system will probably use an audio input-output device to respond to the request. Such devices use a computer-generated "voice" to transmit the requested information. The system developer should make sure that the audio quality of this message is clear and distinct to prevent a misinterpretation of the recipient's remaining balance. Recipients whose primary language is not English also will find the system easier to use if remaining balance amounts are transmitted in their primary language. Because the Reading area includes a large proportion of Spanish-speaking program

recipients, the Reading EBT system can respond to balance inquiries in either English or Spanish. When setting up a recipient's account on the system's master file, a special variable is used to indicate the recipient's preferred language.

Finally, to aid recipients in knowing when their regular monthly benefits have been posted to their accounts, the state agency should inform all recipients of the exact dates (and times) their regular monthly benefits will be available for use.

Problem Resolution. Recipients should know whom to contact when they experience problems using the system or when they dispute the amount left in their EBT accounts. To assist recipients in identifying possible account problems or to verify their account balances, monthly statements listing all issuances and refunds credited to their accounts and all transactions debiting their accounts would be useful. Such statements will increase the cost of administering an EBT system, however, and individual state agencies will have to decide whether the added costs are justified. No statements were provided in the Reading system, and recipients did not find the lack of monthly statements a problem. Nevertheless, monthly statements should make an EBT system easier to use for many recipients.

SYSTEM USE BY GROCERS

The major points of system use by grocers are (a) handling EBT purchases and refunds at the checkout counter, (b) reconciling EBT purchase amounts with subsequent deposits to their bank accounts, and (c) resolving problems with store equipment, purchase procedures and account reconciliation.

Handling EBT Transactions. To reduce procedural errors and to maximize efficiency at the checkout counter, the number of steps which cashiers must perform to handle an EBT purchase or refund should be minimized. In addition, the display screen on the EBT terminal should provide prompts on the next action needed to complete the transaction. Examples of prompts in the Reading EBT system are "Swipe Client Card," "Enter Client PIN," "Enter Amount," "Dialing, Wait," and "Purchase Complete."

The display screen also should be used to provide information about procedural errors and transactions which cannot be processed. This informa-

tion will assist the cashier in resolving problems or in telling the customer why the transaction cannot be processed. In the Reading EBT system, for example, the terminal's screen displays "Invalid PIN, Re-enter" if the recipient enters the wrong PIN. Other prompts include "Invalid Account," "Insufficient Balance," and "Unable to Complete."

In stores handling a large volume of EBT business, cashiers will rapidly become accustomed to handling EBT transactions, and prompts like those listed above should enable cashiers to efficiently perform all the required steps to complete a transaction. For new cashiers and in stores in which cashiers handle few EBT sales, however, prompts may not be sufficient to guide the cashier through the entire purchase. The system operator, therefore, should provide procedural manuals to all stores participating in an EBT system. The manuals should cover all EBT procedures at the checkout counter and should be written so they can be used as a ready reference when cashiers need to rapidly look up the proper steps to complete an EBT purchase.

Reconciling EBT Sales and Deposits. Reconciliation was one of the most troublesome aspects of the Reading EBT system for grocers. To enable accurate and timely reconciliation, grocers need to be able to match their total EBT sales for a given period to the dollar amounts credited to their bank accounts from the same period.

Different grocers will want to use different accounting periods for reconciling sales. For instance, some grocers may reconcile store sales after 6 p.m. each day. Others may reconcile sales from midnight to midnight. Experience with the Reading EBT demonstration indicates that few retailers reconcile their sales on a 2 p.m. to 2 p.m. basis, which was the accounting period used in the original and relocated EBT systems in Reading for totaling store sales and for crediting these sales to stores' bank accounts.

To facilitate grocer reconciliation, therefore, an EBT system should offer grocers flexibility in choosing their own accounting periods. Current software for POS systems allows grocers to tell the system each day when sales should be totaled and credited, and the redesigned EBT system in Reading offers this feature. Flexibility in accounting periods will allow grocers to integrate their EBT sales reconciliation with their overall accounting practices.

When grocers tell the system to total their previous EBT sales for deposit, the system should respond with the total dollar amount which will be credited. This amount could be displayed on the terminal screen, although other means of communication could be used. The goal is to provide sufficient information to grocers so they can check what the system is going to credit to their accounts with their own summation of store EBT sales. This latter information should be provided by each EBT terminal, either on a journal tape or a printed (or displayed) total whenever the grocer requests the information.

Instead of printing or displaying deposit information, the redesigned EBT system in Reading allows grocers to call the system for deposit amounts. An audio input-output device is used to provide the information. As with audio messages for recipients' remaining balances, the system developer should ensure that deposit information messages are clear and easily understood.

Special procedures may be needed to allow easy reconciliation of manually authorized EBT sales. In Reading, manual sales were credited to retailers' accounts only after they mailed a copy of the manual sales slip to the computer center. Retailers never know exactly when their manual sales would be credited, making reconciliation very difficult.

A separate display of electronic and manual sales credits at the end of each day would provide a solution to the problem of reconciling manual sales. As noted above, an EBT system should inform grocers about the total dollar amount which will be credited to their bank account when they tell the system to total their previous sales for deposit. If this response provides subtotals for electronic and manual sales, grocers can check the manual sales subtotal against their outstanding manual EBT sales. This solution is not perfect, inasmuch as it does not indicate which day(s) the manual sales were made. Nevertheless, it should help make reconciliation much easier than during the Reading demonstration. It also will facilitate grocers' reconciliation of daily sales credits against subsequent deposits to their bank accounts.

Problem Resolution. Like recipients, grocers should have clear instructions on what to do or whom to call when they experience problems with an EBT system. The potential list of problems which grocers may encounter,

however, is much longer than for recipients. Not only do store personnel have to learn and deal with more steps for completing EBT functions like purchases and refunds, they have to deal with any problems arising from malfunctioning EBT equipment.

The Reading demonstration indicates that POS equipment like terminals, printers and PIN-pads is heavily used (and abused) and prone to breakdowns. To avoid unnecessary delays in returning faulty equipment to service, retailers should be given clear instructions on how to diagnose and correct simple problems which may occur with this equipment. Examples of problems which could be handled by store personnel include checking for loose electrical connections, fixing paper jams in printers, and using test cards to determine if card readers are working properly (as opposed to problems with a recipient's card itself). For equipment problems which cannot be resolved by store personnel, grocers should have a telephone number to call for assistance.

Grocers also should have a telephone number to call when they have questions about proper procedures for using the system, about account reconciliation, or about whether a particular purchase transaction has been processed by the system.

SYSTEM USE BY PROGRAM STAFF

Local welfare office staff will use an EBT system to perform the following functions: (a) encode identification cards, (b) update information in account records, (c) authorize manual sales, and (d) investigate account records to respond to recipients' or grocers' questions about recent activity. Depending upon system design, state program staff may be responsible for some of these functions when the local welfare office is closed (i.e., during evenings, weekends, and holidays).

Encoding Identification Cards. When encoding an identification card, required information must be entered into the card encoder before it can be written (encoded) onto the card's magnetic stripe. Data entry may be done with a keyboard on the encoder or, if the encoder is connected to the system's workstation, via the workstation's keyboard. Data entry errors can be reduced and the card-encoding process streamlined if data entry requirements are minimized.

In the original EBT system, the card encoder connected to the system's workstation and data entry requirements were minimized. During the development of the redesigned EBT system, program staff learned that the card encoder could not communicate directly with the new system's workstation terminal. Card encoding procedures for the redesigned EBT system, therefore, require double entry of some card information (e.g., the recipient's case number and PIN) and separate entry of the system-generated Benefit Identification Card (BIC) number. The card encoder's inability to link directly to the system's workstation, therefore, increases the difficulty of encoding cards in the redesigned system.

Updating Account Information. Program staff need to update information in an account record when the recipient's or grocer's name or address changes, when a grocer's bank account number changes, when an account must be placed on "hold" because an identification card is reported as lost or stolen, or when other account information needs to be changed. To make the system easier to use by program staff, the number of steps required to access and update account information should be minimized.

Easy updating of account information can be accomplished by including special "edit" functions in a system's workstation software. Edit functions allow all account data which might need to be updated to be displayed on the workstation's screen. Program staff can then move the workstation's cursor to the data field to be edited and enter the updated information.

The system should be designed so that when a data field is edited on one file, any other system files containing that data element are automatically updated with the same information. Having to separately update identical information in multiple files is not only inefficient and time consuming, it introduces the possibility of inconsistent data being held by different system files.

Authorizing Manual Sales. When the system's computers are running but store equipment is not working, program staff will have to access the system to check recipients' account balances before authorizing a manual sale. If the system's computers are not running, program staff will have to check a prior listing of account balances before authorizing a sale.

Because the grocer and the recipient will be waiting for authorization while program staff check an account balance, it is quite important that the steps for checking account balances can be easily and quickly performed. In addition, information about the sale must be added to the system so that the system reflects the recipient's new balance. The system's workstation functions, therefore, should allow easy access to account balances (by authorized program staff) and easy entry of sales information. If the system imposes a daily limit on manually authorized sales (as in Reading), the system should automatically check prior manual sales activity for that recipient that day to reduce the staff member's responsibility for tracking manual sales.

Investigating Account Activity. Grocers or recipients may call the local welfare office when they notice discrepancies in their accounts. They also may call the office when they are not sure if the system has processed a particular transaction. To respond to grocers' and recipients' questions, program staff will need to check past transaction activity against the account. The system's workstation software should enable quick and easy access to this information.

Grocers or recipients may not notice problems with their accounts for several weeks or more. Because archived transaction data take longer to access and investigate than on-line data, an EBT system should maintain at least 60-day's worth of transaction data in on-line files. This should minimize the number of times program staff have to request retrieval of archived data to investigate account problems.

Grocers' and recipients' accounts can be affected by many different types of transactions: electronic or manual purchases, refunds, benefit issuances, deposit credits, and conversion of EBT benefits to coupons (for recipients leaving the system). To facilitate the investigation of recent account activity, workstation screens should clearly identify and label each type of transaction. The screens presenting this information also should provide sufficient data to uniquely identify each transaction. That is, the screen should list not only each transaction type and amount, but where and when the transaction occurred.

Large grocery stores can handle hundreds or thousands of EBT transactions within a 60-day period. On busy days, scores of transactions

could be processed. Thus, program staff should be able to specify a given time period when looking up transactions for a particular account. If this feature is not available, program staff may need to spend considerable time looking through large volumes of stored data before they can review data from the time period in question.

TRAINING

Retailers, recipients and program staff will find an EBT system much easier to use if they are thoroughly trained at the outset in how to use the system and its equipment. This section provides some recommendations for training content and procedures.

Recipient Training. All procedures which recipients must know to complete an EBT purchase should be covered during training. It is probably useful to cover the procedures which store personnel have to do as well, although these procedures do not need to be emphasized. Knowing how the entire purchase transaction is conducted may help recipients remember how their activities (i.e., card swipe, PIN entry and purchase amount verification) fit into the overall progression of steps required to complete the transaction.

Training sessions should include hands-on practice with store equipment. These practice sessions will familiarize recipients with the equipment they will be using in the stores and will reinforce what they have learned during the training session.

The importance of keeping their PIN codes a secret should be stressed during training. Recipients must understand that their PINs are the primary mechanism for preventing unauthorized access to their food stamp accounts.

All procedures for obtaining account balance information should be covered during training. If store terminals can be used in the system to obtain current account balances, recipients should practice getting their

account balances during the hands-on portion of the training session.

Retailer Training. Store personnel need to learn more EBT procedures than recipients, and they need to know how to deal with the many different problems which can arise during EBT operations. As a result, their training will require more time than recipients' training if all the procedures are to be covered adequately.

Retailer training must acquaint store personnel with all the EBT functions which are initiated at the checkout counter. These functions include not only purchase and refund transactions, but procedures for signing terminals on and off the system and for making balance inquiries for recipients. Exact procedures for completing each function then must be discussed. Training also should include a review of store operating manuals and methods of quickly finding pertinent information in the manuals.

As with recipients, store personnel should have the opportunity to perform EBT functions using actual equipment. If possible, this equipment should be connected to the system to provide a realistic environment for practicing each function.

Training should include proper procedures for dealing with equipment or system operating problems, as well as ways to avoid or resolve problems which may occur. Store personnel should know how to deal with simple maintenance functions like replacing printer ribbons or paper.

Procedures for reconciling EBT sales should receive special attention. Because cashiers may not be involved with store reconciliation, however, these procedures may need to be presented only to store managers and owners and their designated assistants.

The logistics of training all store personnel may be complicated. Retailers in Reading were trained in group sessions just prior to system implementation. Some retailers were unable (or unwilling) to send all their cashiers to training sessions, even though the system operator provided a range of alternative training dates and times. Retailers circumvented this problem by training their remaining cashiers themselves, although this secondary training does not appear to have been as thorough as the original training. In future EBT systems, the state agency or system operator may need to consider providing in-store training at the larger stores. Alternatively, a

brief training manual could be provided to those managers or owners planning to train some of their own employees.

Program Staff Training. Program staff who interact with an EBT system or who respond to grocers' and recipients' problems with the system should be thoroughly trained before the system is implemented. Because different groups of program staff may have different responsibilities for system operations, training may need to be tailored to meet the needs of each group.

Program staff who respond to grocers' or recipients' problems with an EBT system should receive training on how these two groups of participants use the system. Such training will enable them to instruct grocers and recipients on proper procedures for using the system. When the system is not working, program staff should be able to explain -- in general terms -- why the system is not working. Such explanations can serve to bolster grocers' and recipients' confidence in the system by indicating that state agency personnel know "what is going on." These program staff, therefore, should receive training in the basic operating fundamentals of the EBT system.

Program staff who work at system workstations should receive training on each workstation function they will be performing. Operating manuals for workstation functions should be used during training and available for reference during daily operations. Prior to system implementation, program staff should have the opportunity to practice using the individual workstation functions.

To facilitate coverage of all system functions during vacation periods or when program staff are otherwise not in the office, some staff should be cross-trained on functions for which they will not normally be responsible. Back-up staff and supervisors also should be trained, and they should occasionally fill in for staff normally assigned EBT responsibilities so that they retain their knowledge of system functions.

6.3 MONITORING SYSTEM EASE OF USE

Recipients and grocers will call designated telephone numbers for assistance when they encounter specific problems with the system. When these calls are received, the local welfare office or the system operator should

record the nature of each problem. These problem records should be reviewed each month. If clear patterns exist in the types of problems being reported, these patterns will suggest areas in which grocers and recipients are having problems using the system. If the problems persist, additional training, a revision of procedures or even a minor redesign of the system may be needed. In Reading, for example, grocers had many problems with loose terminal connections at the beginning of the demonstration. The system developer then installed special clamps to reduce the incidence of these problems. In addition, repeated calls from retailers for assistance with reconciliation provided an early indication that the system's reconciliation procedures were difficult to use.

The system's transaction file also may contain information indicating problems with system use. If the system logs information about invalid PIN entries or attempted purchases rejected for insufficient balances to the transaction file, examination of the relative incidence of these records will indicate whether or not recipients are having problems remembering their PINs or keeping track of their account balances.

Recipients and grocers will undoubtedly have some problems with the system which do not warrant a direct call for assistance or which cannot be revealed on the system's transaction file. We recommend that the state welfare agency implement some mechanism for contacting retailers and recipients to learn about possible problems with system use. A questionnaire could be sent to retailers, asking them to comment on any problems they are having. Recipients could be asked about their problems with the system when they come to the local welfare office for recertification. Participants' responses to these questions can be used to guide decisions about needed improvements in system design or participant training.

The state agency also should discuss problems of system use with its own program staff. When the Pennsylvania Department of Public Welfare redesigned the EBT system in Reading, for instance, local office staff provided valuable information about ways to make system workstations easier to use. Because program staff may circumvent prescribed operating procedures which are difficult to follow, it is important to periodically ask program staff about problems they are encountering. The state agency or system operator can then assess the need for possible revisions to workstation software or system operating procedures.

Chapter Seven

SYSTEM MANAGEMENT INFORMATION

Sound management of an EBT system requires the review and interpretation of substantial amounts of information about the continuing operations and performance of the system. This chapter details the types of information the state welfare agency and system operator need to perform their management oversight responsibilities.

7.1 THE NEED FOR MANAGEMENT INFORMATION PERFORMANCE STANDARDS

The state welfare agency and the system operator need at least five general types of information for effective system management. This information includes data about system use, system performance, the nature and cause of any system problems, system operating costs, and any changes in system design or operating procedures.

INFORMATION ABOUT SYSTEM USE

The state welfare agency and system managers can learn a great deal about how an EBT system is being used by reviewing summary reports on the number and type of transactions processed by the system and their distribution over time. Examples of how this information can be used are presented in the paragraphs below.

Information on the number of retailers and recipients using the system each month, the total number and dollar value of benefit issuances posted to recipients' accounts, and the total number and dollar value of sales processed each month provides a general descriptive summary of the size of an EBT system. These summary measures can be used in reports to agency supervisors and other personnel and, if desired, they can be used to publicize the existence and scope of the EBT system. As discussed in Chapter 5 (System Security), information on daily benefit issuances and sales also is needed when reconciling the system.

Detailed information on system size and processing demands during peak periods can be used to compare actual usage levels against expected system usage. As noted in Chapter 4 (System Capacity), system developers need

estimates of the number of recipients and retailers who will use the system when designing the capacity of an EBT system. They also need estimates of the number of transactions to be processed during a month and during peak periods. If review of actual usage levels indicates that expected usage levels are being exceeded, system capacity may be insufficient to handle processing loads and additional capacity may be needed. Trends in actual usage levels over time also may assist in determining whether and when additional capacity will be needed for an expanding system.

The distribution of transaction volumes throughout the day and month can be used to fine tune staffing requirements and production schedules. For instance, if peak transaction periods occur at different times than expected when system operating schedules were established, these schedules can be changed to more effectively match labor and processing resources to production needs.

Reports on system use by individual retailers and recipients can identify patterns of unusual activity or potential user problems which warrant further investigation. For example, recipients who either do not use a substantial portion of their benefits each month, who have a high incidence of invalid-PIN entries, or whose attempted purchases often are rejected due to insufficient balances may not understand how to use the system, and they may need additional training. Retailers who have a relatively high incidence of manually authorized sales or transaction reversals (caused when the system cannot transmit a final message to a store terminal) may be having unreported equipment problems, or their cashiers may not fully understand how to use the system.

INFORMATION ABOUT SYSTEM PERFORMANCE

Specifying performance standards for system operations makes little sense if system managers and food stamp authorities do not receive summary information about how well the system is performing relative to these standards. Thus, system performance information is needed on an on-going basis to ensure that performance standards are being met. If system performance falters and this information is not available, managers may be unaware of deficiencies in system operations. Problems with system

performance, in turn, will generate dissatisfaction among retailers and recipients and may impair the continued operation of an EBT system.

Information about system reconciliation is a very important component of overall system performance. Each retailer and recipient account should balance at the end of each business day, and the system should provide detailed information about any accounts which do not balance. System managers should immediately investigate any reconciliation discrepancies to determine the cause of the discrepancy and actions needed to resolve the problem.

INFORMATION ABOUT SPECIFIC SYSTEM PROBLEMS

With the exception of daily reconciliation data, system performance information is generally summary information (e.g., the system's average response time or the overall percentage of time the system is inaccessible to system users). As such, this information provides an overview of how well an EBT system is performing. In addition to this summary information, system managers need detailed information on specific operational or procedural problems as soon as they are identified, either by system operators or through review of system performance information. Once a problem is identified, the cause of the problem needs to be determined so that corrective steps can be designed and taken.

Various sources are available to determine the cause of system problems. Simple inspection and diagnostic tests on store equipment, for instance, often can identify why equipment will not work properly. Operator logs and audit trail capabilities can help trace the events leading up to the occurrence of a problem with the system's computers. Error messages on the system's computer console or in computer printout may indicate the nature of a problem, thereby suggesting its cause.

Diagnosing problems in system software can be especially difficult. When problems terminate system operations, it will be most helpful if the system identifies exactly what function was being performed at the time of failure. Such identification will pinpoint which software program is the likely source of the problem. It also will enable system operators -- when the system resumes operations -- to monitor the appropriate recipient and

retailer records carefully to ensure that the system failure has not introduced any data errors into system files.

INFORMATION ABOUT SYSTEM COSTS

Information about administrative costs is important in any government-funded program. With the introduction of a new technology or revised set of procedures for performing a basic program function like benefit issuance and redemption, interest in administrative costs will be high. Thus, both the state welfare agency and the U.S. Department of Agriculture will want detailed information on the costs of operating an EBT system. These cost data can be used to identify areas of possible cost reductions. In addition, operating cost information will help other state agencies in their decisions about whether or not to implement EBT systems for their own food stamp programs.

INFORMATION ABOUT CHANGES IN DESIGN OR OPERATING PROCEDURES

Most computer system designs evolve over time as new functions are added or as more efficient procedures are identified and implemented. If system changes are not thoroughly documented, a danger always exists that -- as original staff leave the project -- new staff will not fully understand how the system works. This ignorance can present major problems if a need ever arises to modify the system further. That is, without full system documentation, system operators will never know the exact consequences of changing any part of the system. Thus, effective system management requires that all changes in system design or operating procedures be fully documented for later reference.

The requirement that changes in system design or operating procedures be documented assumes that the original system design and operating procedures are already documented. Before implementing an EBT system, system operators should have access to complete system documentation, and they should thoroughly understand how the system works. If a problem then arises during system operations, system operators will be in a position to quickly diagnose the cause of the problem and to correct it.

7.2 PERFORMANCE STANDARDS FOR SYSTEM MANAGEMENT INFORMATION

Performance standards for system management information are straightforward. Management reports should be complete, they should be accurate, and they should be timely. Report accuracy and timeliness do not need further explanation. The rest of this section discusses the detailed information needed for complete management reports, organized by the five general types of management information discussed in the preceding section.

SYSTEM USE

System managers should receive information about levels of system use on at least a monthly basis. This information will most easily be obtained from the system's transaction files, and it should include:

- total number of transactions processed by the system -- by day of month and for the month as a whole (by hour of day should be available when requested); total number of transactions by type of transaction (e.g., purchase, refund, issuance, balance inquiry);
- total number and dollar value of purchase transactions -- by day of month and by retailer;
- total number and dollar value of refunds -- by day of month and by retailer;
- percentage distribution of recipients making 1, 2, 3, etc. purchases during the month;
- total number of successful balance inquiries by recipients -- by source of inquiry (i.e., regular store terminal, balance-only terminal, telephone);
 - total number of unsuccessful balance inquiries -- by reason (i.e., invalid PIN, lost/stolen card, account on hold);
- total number of deposit inquiries by retailers;
- total number and dollar value of benefit issuances (by type) -- by day of month and for the month as a whole;
- total unused benefits in recipients' accounts at beginning of month, total benefits issued and used during the month, and total unused benefits in recipients' accounts at end of month;

- total number and dollar value of retailer deposits to ACH accounts -- by day of month and for the month as a whole;
- total number of bad-PIN entries for the month -- by source (i.e., regular store terminal, balance-only terminal, telephone);
 - an exception report of recipients or grocers who have more than some specified number of bad-PIN entries during the month;
- total number of attempted purchases rejected for insufficient funds -- by day of month and for the month as a whole; and
 - an exception report of recipients who have more than some specified number of rejected purchases during the month.

In addition to information on levels of system use, an EBT system will have to provide reports that mirror information provided by the coupon issuance and redemption system being replaced by the EBT system. These reports include:

- periodic reports on the total dollar value of EBT sales by each participating retailer (for monitoring retailer redemption patterns);
- periodic reports on the total dollar value of benefits posted to recipients' accounts (to enable statewide reconciliation of issuance data); and
- periodic reports on the total dollar value of deposits transmitted to retailers' ACH accounts (to allow reconciliation against drawdowns of the state's Food Stamp Program account at the U.S. Treasury).

The frequency with which these reports must be generated depends, in part, on the coupon issuance and redemption reports being replaced. That is, the EBT system reports should be produced at least as often as the coupon system reports. The computerized operations of an EBT system, however, will facilitate more frequent report production if desired by the state welfare agency or by the U.S. Department of Agriculture.

SYSTEM PERFORMANCE

System managers should receive information about system reconciliation each business day. They should receive information about other system performance measures on at least a monthly basis. System performance information will need to be extracted from various sources (discussed in preceding chapters), and it should include:

- the total number of discrepancies noted during daily reconciliation, and explanation of these discrepancies;
- average system queue time and processing time during the month -- by level of processing priority;
- an exception report detailing the percentage of transactions (by level of processing priority) failing to be processed within system response time standards, and when these transactions occurred;
- average time for transaction set-up, connect, transmission and receipt printing (only for those months in which observations are conducted at store locations);
- total scheduled system downtime during the month -- by day of month and time of day;
- total unscheduled system downtime during the month -- by day of month and time of day;
 - system uptime percentage -- during peak and non-peak hours;
- total number of problem calls received from retailers and recipients -- by nature of problem;
 - total number of calls about equipment problems received from retailers -- by type of equipment (e.g., terminal, PIN-pad, printer);
- total number of service calls to retail locations, and distribution of time elapsed between initial call for assistance and resolution of problem;
- total number of manually authorized purchases -- by periods of system downtime and system uptime, and the ratio of manually authorized purchases to electronic purchases;
- total number of damaged cards needing replacement, and the ratio of this number to the total number of cards in use;

- total number of identified processing errors, and the ratio of this number to the total number of transactions affecting system account balances;
- total number of transaction messages needing retransmission -- by incoming line;
- total number of account records (separately for recipients and retailers) on system's master file -- by account status;
- total number of times system users cannot access system because all lines in use, and the ratio of this number to the total number of processed purchase and refund transactions and balance inquiries (from store terminals); and
- utilization rates for processing capacity.

SYSTEM PROBLEMS AND THEIR CAUSE

System operators and other staff should inform their supervisors about any problems affecting system operations or use. Supervisors, in turn, should take steps to identify the cause of the problems and to initiate corrective actions.

System supervisors should inform upper-level management about problems encountered, their causes, and the measures taken to correct the problems. Problems which prevent continued system operations or which affect large numbers of system users should be brought to the attention of management immediately, as should problems for which corrective actions cannot be determined. Less serious problems should be reported on at least a weekly basis.

The exact content of the information needed by system managers cannot be specified in advance. Each problem will require a unique set of data to diagnose its cause and to identify effective corrective measures. System managers, however, should receive sufficient information to develop a full understanding of why the problem occurred. This information will allow them to review the corrective actions taken (to ensure that the actions will correct the problem without creating other problems) or to develop an alternative set of corrective actions. The information also should allow managers to

perceive any continuing patterns of problems affecting the system, so that possible needed changes in design or operating procedures can be developed.

SYSTEM COSTS

System managers should receive information each month that will allow them to track the full costs of operating an EBT system. Accounting practices may vary from one state agency to another, but typical factors which affect operating costs include:

- labor costs incurred by state and local agency staff for both system operations and on-going development and test work;
- data processing charges;
- telecommunications charges;
- equipment purchase and lease charges;
- software purchase and lease charges;
- service contract charges; and
- other direct costs, including consultants, travel, supplies and miscellaneous.

CHANGES IN DESIGN OR OPERATING PROCEDURES

All changes in system design and operating procedures should be fully documented and retained by system managers. If changes require revisions to operating manuals or users' manuals, revised manuals should be distributed (and supplemental training provided, if necessary).

Changes in system software or file organization require special attention for two reasons. First, it is quite easy to ignore documentation tasks in the course of day-to-day system operations which will likely generate tasks needing more immediate attention. Second, if software or file changes are not documented when they are implemented, it may be quite difficult at a later date to reconstruct the exact details of the changes. Pouring through two sets of software code (i.e., before and after changes were made) to pinpoint differences in the code can be a very tedious and difficult job. The job will be especially difficult if the original programmer is not available to document the changes that he or she made.

7.3 MONITORING MANAGEMENT INFORMATION

System managers and food stamp authorities will be in the best position for monitoring the content, accuracy and timeliness of management information. Schedules for the receipt of information (and who is responsible for providing the information) should be established, and managers should require that all information is provided on schedule.

Managers and food stamp authorities should review the information received to ensure that it is complete and accurate. If information is missing, those persons responsible for providing the information should be contacted.

Assessing the accuracy of management information is particularly important at the beginning of system operations because report software may include errors which generate inaccurate data. Wherever possible, information from different sources should be checked to ensure that it is consistent. For example, transaction file records of retailer deposits can be checked against U.S. Treasury records of drawdowns against the state's Food Stamp Program account. End-of-month unused benefits in recipients' accounts for one month can be checked against beginning-of-month unused benefits for the next month. Any discrepancies found should be checked, and the report providing the inaccurate data should be corrected.

Appendix A

ELECTRONIC BENEFIT TRANSFER (EBT) SYSTEM SERVICE LEVEL AGREEMENT

A service level agreement (SLA) covers the pertinent processing parameters and performance standards which an operational EBT system should meet. These parameters and standards include required system processing hours, availability of system components, processing speeds, production schedules, and requirements for hardware servicing and maintenance. If service delivery requirements change, the SLA should be modified to reflect these changes.

The SLA parameters and standards presented below incorporate the performance standards recommended in this report. As such, they refer to an on-line, real-time EBT system using currently available technology. As new system components are introduced to the market, the parameters and standards may need to be updated to reflect possible advances in attainable system performance.

I. System Processing Hours

Days of Week:	7 days
Hours of Day:	24 hours
Time of Day:	Prime - 10 a.m. to 7 p.m. Peak - 10 a.m. to 7 p.m. each regular issuance day and the two days thereafter (excluding Sundays)

II. On-Line Availability

On-line availability refers to the minimum acceptable level of network and system availability for recipient usage of electronic benefit processing.

On-line availability is measured as the percentage of time the system is available for transaction processing. The calculation consists of total Unscheduled Downtime divided by Net Processing Time (i.e. total available processing time less scheduled downtime).

Note, Peak Processing Time will not usually include scheduled downtime.

III. System Workstation Availability

	<u>Local Office</u>	<u>Operations Center</u>
Hours of Usage:	8 a.m. to 5 p.m.	24 hours
Availability	95%	95%

IV. Telecommunications Network Availability

Percentage of Calls encountering Busy Signals: <1.0%
(local telephone company measurement)

Percentage of Messages requiring Retransmission: <1.0%
(system measurement)

V. Maximum System Processing Times (in seconds)

System processing time standards include transmission and system queue time as well as actual system processing time. For functions originating at store checkout counters, the standards also include connect time and receipt printing time.

Average system processing time is the arithmetic mean of processing times over any specified time period. The 99 percent standard imposes an upper bound for processing times. No more than one percent of all response times should exceed this standard.

Functions Originating at Store Checkout Counters:

<u>Period</u>	<u>Average</u>	<u>99 Percent</u>
Overall	20	23
Prime	21	24
Peak	22	25

Functions Originating at Local Office Workstations:

<u>Period</u>	<u>Average</u>	<u>99 Percent</u>
Overall	5	8
Prime	5	8
Peak	6	9

Functions Originating from Telephones:

<u>Period</u>	<u>Average</u>	<u>99 Percent</u>
Overall	3	4
Prime	3	4
Peak	4	5

Functions Originating at Operations Center Workstations:

<u>Period</u>	<u>Average</u>	<u>99 Percent</u>
Overall	4	5
Prime	4	5
Peak	5	6

VI. Batch Processing Requirements (Production Schedules)

Issuance Posting:	6 a.m. -- scheduled day of issuance
Deposit Processing:	2 p.m. -- current business day settlement cutoff
	6 p.m. -- current business day delivery to ACH
System Reconciliation:	2 a.m. -- 1 business day after processing date
Report Production:	9 a.m. -- 1 business day after processing date
Report Distribution:	9 a.m. -- 2 business days after processing date

VII. Processing Accuracy

Error Rate for all System Functions:	<.02%
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VIII. Scheduled System Maintenance

Acceptable Time of Day:	10 p.m. to 8 a.m.
Acceptable Days of Week:	Saturday and Sunday
Acceptable Period of Time:	2 to 4 hours per week

Notification/Contacts:

CAO - Manager
Division Manager
Application Manager

Leadtimes Required:

3 business days

IX. Service Maintenance Requirements

	<u>Store Equipment</u>	<u>Local Office Workstations</u>	<u>Operations Center Workstations</u>
Required time availability:	8 a.m.- 9 p.m.	8 a.m.- 5 p.m.	All hours
Maximum response time:	2 hrs	2 hrs	2 hrs - normal business hours 4 hrs - other times

X. Maintenance Contracts

Hardware

Company Name
Contact Name
Contact Number
Service Hours

System Software

Company Name
Contact Name
Contact Number
Service Hours

Application Software

Company Name
Contact Name
Contact Number
Service Hours

POS Terminals

Company Name
Contact Name
Contact Number
Service Hours

Telephone Lines

Telephone Company
Contact Name
Contact Number
Service Hours

Appendix B

PROCEDURES FOR ESTIMATING PEAK TRANSACTION VOLUMES

When planning system processing and communications capacity for an EBT system, system designers need to estimate how many purchase transactions the system must accept and process during peak usage periods. Peak transaction volumes directly affect how many telephone lines the system needs to ensure communications access to the system. Peak transaction volumes also represent one of the largest components of necessary system processing, although processing resources are needed for other system functions (e.g., file maintenance, benefit issuance, management reports) as well.

This appendix describes a set of procedures for estimating expected peak transaction volumes in an EBT system. Designers of commercial POS systems use similar procedures to estimate communications and processing capacity requirements. The appendix also includes data on actual levels and patterns of transaction activity in the Reading EBT demonstration.¹

The procedures for estimating peak transaction volumes are described in three subsections: estimating monthly transaction volumes, estimating peak hourly volumes, and estimating peak volumes within the peak hour.

ESTIMATING MONTHLY TRANSACTION VOLUMES

The first step in estimating expected peak transaction volumes is to estimate total expected transaction volume for a specified unit of time. Because food stamp benefits are issued on a monthly cycle, it is reasonable to begin by estimating total monthly transaction levels.

Monthly transaction demand for an EBT system depends on the number of recipients using the system each month and the average number of EBT

¹These data have been presented in two reports: John A. Kirilin and William L. Hamilton, Performance Issues in an Electronic Benefit Transfer System for the Food Stamp Program, Cambridge, Massachusetts: Abt Associates Inc., February 1987; and Susan H. Bartlett and Margaret M. Hart, Food Stamp Recipients' Patterns of Benefit Redemption, Cambridge, Massachusetts: Abt Associates Inc., May 1987. The first report also describes some of the estimation procedures presented in this appendix.

purchases each recipient makes per month. For commercial POS systems, the number of people using the system each month is related to the size of the cardholder base. The size of the cardholder base is equal to the number of debit cards issued by financial institutions or retailers participating in the system. For an EBT system, the "cardholder base" is the number of food stamp recipients placed on the system.

Once the size of the cardholder base is known, POS system planners estimate the expected number of cardholders who will use their cards each month. Little information exists on debit card usage for point-of-sale purchases, but experience with automated teller machines (ATMs) is relevant. This experience suggests that, on average, less than one-half of all cardholders use ATMs in a given month. The EBT pattern is much different because food stamp recipients in EBT systems must use their cards to access their food stamp benefits. EBT system planners can expect usage rates to approximate 100 percent. In fact, during the Reading EBT demonstration, from 102 to 104 percent of each month's eligible food stamp caseload made EBT purchases each month. The figure exceeded 100 percent because former recipients continued to use their cards to access remaining benefits after their food stamp cases had closed.

After estimating the percentage of all cardholders expected to generate POS activity, the system developer must estimate how often cardholders will use their cards at the point of sale each month. The Reading demonstration provides the only evidence to date of how often food stamp recipients use their benefit cards to purchase groceries. Between February and December of 1985, the average number of EBT purchases (for recipients using the system) ranged from 7.1 to 8.9 transactions each month. The mean for the entire period was 8.3 transactions per month.

ESTIMATING PEAK HOURLY TRANSACTION VOLUMES

Once total expected monthly transaction volumes are estimated, the system designer must estimate expected peak hourly transaction volumes. The ratio of peak hourly volume to total monthly volume will be affected by cardholders' temporal patterns of card use. If detailed information of this nature is unavailable, system designers will need to collect additional data

or make some assumptions about usage patterns to estimate peak hourly transaction volumes.

For EBT system designers, the Reading EBT demonstration has provided a great deal of information on patterns of card use, and some of this information is presented below. Designers of future systems should not expect usage patterns to follow the exact patterns observed in Reading, however, because caseload and retail market characteristics may vary by locale. Nevertheless, the card usage patterns in Reading provide the best information currently available. In addition, the previously cited report by Bartlett and Hart provides information on how card use varies by recipients' socioeconomic characteristics.

As previously reported, food stamp recipients in Reading made, on average, 8.3 EBT purchases per month. Card usage varied by the size of the recipient's monthly allotment, as shown below:

<u>Monthly Allotment</u>	<u>Average Number of Monthly Purchases</u>
\$ 0 - 50	2.7
\$ 51 - 100	7.0
\$101 - 160	9.0
\$161 - above	13.5

Recipients generally made most of their monthly purchases shortly after they received their monthly food stamp allotment.

<u>Time Since Issuance</u>	<u>Percent of Monthly Purchases</u>
Issuance Day	10.1
Day 2	8.8
Day 3	7.2
Day 4	6.9
Day 5	6.3
Day 6	5.9
Day 7	5.0

Thus, by the end of the first week after issuance, recipients had made, on average, 50.2 percent of their total monthly purchases. During the following three weeks, the percentages of purchases made were 27.9 percent, 13.6 percent, and 8.2 percent, respectively.

Based on the above patterns of card usage, EBT system designers should anticipate that peak transaction volumes will occur within a day or two of issuance. If portions of the food stamp caseload receive their monthly benefits on different days, the system's peak transaction volumes will be reduced and spread over a longer time interval.

Since July 1985, monthly food stamp issuance in Reading has been split between two days, one week apart. Approximately half of the caseload receives its monthly issuance on each of the two issuance days. With this staggered issuance schedule, peak hourly transaction volumes have seldom exceeded 1.0 percent of the total monthly transaction volume. The peak shopping hours are between 3 p.m. and 7 p.m., although system usage is high from 10 a.m. to 7 p.m. each day.

ESTIMATING PEAK TRANSACTION VOLUMES

After a system designer estimates expected peak hourly transaction volumes, peak activity levels within the peak hour must be estimated. If the system's communications and processing capacities are sized to handle the estimated peak activity, problems with gaining access to the system and with system processing speeds should be minimized.

A standard approach for estimating peak activity within a peak hour is to assume that transactions follow a Poisson distribution in their rate of occurrence. (The Poisson distribution is often used in statistical analysis to model the rate of occurrence of a random event.) With the Poisson distribution, the probability of k events occurring in a time interval t is:

$$P(k) = \frac{e^{-\gamma t} (\gamma t)^k}{k!},$$

where γ is the mean rate of occurrence.

An example of using the Poisson distribution to estimate expected peak activity levels in an EBT system follows. Suppose that a food stamp caseload generates 30,000 transactions per month (which is close to the number generated in the Reading EBT demonstration). The peak-hour volume is estimated as 300 transactions (i.e., 1.0 percent of 30,000). Within the peak hour, the mean rate of occurrence, \underline{v} , is 5 transactions per minute (i.e., 300 transactions/60 minutes). Using the above formula, the following probabilities describe the likelihood of receiving the specified number of transactions within any given minute of the peak hour:

Number of Transactions (k)	Probability	Cumulative Probability
0	.0067	.0067
1	.0337	.0404
2	.0842	.1246
3	.1404	.2650
4	.1755	.4405
5	.1755	.6160
6	.1462	.7622
8	.0653	.9319
9	.0363	.9682
10	.0181	.9863
11	.0082	.9945

The probability of receiving more than 10 transactions in any given minute, for example, is only .0137 (i.e., 1.0 minus .9863). The system designer can use this information (together with an estimate of how long each transaction will occupy a telephone line) to select an appropriate communications and processing capacity for the system.