BY THE COMPTROLLER GENERAL

Report To The Congress

OF THE UNITED STATES

Conversion To Automated Mail Processing And Nine-Digit ZIP Code--A Status Report

The Postal Service intends as part of a move to a new generation of mail sorting equipment to expand its five-digit ZIP Code to nine digits effective October 1, 1983 The Service expects its nine-digit ZIP Code program (ZIP + 4) to save money by reducing personnel costs

This report presents the status of the Service s move to automation and ZIP + 4

GAO believes that the Service will be in a position to implement the ZIP - 4 program on or about October 1 1983 as planned As summarized below, there are some uncertainties about equipment performance, and GAO identified several needed program improvements However none of the uncertainties or needed improvements identified by GAO warrant a delay in the start of the program

--At the completion of its review in August 1983 performance of the mail sorting equipment--optical character readers and bar code sorters--was still uncertain Subsequently the Postal Service completed tests of optical character reading equipment Results of these tests were not reviewed by GAO According to the Service the tests indicated that the equipment will perform up to expectations The Service had not yet conducted planned extended tests of bar code sorters (equipment that sorts mail by reading a bar code printed on the envelope)

- Improvements are needed in the Service s programs to (1) improve the optical character readability of mail addresses and (2) administer the postage rate incentive proposed for large-volume mailers who use ZIP + 4

GAO/GGD-83-84
SEPTEMBER 28, 1983

COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON D C 20548

B-206332

To the President of the Senate and the
Speaker of the House of Representatives

This is our second report on the automated mail processing equipment the U.S. Postal Service is buying and the nine-digit ZIP Code system (ZIP + 4) the Service plans to implement October 1, 1983. This followup report discusses (1) the Service's equipment performance testing, (2) the Service's market research on potential mailer usage of ZIP + 4, (3) the National ZIP + 4 Directory, and (4) the Service's efforts to increase the optical character readability of mail. This report presents data on these matters that was not available at the time we made our initial review.

We are issuing the report to the Congress, rather than to the individual requesters, in view of (1) continued and widespread congressional interest in the ZIP + 4 issue, (2) 1981 congressional actions delaying implementation of the ZIP + 4 system, and (3) the request of the fiscal year 1981 budget reconciliation conference committee for a General Accounting Office study of ZIP + 4.

We are sending copies of this report to signatories to the joint letter of October 1, 1981; other interested Members of Congress; the Director, Office of Management and Budget; and the Postmaster General, for whom the report contains recommendations.

Sincerely yours,

Charles A. Bowsher

Comptroller General
of the United States

COMPTROLLER GENERAL'S
REPORT TO THE CONGRESS

CONVERSION TO AUTOMATED MAIL PROCESSING AND NINE-DIGIT ZIP CODE--A STATUS REPORT

D I G E S T

The Postal Service intends, as part of a move to a new generation of mail sorting equipment, to expand its five-digit ZIP Code to nine digits, effective October 1, 1983. The Service expects its nine-digit ZIP Code program ("ZIP + 4") to save money by reducing personnel costs. In a previous report[1] prepared at the Congress' request, GAO discussed (1) the Service's financial projections, (2) the automated equipment intended for use with the program--primarily optical character reader/channel sorters and bar code sorters, and (3) the potential impact of ZIP + 4 on mailers. In that January 1983 report, GAO stated its intent to monitor and report on subsequent program developments.

This report describes the current status of the Service's move to automation and ZIP + 4. It also presents information on some of the above issues that was not available during the initial review.

CONCLUSIONS

GAO believes that the Service will be in a position to implement the ZIP + 4 program on or about October 1, 1983, as planned. As summarized below, there are some uncertainties about equipment performance, and GAO did identify several needed program improvements. However, none of the uncertainties or needed improvements identified by GAO warrant a delay in the start of the program.

--At the completion of GAO's review, performance of the optical character reading equipment was uncertain. This equipment reads the city, State, and ZIP Code of an address and prints

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[1]"Conversion to Automated Mail Processing Should Continue; Nine-Digit ZIP Code Should Be Adopted If Conditions Are Met," (GAO/GGD-83-24, January 6, 1983).

on an envelope a bar code representing the ZIP Code. Results of recently completed tests of the optical character reading equipment were not reviewed by GAO. According to the Postal Service, the tests indicated that the equipment will perform up to expectations. On the basis of operational data and observations made at the test sites, GAO believes that, with sufficient management supervision to ensure that proper operator and maintenance procedures are followed, the Service can bring these machines' performance up to or close to contract levels.

--Performance of the bar code sorting equipment was also uncertain. Bar code sorters sort mail by reading the bar code imprinted on an envelope. The Service has not yet conducted planned extended tests of this equipment. However, GAO's work has revealed no evidence of catastrophic or uncorrectable problems with the design or performance of the bar code sorters.

--Improvements are needed in the Service's programs to (1) improve the optical character readability of mail and (2) administer the postage rate incentive proposed for large-volume mailings of ZIP + 4 coded mail. These improvements can be made after the start of the ZIP + 4 program.

--Although GAO believes that with an appropriate rate incentive a substantial market for ZIP + 4 exists, the Service's estimate of potential mailer usage of ZIP + 4--based largely on a Service-commissioned market study--is questionable because of deficiencies in study methodology.

PERFORMANCE OF AUTOMATED EQUIPMENT

In its earlier report, after describing uncertainties affecting the nine-digit ZIP Code program, GAO still endorsed acquisition of the new automated equipment and its use to automate the processing of five-digit mail, provided that the Service demonstrated that the equipment would perform at levels specified by the contracts. At the close of this subsequent review in August

1983, the Service had not demonstrated that the equipment could perform under operational conditions at contract levels because:

--Extended (8 to 12 week) optical character reader/channel sorter tests that GAO recommended in the prior report and that the Service agreed to conduct had not been completed. (See pp. 8 and 11.) (Subsequent completion of the tests indicated, according to the Postal Service, that the equipment will perform up to expectations.)

--The Service's 1 day bar code sorter acceptance tests do not provide reliable data because (1) the tests are too short to identify design defects and (2) test procedures and staffing levels are not consistent with normal operating conditions. (See pp. 12 to 15.)

IMPROVEMENTS NEEDED IN OPTICAL CHARACTER READABILITY AND PROPOSED ZIP + 4 RATE INCENTIVE PROGRAMS

Equipment performance assumptions which the Service used in its 1980 economic analysis to justify the automation program were based, in part, on assumed future improvements in machine readability of addresses. The readability improvements were to be achieved in part through mailer cooperation in eliminating problem characteristics in mail addresses. (See p. 19.) A ZIP + 4 postage rate reduction, which the Service has proposed to the Postal Rate Commission, would provide an incentive for large-volume mailers to improve the optical character readability of their mail. (See pp. 22 and 25.) Commission action on this proposal was scheduled for completion in late September 1983.

At the time of this review, the Service was developing programs to achieve optical character readability improvements and administer the ZIP + 4 rate incentive program. However, GAO's assessment of these programs showed a need for:

--Complete and timely readability criteria to ensure that a rate reduction--if established--is given only for mail that is machine readable. (See pp. 21 to 24.)

--Written policies and procedures establishing a more structured and coordinated management of these programs. For example, (1) organizational and management responsibilities need to be clarified, (2) a program is needed to provide large-volume mailers technical assistance to improve the optical character readability of their mail, and (3) policies and procedures are needed for determining whether mail qualifies for the ZIP + 4 rate reduction. (See pp. 24 to 28.)

Unless these needs are met, the Service may not achieve the high optical character read rates necessary to realize the ZIP + 4 program's full savings potential.

POSTAL SERVICE'S MARKET STUDY ON POTENTIAL ZIP + 4 USAGE PROVIDES QUESTIONABLE RESULTS

The Postal Service estimates that if a proposed half-cent-per-piece postage rate reduction is authorized for qualifying ZIP + 4 mail, at least 12 billion pieces of First-Class Mail nationwide will be--by fiscal year 1984--ZIP + 4 coded and otherwise qualified for the reduction. The Service's 12-billion-piece estimate is based largely on a market study it commissioned in 1982. The Service believes that the market study indicates a positive mailer reaction to a 0.5 cent postage reduction and that the proposed reduction should generate sufficient ZIP + 4 coded mail to ensure that ZIP + 4 benefits to the Service exceed costs. (See pp. 31 to 32.)

GAO has reservations about the methodology used in the study. GAO believes·

--The approximate 48 percent response rate among businesses contacted was too low to assure that conclusions reached were valid. (See p. 33.)

--The study universe was not representative of the Nation because the Service restricted the universe to businesses in the 50 largest metropolitan areas. (See pp. 33 to 34.)

Because of these shortcomings in study methodology, GAO is unable to endorse the Service's

study results or its follow-on projection that 12 billion pieces of First-Class Mail would qualify for a ZIP + 4 incentive in fiscal year 1984. Although GAO believes that with an appropriate rate incentive a substantial market for ZIP + 4 exists, it cannot say whether the Service's estimate is too high, too low, or on target.

TEST SUGGESTS RESIDENTIAL ADDRESS DATA IN ZIP + 4 DIRECTORY IS REASONABLY ACCURATE

The National ZIP + 4 Directory is designed to provide ZIP + 4 codes and related address information to mailers. To test the directory's completeness and correctness, GAO asked the Service to compare its employees' residential addresses with the directory. The Service reported that the directory was in error for only 1.6 percent of the approximate 700,000 addresses in the comparison. Errors included missing addresses and incorrect address information. (See pp. 38 to 41.)

GAO's limited verification of the Service's work suggested--with regard to employee addresses--an overall directory error rate of about 4 percent for the six major metropolitan areas GAO visited. (See pp. 41 to 43.) Nevertheless, the Service's results and GAO's verification work suggest that:

--The directory is substantially complete; that is, it contains most residential mailing addresses.

--The directory is reasonably correct; that is, most of the residential address data it contains is correct. However, improvements are still attainable.

GAO identified ways in which directory information could be further standardized to improve its usefulness to mailers, and the Service has initiated corrective action. (See p. 44.)

RECOMMENDATIONS TO THE POSTMASTER GENERAL

To identify bar code sorter performance capabilities, identify potential design defects, and obtain reliability data, the Postal Service should conduct--as planned--an extended test on one or two of the bar code sorters already accepted. (See p. 16.)

To achieve needed improvements in the optical character readability and ZIP + 4 rate incentive programs, the Service should

--Expedite the issuance of complete address readability criteria. (See p. 30.)

--Issue written guidance clarifying organizational responsibilities for these programs and establishing management responsibilities for program oversight. (See p. 30.)

--Provide technical support for large-volume mailers in the form of (1) an orientation program to analyze their mail and demonstrate to them the optical character reader/channel sorter's capabilities and limitations, and (2) training and technical support for the Postal Service's Customer Service Representatives. (See p. 30.)

--Develop policies and procedures for (1) determining whether mail is eligible for the ZIP + 4 discount, (2) training and equipping Postal Service acceptance unit staffs receiving ZIP + 4 discount mail, and (3) using data obtained from actual optical character readings to monitor implementation of the ZIP + 4 rate incentive program. (See p. 30.)

AGENCY COMMENTS AND GAO'S EVALUATION

Postal Service comments on GAO's draft report appear in full in appendix VI. Comments on the draft report were also received from equipment contractors (Bell and Howell, Burroughs Corporation, and Pitney Bowes). These contractors' comments appear in full in appendix VII. GAO discusses the Service's and contractors' comments in relevant chapters of the report.

The Service said that preliminary results from the (then) ongoing extended tests of optical character reader/channel sorters indicated that the equipment would perform up to expectations. GAO cannot refute this contention because final test results were not available at the completion of its review. However, the results referred to by the Service should be the best attainable now because of recent improvements made in the test equipment and in operating and maintenance procedures at the test sites. (See p. 16.)

Further, although GAO did not review the final test results, it believes, on the basis of operational data and observations made at the test sites, that with sufficient management supervision to ensure that proper operator and maintenance procedures are followed, the Service can bring these machines' performance up to or close to contract levels.

Regarding GAO's recommendations for improving the Service's optical character readability of mail and administering the ZIP + 4 rate incentive program, the Service said it would give these programs continued management emphasis and that improvements were underway along the lines GAO recommended. GAO believes the improvements listed by the Service will, if fully and effectively implemented, accomplish the intent of GAO's recommendations.

The Postal Service reaffirmed its intent to conduct--as GAO recommended--an extended test on a bar code sorter and said it will do so as soon as the optical character reader extended tests are completed and staffing is available to conduct the bar code sorter test.

The Service responded positively to GAO's concerns about the use of contractor personnel to help operate bar code sorters during acceptance testing and about the larger-than-normal staffing used during testing. In concurring with GAO's recommendations (see p. 75), it said that future equipment tests would be conducted with postal personnel only and with the same staffing levels as anticipated for actual operations.

The Service disagreed with GAO's conclusion that, because of shortcomings in study

methodology, the Service's market study on potential ZIP + 4 usage provides questionable results. The Service maintained that the study was valid and said that:

--The contractor anticipated that many businesses would not provide an interview and, therefore, the number of businesses contacted was greater than double the number required to make projections. (See p. 76.)

--Necessary trade-offs limited the study to the 50 largest metropolitan areas. The Service added that when making the trade-offs, it believed that mailer characteristics (such as mail volume and size of mailings) which would be learned from the study would be more important than where the mailer was located. (See p. 77.)

GAO holds to its belief that the market study's response rate was too low to assure valid results. Although the "required" number of interviews was obtained, businesses which agreed to provide interviews were, in effect, substituted for those which could not be interviewed until the desired number of interviews was obtained. Because so many businesses could not be interviewed and were replaced with substitutes, there is little assurance that nonrespondents would have answered study questions in the same manner as the substitute respondents.

As indicated on pages 33 to 34, GAO understands the need for practical trade-offs. However, because the study sample was based essentially on location--the 50 largest metropolitan areas--rather than mailer characteristics, GAO believes the Service does not know whether businesses located outside the 50 metropolitan areas share the same mailing characteristics and ZIP + 4 attitudes as those located within these 50 areas.

C O N T E N T S

ABBREVIATIONS

BCS Bar code sorter

CSR Customer service representative

ELSAG Elettronica San Giorgio

EZR	Expanded ZIP retrofit
GAO	General Accounting Office
MPLSM	Multiposition letter sorting machine
MTSC	Maintenance Technical Support Center
NEC	Nippon Electric Company
OCR	Optical character reader
OCR/CS	Optical character reader/channel sorter
ROI	Return on investment
USPS	United States Postal Service

GLOSSARY

Bar code — A series of vertical printed lines designed to represent a numerical value. The Postal Service has a bar code, designed to represent a ZIP Code, to be printed by optical character reader machines and read by bar code sorters. To illustrate, the bar code for ZIP Code 20548-1369 is

Bar code sorter (BCS) — A Postal Service letter sorting machine that optically reads the bar code printed on an envelope and sorts the letter into one of a number of attached bins, according to the ZIP Code that the bar code represents. A BCS has 96 to 102 bins.

Error rate — The percentage of total mail sorted by a letter sorting machine that is sorted incorrectly or, in the case of optical character reader/channel sorters, coded or sorted incorrectly.

Expanded ZIP retrofit (EZR) — A package of electronics designed to upgrade the capabilities of multiposition letter sorting machines. These electronics (1) allow operators to sort mail on the basis of

	four ZIP Code digits, instead of the current three digits; (2) are designed to improve the mail transport mechanism within the multiposition letter sorting machine (MPLSM); and (3) provide more data on, and better monitoring of, machine and operator performance.
Gross accept rate	The percentage of mail handled by a sorting machine that is actually sorted (whether correctly or incorrectly).
Machinable mail	Mail pieces meeting Postal Service standards for mail that can be handled by letter sorting machines. Machinable mail is between 3-1/2 and 6-1/8 inches wide; is between 5 and 11-1/2 inches long; and is between 7/1,000 and 1/4 inch thick.
Mechanical throughput (also called throughput rate)	The number of pieces of mail handled by a sorting machine in an hour.
Meter mail	Mail bearing a postage meter imprint and collected by Postal Service carriers or from collection boxes. Because meter mail has a meter imprint rather than stamps, it does not need to be canceled.
Meter belt mail	Meter mail collected and initially separated from other mail by Postal Service employees. It is processed on a separate conveyor belt (physically separate from conveyor belts used for collection and stamped mail). Meter belt mail is processed through a facer-canceler machine for facing only.
Multiposition letter sorting machine (MPLSM)	A semiautomatic sorting machine that allows up to 12 operators to sort mail pieces by keying either part of the ZIP Code, or the carrier route number, into the machine. The MPLSM can sort mail into as many as 277 bins.
Net accept rate	The percentage of mail handled by a sorting machine that is actually sorted correctly.

Optical character reader (OCR)	The generic name for equipment that optically detects and reads alphabetic and numeric characters, marks, and bar codes. In this report, the term refers to equipment that reads all or part of the address on a piece of mail.
Optical character reader/ channel sorter (OCR/CS)	A type of optical character reader that detects and reads the city, State, and ZIP Code on an address; prints a bar code representing the ZIP Code; and sorts the piece of mail to one of up to 60 bins attached to the machine.
Return on investment (ROI)	An average effective rate of interest at which a project's positive net cash flow values repay the negative net cash flow values over the project's evaluation period.

CHAPTER 1

INTRODUCTION

In late 1980, the U.S. Postal Service requested and received approval from its Board of Governors to purchase automated mail sorting equipment. The Service proposes to maximize the benefits of this automation by expanding its five-digit ZIP [1] Code to nine digits, effective October 1, 1983. Added to the current five digits (which for most mailers would not change) would be a hyphen and four new numbers, as in the following example:

XYZ Company
1139 Main Street
Herndon, VA 22070-2704

The Postal Service has adopted the term "ZIP + 4" as its trademark for the nine-digit code.

The Postal Service expects the planned automation, if used with the current five-digit ZIP Code only, to save money by reducing the number of mail sorting clerks involved in intermediate processing, thereby contributing to postage rate stability (that is, smaller or less frequent rate increases). Used with the proposed nine-digit code, the new equipment would further reduce the number of mail sorting clerks, primarily by providing automated mail sorting of First-Class letter mail [2] down to carrier routes with fewer errors than now occur with manual and machine sorting. The Service believes this increase in sorting accuracy would improve mail service through greater consistency in meeting current delivery-time standards.

For a chronology of significant events in the evolution of ZIP Codes, see appendix II.

PRIMARY TARGET FOR ZIP + 4: LARGE-VOLUME BUSINESS MAILERS

Efforts to promote ZIP + 4 have been targeted primarily to large-volume business mailers, whose use of the new code would

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[1]The acronym "ZIP" (for Zone Improvement Plan) was introduced to the public in 1963 with the new five-digit ZIP Code.

[2]The discussion of the processing of "letters" and "letter mail" in this report pertains to the processing of all First-Class letter-size mail, including post cards.

be essential for the achievement of projected savings.[3] Although the Service states that use of the nine-digit code would be voluntary, it has sought approval for lower postal rates which would serve as an incentive to encourage businesses to use ZIP + 4. In December, 1982, it filed with the Postal Rate Commission a proposal to offer mailers a rate incentive of 0.5 cents per piece for volume First-Class Mail bearing the ZIP + 4 code. (For rate incentive purposes, volume mailings are mailings containing 500 pieces or more.) Commission action on the proposal was scheduled for completion in September 1983.

The Service does not consider the use of ZIP + 4 by householders to be critical to the success of the program, and at this time it has no plans to take the initiative to notify householders of their ZIP + 4 code.

RELATIONSHIP BETWEEN AUTOMATION AND ZIP + 4

The Postal Service's planned programs to automate its mail sorting operation and expand the ZIP Code to nine digits are two separate but directly related programs. The Service maintains that savings achievable by using automated equipment in conjunction with the current five-digit code would justify the equipment investment but maintains that the equipment's full potential for savings and efficiency can be achieved only by implementing the nine-digit code. In fact, the ZIP + 4 code was designed specifically for use with the planned, automated mail processing system. Because of this interrelationship between automated equipment and expanded code, the terms "ZIP + 4 program" and "ZIP + 4 system" implicitly refer to the processing of nine-digit mail by automation.

For a discussion of how the nine-digit ZIP Code would be used and how it would change mail processing, see appendix III.

PREVIOUS GAO REPORT

In a review conducted in 1982, we assessed (1) the Postal Service's financial projections for the ZIP + 4 program, (2) the new automated equipment intended for use with ZIP + 4 , and (3) the potential impact of ZIP + 4 on mailers.

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[3]For purposes of the ZIP + 4 program, the Postal Service's definition of the term "business mailer" includes "standard business organizations, professional services, churches, schools, government, etc." According to the Service, business mailers generate over 80 percent of the letter mail volume.

The results of the above review were published in a report to the Congress in January 1983. [4] We endorsed both the planned automation and ZIP + 4, provided the Postal Service (1) demonstrates that the automated equipment will perform satisfactorily, (2) establishes a postage rate incentive for volume ZIP + 4 mailers, and (3) has reasonable assurance that the established incentive will result in usage sufficient to make ZIP + 4 cost effective.

The Digest of the above report is included as appendix IV.

OBJECTIVES, SCOPE, AND METHODOLOGY

In this review we followed up on certain matters on which data was not available when we made our initial ZIP + 4 review.

Our objectives were to:

--Assess the design, conduct, and results of the Postal Service's equipment tests. Our purpose was to determine whether the Service has demonstrated that the new equipment will work satisfactorily.

--Assess Postal Service efforts to improve the machine "readability" of mail. Purpose: to identify possible improvements in the readability improvement program.

--Assess the design, conduct, and results of a recent, Postal Service-commissioned market study on potential mailer usage of the proposed ZIP + 4 postage rate incentive. Purpose: to independently assess the validity of study findings and Postal Service projections based on the findings.

--Assess the design and results of a Postal Service computer match of approximately 700,000 postal employees' residential addresses against the National ZIP + 4 Directory. Purpose: to obtain an indication of the accuracy (that is, completeness and correctness) of the directory.

Assessing equipment tests

To assess the Service's testing of automated equipment it is buying--specifically, optical character reader/channel

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[4]"Conversion to Automated Mail Processing Should Continue; Nine-Digit ZIP Code Should Be Adopted If Conditions Are Met" (GAO/GGD-83-24, January 6, 1983).

sorters (OCR/CSs) and bar code sorters (BCSs), we examined acceptance test plans and observed acceptance testing in postal facilities in five major cities (District of Columbia, Los Angeles, Minneapolis, New York City, and Philadelphia). These five test sites were selected because they were among the first sites where tests were available to observe. Also, this selection of cities enabled us to observe tests of OCR/CSs made by both contractors.

In addition, we observed OCR/CSs and BCSs in normal mail operations in Baltimore and New York City. We interviewed officials and staff members of the Postal Service and the OCR/CS and BCS equipment contractors. Finally, we observed the post-acceptance testing of the OCR/CSs conducted by the Service in Philadelphia and District of Columbia post offices.

We were aided by a team of engineers from the National Bureau of Standards, Department of Commerce. This team possessed expertise in electronic and mechanical engineering, optical character reading equipment, test design and application, and statistical analysis.

Assessing Postal Service efforts to improve the OCR readability of mail

To determine whether the Service has an effective program to improve the OCR readability of mail, we observed OCR/CS acceptance tests in postal facilities in five cities (listed above) to learn about readability problems in the current mail base and observe how these problems affect OCR performance. We also discussed these problems with Service officials, reviewed OCR readability test data, and reviewed Service plans to improve the OCR readability of the current mail base. We were assisted in our work by National Bureau of Standards engineers.

Assessing Postal Service's market study on ZIP + 4 usage

In assessing the Service's market study on potential usage of the proposed ZIP + 4 postage rate incentive, we used generally accepted statistical procedures and practices as the standard against which we evaluated the study. We reviewed the statistical methodology used in the study. We interviewed Service and contractor personnel, examined detailed data obtained from the Service concerning study methodology, and reviewed Service responses to questions asked by participants in the Postal Rate Commission proceedings regarding the Service's request for a ZIP + 4 postage rate incentive.

Assessing Postal Service's test of data in National ZIP + 4 Directory

In assessing the Service's computerized comparison of residential addresses with data in the National ZIP + 4 Directory, we visited an Address Information Systems unit in each of the following six locations: San Francisco, Oakland, Chicago, south suburban Chicago, Dallas, and Fort Worth. The units maintain the ZIP + 4 directory for the cities in which they are located and, except for the Chicago unit, for geographic areas extending from these cities. We selected the units judgmentally on the basis of the number of employee addresses they had reviewed and our need to visit, in a short time, several units in different areas of the country. We verified--on a sample basis--the comparison work the Service had done at each of these units.

At Service Headquarters, we compared a sample of employee addresses with the directory to verify the Service's reported match rate.

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Most of our field work was done during the period March 1983 to July 1983. Data used in our analysis is the latest data available. Our work was performed in accordance with generally accepted government auditing standards.

CHAPTER 2

PERFORMANCE OF AUTOMATED EQUIPMENT

In our prior report, we concluded that, as a condition for proceeding with plans to acquire automated equipment and adopt the ZIP + 4 code, the Postal Service should first demonstrate that the equipment will perform at levels specified by the contracts.

At the close of our review in August 1983, the OCR/CS equipment was regularly passing an adequately designed acceptance test. However, OCR/CS and BCS performance in regular mail processing operations was still uncertain because:

--Extended testing of OCR/CSs had not been completed. (Service officials believe the extended OCR/CS tests will demonstrate that this equipment is capable of meeting contract requirements and that the OCR/CSs are reliable machines).

--The acceptance test for BCSs was deficient. (At the close of our review, the Service planned to also conduct an extended test on a BCS.)

--Acceptance tests of OCR/CSs, and performance of both OCR/CSs and BCSs in mail processing operations, have disclosed design defects. (We did not determine the severity of the design defects or the adequacy of contractor actions to correct them.)

PRIOR GAO CONCLUSIONS AND RECOMMENDATIONS

In our prior report, we said that acceptance tests of commercial equipment such as that which the Postal Service is buying should provide assurance that:

--The design of the contractor's equipment is sound and the equipment is capable of meeting acceptance criteria.

--Individual production machines have been produced with adequate quality control and manufacturing procedures.

We said the length of tests and retests required to accomplish these two objectives can vary according to the risk and costs involved. In elaborating, we said that:

"Validation of the **design** of equipment is done to avoid risks with serious consequences. The expected

return on investment can be reduced if the equipment cannot meet acceptance criteria. Therefore, any tests should be conducted over a length of time sufficient to identify significant design flaws in critical components."

"Validation of the **performance** of an individual piece of equipment involves a lesser risk once the design has been successfully tested: Only defects in individual machines should be expected. Therefore, tests need be only long enough to assure that the piece of equipment works at an acceptable level of performance."

OCR/CS equipment tests

Regarding the testing of OCR/CS equipment, we said that the Postal Service combined the verification-of-design and individual machine performance tests into a single 1-week test of each machine. We did not believe that the Service's 1-week test was adequate to either validate the design or properly test individual machine performance.

We pointed out that even if a successful design test on an OCR/CS had been performed, the original acceptance test plan would not have accurately tested individual machines. Our statistical analysis of that test plan showed that a machine which met contract requirements might never have passed the entire test (16 subtests) at one time. However, if only the subtests that were failed had been repeated, this limited testing might not have been stringent enough to assure the Service that the machine met contract specifications.

For the current OCR/CS contracts (that is, the contracts in Phase I[1] of the Service's two-phase automation program), we recommended that the Postal Service:

--Conduct an 8-week test on the first unit or units built by each contractor.

--Thoroughly evaluate the criteria to be used for retesting of machines which fail initial acceptance tests.

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[1]The Postal Service is acquiring equipment for its automation program in two phases. In Phase I, now in progress, the Service let contracts for 252 OCR/CSs and 248 BCSs. In Phase II, scheduled to begin in the summer of 1984, the Service plans to let contracts for 307 OCR/CSs and 577 BCSs.

BCS testing

With regard to the BCS contract, we reported that the Postal Service did not require a standard first article test.[2] However, we pointed out that the contractor followed good production procedures and conducted its own test, even though:

--The design of the production machine closely resembled the machine tested by the Postal Service.

--No transfer of technology from a foreign firm was required.

--The firm had been making similar equipment for several years.

According to the contractor, the tests were needed, in part, because some new parts were substituted for hand fabricated parts used in the test machine. However, since the contractor's in-plant tests were not supervised or directed by the Postal Service, they cannot be considered adequate first article tests.

As we concluded in our prior report, the BCS acceptance test which is required by the contract, and which is conducted in about 1 day, is not long enough to identify design problems.

Postal Service agreed to extended OCR/CS testing

As stated earlier, the prior report endorsed the acquisition of the new equipment and its use to automate the processing of mail, provided the Postal Service demonstrated that the equipment would perform adequately.

As a means of demonstrating the adequacy of OCR/CS performance, the Service accepted our recommendations for extended testing of OCR/CS equipment and agreed to conduct an 8- to 12-week test on one of the first OCR/CSs delivered to a postal facility by each contractor. The Service believed that an extended test done after the machines passed the acceptance test would clearly establish the performance capabilities of these machines and provide data to better estimate their reliability, maintainability, and logistical requirements.

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[2]A first article test is a test which subjects a first unit off the production line (or a sample of the first units off the production line) to a test over a period of time long enough to establish that the machine performs at the expected level.

STATUS OF CURRENT EQUIPMENT CONTRACTS

The number of OCR/CSs and BCSs accepted by the Service as of July 15, 1983, and the total number to be provided under Phase I contracts are shown in the following table.

Equipment/ (Contractor)	Number of units accepted as of July 15, 1983	Number of units originally scheduled to be accepted by July 15, 1983	Number of units under contract in Phase I
OCR/CS (Burroughs)	14	36	126
OCR/CS (Pitney Bowes)	51	49	126
BCS (Bell & Howell)	139	134	248

Deployment of OCR/CSs to postal operations has been slowed by contractors' manufacturing delays and/or problems in passing acceptance tests. Burroughs' October 1982 scheduled date for its first delivery to an operating post office slipped to January 1983. Pitney Bowes delivered its first unit to an operating facility on schedule in September 1982. However, during testing in operating post offices, both Burroughs and Pitney Bowes machines were unable to pass the test criteria in the original contract. After numerous failed attempts by both OCR/CS contractors, the Service and the contractors agreed to change the acceptance test criteria. The Service revised its contract with Pitney Bowes in January 1983 and with Burroughs in April 1983.

Under the revised contracts, the cost of processing 1,000 letters on an individual machine is compared with cost criteria in the contract. We believe the new plan is properly drawn to fairly test the equipment.

Both contractors have had more success in passing the revised test criteria. In August 1983, Service officials said that both contractors' OCRs were regularly passing acceptance tests. As of August 1983, Pitney Bowes was, in fact, back on schedule. Service officials said that Burroughs had submitted a revised test schedule which will bring it back on schedule.

Both Burroughs and Pitney Bowes experienced mechanical and software problems during acceptance testing, causing design changes. We did not review the nature and extent of these problems, but Service officials believed the problems were normal, considering that the contractors had never before built OCR equipment.

Burroughs

The acceptance tests, and preliminary data from the extended test, indicate that Burroughs has hardware, software, and manufacturing problems with its OCR/CS. For example, Burroughs engineers and quality control personnel visited the extended-test site to investigate repeated machine operating failures. According to Service officials, the Burroughs staff found design and manufacturing problems in the test machine. Service officials said that other Burroughs machines already deployed were experiencing these same problems.

Service officials said operating failures on the extended-test machine were substantially reduced after correction of the problems identified during the Burroughs visit to the test site. However, in May 1983, Burroughs suspended acceptance testing for about 1 month to further analyze technical problems. When testing was resumed in the week of June 6, Burroughs machines passed two acceptance tests, and, according to Burroughs, the problems which caused the suspension were corrected in the machines previously deployed.

Service officials believe the engineering problems have been resolved. We have not reviewed the engineering problems or the Service's solutions.

In commenting on our draft report (the full text of all three equipment contractors' comments appears in app. VII), Burroughs said that the resolution of problems common to the extended-test machine and other machines already deployed had resulted in improved machine performance during subsequent testing.

Pitney Bowes

Since the acceptance test criteria were modified, Pitney Bowes machines have been passing the acceptance tests with regularity. During February and March 1983, Pitney Bowes OCR/CSs passed eight tests in a row on the first try. Statistically, this test performance indicates that the Pitney Bowes machines are equal to or better than the machine tested in the Phase I

release-loan testing program [3] with respect to an estimated cost to process 1,000 letters. This processing cost is computed using a weighted average of throughput, read rates, and error rates.

The Pitney Bowes machines have had some mechanical and software problems during the acceptance tests and in mail processing operations after acceptance. For example, the feeder section was redesigned and retrofitted on already deployed machines. Service and contractor officials told us that, to enhance performance, several other changes to the hardware and software had been implemented or were under consideration.

Service officials stated that the Pitney Bowes machines were experiencing fewer problems at each succeeding test site and in subsequent mail processing operations. Pitney Bowes voluntarily increased its pre-acceptance test preparation from 2 to 3 weeks to more thoroughly check out each machine prior to acceptance testing. Service officials believed that the problems currently being identified were minor and easily correctable.

In August 1983, Service officials said that Pitney Bowes' machines had passed all tests on the first try since the contract was modified in January 1983.

OCR/CS EXTENDED TESTS NOT COMPLETED

As of July 1983, two OCR/CSs (one from each contractor) had been tested for 8 weeks. Preliminary test data showed that each machine performed below target levels. Service officials concluded, on the basis of preliminary data and observations made by engineers who supervised the tests, that the below-target-level performance was caused by operational and equipment-start-up problems. The two OCR/CSs were retested for 2 weeks after

--operational and maintenance personnel received additional training,

--the contractors fixed known problems, and

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[3]During the period 1979 to 1981, the Postal Service tested commercial OCR/CS and BCS mail sorting equipment from several American and foreign manufacturers. These tests were conducted in operating postal facilities, using actual U.S. mail. They were conducted under "release-loan" agreements, under which the manufacturers and the Postal Service shared the costs. The tests were designed to prove that the commercial equipment could process U.S. mail under realistic operating conditions. Similar tests were begun in June 1983, in preparation for Phase II equipment acquisitions.

--the OCR/CSs were fine-tuned to maximize mechanical recognition performance.

The 2 week operational retest was conducted from August 8 to August 19, 1983, but the final extended-test results were not available for inclusion in this report.

BCS ACCEPTANCE TEST DEFICIENCIES MAY HAVE OBSCURED POTENTIAL DESIGN PROBLEMS

Short BCS acceptance tests and the manner in which they were conducted may have obscured potential design problems.

Observations by GAO and Service officials indicate possible design problems. At the close of our review, the Service was planning an 8 week extended test on the BCS similar to the extended OCR/CS tests. This new test should provide the necessary data to determine whether operating performance can reach contract levels and to attribute any degradation in performance to either staff deficiencies or machine performance problems.

Acceptance test deficiencies

The acceptance test plan is deficient because

--The tests are too short.

--Contractor personnel directly affect the outcome of tests.

--Larger-than-normal staffing is used.

As a result, the Service does not have reliable test data to identify potential design defects before accepting these machines.

Tests are too short--The Postal Service commingles the validation-of-design and individual machine performance tests into a 1-day test of each machine. We believe that the Service's 1-day test is inadequate to validate the design or to properly test individual machines' performance. The test is not long enough to (1) identify design problems which could cause excessive wear or the need for critical adjustments or (2) reveal quality control problems which may have developed during manufacturing. As discussed below, some indications are present of design problems which could affect machine performance.

Exactly how long the BCS acceptance test should be is subject to engineering judgment. However, for our prior report, NBS engineers concluded that a 1-week test for OCR/CS equipment

was reasonable for quality control purposes, but only after a successful design-validation test of about 8 weeks. The similarity of mechanical characteristics (BCS versus OCR/CS) makes the disparity between acceptance test periods (1 day versus 1 week) questionable.

Actions of contractor personnel--Contractor personnel are directly affecting the outcome of the tests because, in the absence of any contractual prohibition, the Service allows them to participate in the operation of the machine. Unlike the OCR/CS tests, in the two BCS tests we observed, contractor personnel prepared the mail, fed the machine, cleared jams, and directed Postal Service sweepers [4] in preventing jams caused by mail backing up in the stackers. Procedures for the OCR/CS acceptance tests do not allow contractor personnel to participate in the conduct of the tests. Service personnel said that in most instances, contractor personnel no longer prepare mail, feed the machine, or direct Service personnel. However, they said that contractor personnel still clear jams. We did not verify these statements.

In commenting on our draft report, Bell and Howell said that participation by the contractor can provide a more objective test of the machine by removing the factor of inexperienced operators. (See p. 80.)

The Service, as noted above, does not allow contractor personnel to participate in the OCR/CS acceptance tests, nor did it allow contractor personnel to participate in other equipment tests we observed. According to the test plan, contractor personnel also were not allowed to participate in the Phase II OCR/CS release-loan tests. We concur with the Service's general practice of excluding contractor personnel from conducting equipment tests because the tests should prove that Service personnel with average skills can operate the machines under realistic operating conditions.

Larger-than-normal staffing--The BCS acceptance tests are conducted with higher staffing levels than those the Service uses during normal operations.[5] Staffing for the tests

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[4]A sweeper is a person assigned to remove mail from a stacker and place the mail in the proper trays.

[5]OCR/CSs also have higher staffing levels (3 persons) during acceptance tests than the two-person staffs the Service plans to use during normal mail processing operations. Service officials said, however, that in actual mail processing operations, with two persons operating the OCR/CSs, OCR/CS productivity had, in some facilities, been equal to or better than the planned 10,000 pieces per staff-hour. We did not examine the Service's OCR/CS productivity data, or the system used to collect it, because the Service did not have the system operational prior to completion of our review.

consists of at least five persons, including two sweepers and a person assigned to clear jams. During our observations of actual tests, the jam clearer also participated in sweeper operations; in effect three sweepers were used in the test. These sweepers were able to keep mail inside the stackers from obstructing entry of additional letters. In our opinion, this action prevented additional jams from occurring during the two tests we observed. In one of the tests, if additional jams had occurred, the machine would have failed the test. During normal mail processing operations we observed, only one sweeper was assigned to each BCS. This sweeper was frequently too busy to adjust the mail inside the stacker to prevent jams. No jam clearer was assigned during normal operations.

Service officials said the jam clearer no longer sweeps the machine during acceptance tests. We did not verify this statement.

Indicators of design problems

The Service did not require a first article test prior to full production of the BCSs. As a result, the Service does not have reliable test data to identify potential design defects before accepting these machines.

Service officials have expressed concern about the performance of the BCSs because the machines have not always achieved contract performance levels during normal mail processing operations. They said they had given increased management attention to BCS performance.

On the basis of our observations of machine performance, we pointed out to the Service that some BCSs were rejecting excessive amounts of mail and were jamming more than they did during contract acceptance tests. We agree with Service officials that this performance degradation may be caused by (1) poor operator performance, (2) design problems, (3) maintenance problems, or, more likely, (4) a combination of these problems.

Service officials agree that further testing is needed, and a test program for the BCS, similar to the extended tests for the OCR/CSs, has been prepared. The tests were scheduled to begin as soon as staff was available.

Service officials said they had already conducted preliminary analysis of one problem--mail rejection--and had found that much of the reject mail was either improperly bar coded by the OCR or had interference in the bar code read zone. They estimated a true reject rate of less than 2 percent, compared to the 5 percent reject rate allowed by the contract.

In response to our draft report, Bell and Howell maintained that it had thoroughly tested the BCS prior to production and was unaware of any potential design defects. It also questioned the validity of our observations of machine performance. We recognize that our observations of BCS performance were limited. However, our observations, as well as those made by Service officials, led to GAO and Service conclusions that BCS operating performance indicates that testing should be done beyond the 1 day acceptance test. For example, the continuing jamming problems of the Bell and Howell machine were sufficiently serious to warrant further engineering study of:

--the timing of gates used to deflect mail into the stackers;

--changes to allow quicker and easier clearance of jams with less mail damage;

--alternative methods of stacking letters when a number of letters are sorted to one stacker in rapid succession and back up into the entry path to the stacker.

Bell and Howell also said that, while it may be true that elements of the sorter design can be improved or enhanced, the extensive testing programs have made it prudently cautious in making any changes. We agree with Bell and Howell that a complete understanding of the exact cause-and-effect implication of any redesign must be determined before action can be undertaken.

CONCLUSIONS

Data from the OCR/CS extended tests that we recommended in our earlier report and that the Service agreed to conduct had not been completely compiled or verified by the Service at the close of our review. For this reason, we cannot conclude that the Service has fully demonstrated that the OCR/CS equipment is capable of meeting contract performance criteria in normal operating conditions. The subsequently completed tests indicate, according to the Postal Service, that the equipment will perform up to expectations.

We also cannot conclude that the Service has fully demonstrated that the BCS equipment, under normal operating conditions, is capable of meeting contract performance criteria. The Service plans to conduct an extended test to determine whether the BCS has design deficiencies and to provide better measurement data on BCS performance and reliability. We believe an extended test is essential for these purposes.

In both OCR/CS and BCS acceptance tests, the Service used higher staffing levels than it anticipates using in normal mail processing operations. The extra staffing, together with the inappropriate involvement of contractor personnel in BCS tests, may have obscured potential design and performance problems with the equipment.

RECOMMENDATIONS TO THE POSTMASTER GENERAL

We recommend that the Postal Service:

--Conduct--as planned--an extended test on one or two of the BCSs already accepted in Phase I to (1) identify BCS performance capabilities, (2) identify potential design defects, and (3) obtain reliability data. If design flaws are detected, the Postal Service should fully enforce existing contractual remedies.

--To ensure that Phase II equipment test results accurately reflect anticipated operating results, (1) staff Phase II OCR/CS and BCS release-loan and acceptance tests at levels consistent with normal operating conditions and (2) use Postal Service personnel--not contractor personnel--to operate BCSs during testing.

AGENCY COMMENTS AND OUR EVALUATION

In commenting on our draft report, the Service said (see p. 75) both OCR/CS contractors had overcome initial problems and were consistently passing the new acceptance test. They also said preliminary results from the (then) ongoing 2-week phase of the extended post acceptance tests indicated the equipment will perform up to expectations.

We cannot refute the Service's contention that the test data for the 2-week period will indicate that the OCR/CS equipment will perform up to expectations because final test results were not available to us. At our cutoff date (late August 1983) for finalizing this report the Service had not completely compiled or verified the 2 week test data. It should be noted, however, that equipment performance during this 2-week period should be the best attainable now because, as pointed out on pages 11-12, the two OCR/CSs were retested after

--operational and maintenance personnel received additional training,

--the contractors fixed known problems, and

--the OCR/CSs were fine-tuned to maximize mechanical recognition performance.

Also, to improve performance during the 2 week retest period, the Service culled (removed) from the test certain mail which it had not culled during either the release-loan test or during the first 8 weeks of the extended tests. Culling at the Burroughs test site was more extensive than at the Pitney Bowes

site. In addition, the Service had its technical specialists and contractors' technicians available to service the equipment during the tests.

However, on the basis of operational data and observations made at the test sites, we believe that with sufficient management supervision to ensure that proper operator and maintenance procedures are followed, the Service can bring the OCR/CSs' performance up to or close to contract levels.

The Postal Service reaffirmed its intent to conduct--as we recommended--an extended test on a bar code sorter. It said these extended tests would be conducted as soon as the OCR extended tests are complete and staffing is available. The Service also agreed that contractor personnel should be phased out of the BCS acceptance tests. The Service said future tests will be conducted with Service personnel, using the same staffing as anticipated in actual operations.

Although the Service agreed to conduct extended BCS tests, it said the BCSs had consistently performed reliably in field usage and no significant design defects had been identified. This conclusion is based on limited operating time and performance data. Service data for the period May through July 1983 shows a nationwide daily average run time of just over 3 hours per machine. This use of the BCS, a result of delays in OCR/CS deployment, is about 57 percent of anticipated field usage. Also, current field performance of BCSs is below the Service's mail processing targets in all categories. For example, throughput per hour is 68 percent of target, and net productivity is 63 percent of target. The tests which we recommended and the Service agreed to perform are needed to prove that these figures are not representative of BCS performance. However, GAO's work has revealed no evidence of catastrophic or uncorrectable problems with the design or performance of the bar code sorters.

CHAPTER 3

IMPROVEMENTS NEEDED IN OCR READABILITY AND PROPOSED ZIP + 4 RATE INCENTIVE PROGRAMS

Significant volumes of business mail have characteristics which lower the mail's chances of being correctly read and sorted by an OCR. Performance of the OCR equipment could be less than the Service anticipated, resulting in less-than-maximum cost effectiveness of the ZIP + 4 program, unless the Service:

--Establishes and enforces adequate OCR readability criteria to ensure that mail for which a ZIP + 4 postage rate incentive is given--if the proposed incentive is established--is OCR readable.

--Implements more structured and coordinated management of the OCR readability improvement and ZIP + 4 rate incentive programs.

Without adequate OCR readability criteria, the Service (1) probably will not be able to raise the performance of the OCRs from contract levels to the levels assumed by the Service in its cost studies, and (2) through erroneous granting of a ZIP + 4 postage rate incentive (if the proposed incentive is established), might forgo revenue without receiving any benefit in return.

Service officials generally agreed with our observations and said they had raised the priorities assigned to these programs. They related actions being taken or planned to improve the programs.

PRIOR GAO CONCLUSIONS AND RECOMMENDATIONS

In our prior report on ZIP + 4, we used in our ROI computations the Service's assumption that the OCR/CSs being purchased will perform better than the machines tested under the release-loan program. If the performance of these OCR/CSs does not exceed the actual performance level achieved by the machines tested under the release-loan program, the ROI using the nine-digit ZIP Code will be reduced as follows:

Comparison of ROIs Using Assumed Acceptance Rates With ROIs Using Actual Test Results

	ROI based on assumed rate (percent)	ROI based on actual test results (note a) (percent)
Automated system using the five-digit ZIP Code	16.3	16.5
Automated system with ZIP Code expanded to nine digits (using fixed 0.5 cent postage rate incentive/using incentive escalated at the same rate the Service assumed for increased labor costs)	36.4/23.5	30.1/15.3

a/Computed by GAO using raw test data and the Postal Service's formula for determining an acceptance rate for nine-digit mail. The release-loan equipment was tested using five-digit mail. The ROIs presented represent a midpoint between the highest and lowest acceptance rates projected from the raw test results. (The Postal Service did not accept our projected ROIs for reasons contained in its comments on our earlier report. For the Service's views and ours, see appendix IV, pages 62 to 72.)

In anticipation of improved acceptance rates, the Service used a higher OCR/CS performance level in its 1980 ZIP + 4 proposal than that achieved under the release-loan program. It found that mail pieces were rejected by the release-loan OCRs because of difficulty in finding the address or ZIP Code, skewed lines, poor contrast, special printing fonts (sizes and styles of print), or poor printing quality. The Service assumed that more than half of these rejected pieces could be read if it developed:

> "a vigorous effort to obtain better compliance with addressing standards, a very limited OCR recognition improvement for printed mail, and a modest OCR capability to read script."

To upgrade the OCR readability of mail, the Service established guidelines for mailers to follow in preparing their mail. The Service planned to improve these guidelines after actual operating data was available from deployed OCR/CSs. The Service also prepared pre- and post-equipment-deployment operating plans to guide Service personnel in increasing the volume of OCR readable mail.

However, Postal Service officials acknowledged that many of the procedures and guidelines that need to be developed to ensure a significant improvement in OCR readability had not been

fully identified. They pointed out that operating experience on the OCR equipment could not be obtained until the equipment was deployed. They said experience on deployed equipment is required to identify actual problem areas and corrective actions needed. They stated that programs responsive to these problems would be implemented as the need for such programs was identified.

In our view, the need for taking these steps had already been demonstrated. We recommended that to improve OCR readability of mail, the Postal Service:

--Implement a test program to develop adequate data for improving OCR readability guidelines.

--Develop clear and precise procedures and techniques to apply OCR readability guidelines to determine that mail is eligible for a reduced postage rate.

--Obtain data on mailer reactions to the Service's requests that they voluntarily improve the OCR readability of their mail, and determine whether additional management actions are needed to encourage cooperation.

The Service concurred with our recommendations and said it would:

--Develop a test program to improve the OCR readability of mail.

--On the basis of actual machine performance, develop criteria for use in qualifying mail for a proposed rate incentive.

--Develop a plan to train postal clerks in the application of OCR readability guidelines.

--Identify mailers' reactions to requests for voluntary changes that would improve the OCR readability of mail.

OCR READABILITY PROBLEMS ARE WIDESPREAD

Extensive effort will be required to improve the OCR readability of mail because readability problems are present to some degree in mail from many large- and small-volume mailers.

Evidence of the widespread nature of the problem is contained in the OCR/CS acceptance test scores. For example, during our observations of OCR/CS acceptance tests, five-digit meter belt mail (mail generally sent by small-volume business mailers) was consistently read successfully by the OCR/CSs at a rate of about 65 to 75 percent. Thus, unless the readability of mail is improved, about 25 to 35 percent of this segment of mail in any city will not be read by the OCR/CSs.

Further evidence of the widespread existence of OCR readability problems in mail pieces from large-volume mailers is found in our observations of OCR extended tests, in which five-digit meter mail from large-volume mailers was frequently being read at rates below the Service's cost study assumption of 80 percent for nine-digit mail. Mail from large-volume mailers is generally considered more OCR readable than mail from small mailers.

Service officials agreed that readability problems are present in mail from many mailers, but they said that meter belt mail often comes from small business mailers, and the read rates obtained in acceptance tests were reasonable for this type of mail before implementation of the readability improvement program. However, we believe the issue is that the OCR/CSs could not read significant percentages of this mail, rather than whether or not these rates were reasonable for this type of mail at this time.

Service officials also disagreed with our observations on how well the OCR/CSs read large-volume mail. They said this mail is commonly read well above 80 percent and often in excess of 90 percent. However, they did agree that many large-volume mailings are not read at these levels. The Service intends to bring all large-volume mail up to the quality needed for a 90 percent read rate, but has not done so.

COMPLETE AND BALANCED OCR READABILITY CRITERIA NEEDED

The Service may not realize the ZIP + 4 program's full savings potential unless it issues OCR readability criteria which:

--Are complete and timely (that is, available when ZIP + 4 is implemented).

--Adequately strike a balance between (1) technical criteria needed for a high read rate, and (2) reasonable demands on mailers to incur costs to conform to the technical requirements.

Initially during our review, the Postal Service did not expect to issue complete OCR readability criteria until at least September 1984. In addition, the Service planned to issue only simple criteria which would be easily understood and lenient enough to secure the use of the ZIP + 4 code by large-volume mailers.

Late issuance of adequately drawn criteria (that is, issuance after ZIP + 4 is implemented) might result in reduced Postal Service savings because of (1) delays in improvements in the OCR readability of mail and (2)--if a ZIP + 4 postage rate incentive is established--giving a discount for mail which is not correctly sorted by an OCR.

After we discussed our concerns with Service officials, they agreed to make every effort to issue complete and balanced criteria on a timely basis.

Complete OCR readability guidelines needed

At the time of our review, the anticipated date of completion of the OCR readability study was September 1984--almost 1 year after the Service's planned date for implementing ZIP + 4 and the proposed 0.5 cent postage rate incentive. The study includes an examination of the OCR readability capabilities of the OCR systems purchased from Pitney Bowes and Burroughs. The study is composed of:

--A first phase, in which OCR processing of live (actual) mail samples is tested to identify causes of mail rejections (such as inadequate line spacing and obscured addresses). A report on test results from this phase was due in December 1983.

--A second phase, in which tests will be conducted using a "test deck" of mail to (1) isolate each cause of mail rejection and (2) determine for each cause the specific numerical "score" at which the mail is rejected. For example, use of the test deck would isolate the effect of print reflectance, so that the Service could measure exactly how much difference in reflectance between the envelope and the address print is necessary to achieve accurate sorting. The report on this phase was due around June 1984.

--A third phase, in which tests of the live mail stream will be conducted to identify the frequency with which each cause of mail rejection occurs in the mail stream. The report on this phase was due around September 1984.

Service officials told us data from the completed study would be used to:

--Establish new OCR readability criteria which reflect design characteristics of both machines. All business mailers will be encouraged to comply with these criteria.

--Determine OCR readability criteria which a mailer must meet to qualify for the ZIP + 4 discount. These criteria will be one part of the overall OCR readability criteria.

Until the study's completion and its review by headquarters officials, the Service planned to make only 3 of the 16 current criteria mandatory for a mailer to receive the ZIP + 4 rate

incentive. Service officials considered these criteria easy to administer and believed they would result in the projected acceptance rates. They said mailers would be encouraged to meet the remaining 13 current criteria. However, they said that mail would not be rejected for the rate incentive if any of these 13 criteria were not met. (The 16 current criteria are included as appendix V.)

Service officials explained that they would not make any of the 13 recommended criteria mandatory until they have final study results showing that the criteria were necessary to obtain the level of OCR performance required for the Service to obtain the projected savings. They said they believed mailers would object to the Service's imposing unnecessary requirements which may later be removed or made less stringent.

We pointed out to the Service that its plans:

--Would not maximize possible savings because critical criteria required to ensure high read rates would not be in place on October 1, 1983, the planned date for ZIP + 4 implementation.

--Would make it very difficult to install a complete and probably tougher set of criteria after mailers have adjusted to a year of the minimum requirements.

After we discussed our concerns with Service officials, they re-evaluated the study data available to date and revised the OCR readability criteria. At the completion of our review, Service officials were also re-evaluating proposed eligibility criteria for the ZIP + 4 rate incentive program and said they would, if necessary, modify these criteria prior to October 1983 or as soon as practicable thereafter. They said every effort was being made to complete the live mail tests and the running of the test deck by October 1983, so that the criteria for the ZIP + 4 rate incentive could be as complete as possible.

Service officials said they expect to continually make revisions to the criteria after October 1, 1983, as they gain experience and knowledge of the OCR/CS' capabilities.

More balance needed in developing OCR readability criteria

During our review, some Service officials told us they wanted to avoid writing technically complex standards for the readability criteria and for criteria to qualify for the ZIP + 4 incentive. They explained that these criteria must be easily understood by mailers and by Service personnel who must determine whether mail qualifies for the incentive. They pointed out that only limited time is available to examine mail because the Service must maintain scheduled mail dispatch times.

Service officials also told us they do not want criteria which will require mailers to make unnecessarily costly changes. Their concern is that mailers will not use the ZIP + 4 code if it appears that costs will exceed benefits or that the eligibility requirements are unreasonable.

We believe the Service's position should be balanced by the following considerations:

--Although simplicity is desirable, the criteria must also be drawn so that the Service can be reasonably sure that if properly applied, they will result in the read rate needed to obtain the ROI expected.

--Mailers, especially large-volume mailers, will have personnel with the technical expertise to understand the criteria.

--Training and technical support can be provided to Service staff who deal with mailers and to staff who must determine whether mail qualifies for the rate incentive.

At the close of our review, we discussed these considerations with Service top-management officials. They said they will adopt whatever criteria are necessary to ensure achieving the projected acceptance rates, even if this makes it more difficult to achieve mailer compliance with the criteria.

MANAGEMENT OF THE OCR READABILITY AND ZIP + 4 RATE INCENTIVE PROGRAMS SHOULD BE MORE STRUCTURED AND COORDINATED

At the time of our field work, the Service had not made adequate preparations to implement the OCR readability improvement program and to determine whether mail qualifies for the proposed ZIP + 4 incentive. In June 1983, 8 months after the first OCR was delivered, the Service had not:

--Clarified organizational responsibilities and established management responsibilities for the OCR readability program and an attendant program to award a rate incentive.

--Established a program to provide large-volume business mailers the technical assistance they need to improve the OCR readability of their mail.

--Established policies and procedures for determining whether mail qualifies for the ZIP + 4 rate reduction.

Organizational and management responsibilities need to be clarified

At the time of our review, the Service had not completed writing guidance clarifying organizational responsibilities and establishing management responsibilities, at the various organizational levels, for the OCR readability and rate incentive programs. We believe that without such management guidance, the Service will not achieve timely and consistent implementation of these programs.

In May 1983 the Service undertook a complete re-evaluation of its OCR readability improvement program and the procedures it was considering for determining whether mail qualifies for a ZIP + 4 postage discount. On the basis of our observations, we advised Service officials--and they agreed--that they needed to:

--Clarify organizational responsibilities among the various units involved in the readability and rate incentive programs.

--Establish headquarters, regional, and district responsibilities for oversight, including oversight of staff training and budget support for the readability and rate incentive programs.

The Senior Assistant Postmaster General for Operations agreed with our observation that organizational responsibilities needed to be clarified. He established a committee which developed a plan for improving the OCR readability of mail and assigned responsibilities to specific organizational elements. Time constraints prevented our assessing the adequacy of the plan. At the close of our review, this plan had not been implemented. Service officials assured us that sufficient staff training and budget support would be provided to achieve program objectives.

Technical assistance to large-volume mailers is needed

Most of the Service's ZIP+ 4 savings will come from large-volume mailers' use of the nine-digit ZIP code on OCR readable mail. However, at the time of an our review, the Service did not have programs in place to provide large mailers with technical assistance in making their mail as OCR readable as possible. Specifically, we believe--and Service officials agreed--that the Service needs to provide training and technical support for the Service staff who advise mailers on how to improve the OCR readability of their mail.

The Service plans to use its sales force (that is, Customer Service Representatives) and associate office [1] postmasters to communicate with mailers about necessary improvements in the OCR readability of mail and to obtain their cooperation in making these changes. To carry out these responsibilities, the Customer Service Representatives (CSRs) have been provided with about 4 hours of familiarization on (1) pre- and post-deployment action plans for upgrading the OCR readability of First-Class Mail and (2) the existing OCR readability standards. Service officials acknowledge that this training is not sufficient to enable CSRs to fully understand why a mail piece is not OCR readable and to effectively communicate OCR readability problems to mailers. Associate office postmasters have not yet received any training.

At the time of our review, CSRs were using an assessment of address characteristics of a few letters provided by mail processing personnel to inform mailers of OCR readability problems. This method has limited value because it relies on too few examples and may not result in the identification of all OCR readability problems. A much better method was tested by the Service during our review.

As a demonstration, the Service had four large-volume mailers observe the processing of samples of their mail on an OCR. This test demonstrated

--to the mailers, the problems the OCR had in processing their mail and how these problems could be corrected; and

--to the Service, that mailers were receptive to this demonstration technique and that the technique promises to be effective in gaining their cooperation.

We believe the test also showed that specially trained personnel are required to examine many mail pieces which have readability problems whose causes are not readily identifiable and to explain such causes to mailers. During our earlier ZIP + 4 review, foreign postal officials with OCR experience told us that direct contact between engineering technicians analyzing readability problems and mailers whose problems they are analyzing provides the best means of communicating the nature of technical problems and changes needed to correct them. Organizing and staffing such technical support for CSRs, associate office postmasters, and mailers had not been fully addressed by the Service at the time of our review.

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[1] An associate office is a type of post office located within the area of responsibility of a large mail processing center. The associate office receives mail directly from the mail processing center and is responsible for mail collection and delivery within its own assigned geographical area.

Service officials said they were developing the training and tools the CSRs and associate office postmasters will need to explain routine, clear-cut readability problems to mailers. They added that 10 sophisticated diagnostic centers will be established to which CSRs and associate office postmasters can send 100 to 500 piece mail samples for analysis of nonroutine problems. The officials said they were developing training and operating plans for diagnostic center staffs.

After the close of our field work, the Service also endorsed the concept of organized demonstrations for large-volume mailers. Officials said that, for the time being, these demonstrations will be arranged at the discretion of local postmasters, but a more formal policy will be imposed if necessary.

Service officials agreed that in many cases trained technicians will be necessary to explain complex OCR readability problems to mailers. They said higher grade technicians at each site receiving OCR equipment have already received OCR readability training and will help CSRs and associate office postmasters explain readability problems to mailers when necessary.

Policies and procedures needed for accepting ZIP + 4 discount mail

Beginning October 1, 1983, the Service intends to give a postage rate reduction for nine-digit ZIP Code mail that is OCR readable. However, in July 1983, the Service did not have policies and procedures for:

--Acceptance units to follow when reviewing mail that is submitted as OCR readable and otherwise eligible for the rate reduction.[2]

--Training and equipping personnel who must check for compliance with OCR readability criteria.

--Using the OCRs to determine how well mail for which the discount was given was actually read.

As a result of this lack of policies and procedures, the Service could lose significant revenue through erroneous granting of the rate reduction, without receiving any benefits from automated processing in return.

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[2] As part of the Service's Revenue Protection Program, an acceptance unit (1) determines that mail is properly classified, (2) determines that mail meets Service preparation requirements, and (3) ensures that appropriate postage is paid.

Determining eligibility of mail for the ZIP + 4 discount--Determining whether mail meets Service requirements for the proposed reduction will require, among other things, policies and procedures governing (1) how mail will be selected for sampling, (2) how much mail will be sampled, (3) how the samples will be compared with the OCR readability criteria, and (4) how many defects (if any) will be allowed before a mailing is rejected. The acceptance units will need guidance on these matters in order to properly and consistently make eligibility determinations.

Training and equipment--Acceptance unit staffs will need to know enough about OCR readability to (1) apply the readability criteria and (2) inform CSRs, associate office postmasters, and mailers of reasons why mail was not OCR readable. In the past, acceptance units have not been required to apply requirements as complex as the criteria they will need to apply to ensure that mail is OCR readable.

Acceptance units will also need to use test equipment in applying readability criteria; for example, in measuring such address characteristics as print reflectance and height, width, and spacing of characters. At the time of our review, the Service had not identified equipment needs.

Using the OCR as a management tool--The OCR can be an excellent management tool to monitor the implementation of the ZIP + 4 rate incentive program. Data obtained from the OCR can be used to compare the read rates of mail receiving the ZIP + 4 discount to the read rate anticipated by the Service. This comparison would enable the Service to assess the performance of acceptance units and the adequacy of readability criteria. At the same time, the Service could provide feedback to acceptance units on mailers' performance, enabling the acceptance units to focus their activities on known problem mailers.

CONCLUSIONS

Adequate OCR readability criteria are essential to raising the performance of the OCRs from contract levels to the levels assumed by the Service in its ROI determinations. These criteria are needed so that the Service can identify for mailers the reasons for their mail not being read at the desired rate.

Adequate criteria are even more important, however, for determining whether mail qualifies for the ZIP + 4 postage rate reduction (should such a reduction be established). If the criteria are not properly drawn and enforced, the Service may lose revenue through erroneous granting of rate reductions, without receiving benefits of automated processing in return.

However, the Service may not have complete OCR readability criteria in place at the time it begins giving a ZIP + 4 rate reduction.

The readability criteria should be balanced. That is, while they should not cause mailers prohibitive expense, they should be rigorous enough that their application can be reasonably expected to result in the read rates assumed in the Service's ROI calculations.

We believe that if the Service does not issue complete and balanced criteria in a timely fashion·

--It will not maximize savings.

--Using interim criteria, it will have difficulty persuading mailers to use the nine-digit ZIP Code.

--It would find radically strengthening loosely drawn, interim guidelines very difficult.

The criticality of the OCR readability program and attendant rate incentive program to the full realization of the potential savings from the ZIP + 4 program also calls for strong top management support in the design and implementation of these programs. Top management must ensure that program objectives, policies, and procedures are thoroughly discussed and promulgated in written guidance. The guidance should be written to ensure that it is applied consistently throughout the Service. It should clearly spell out organizational responsibilities to prevent duplication of effort and should establish adequate headquarters, regional, and district responsibilities for program oversight, including oversight of staff training and budget support.

Because large-volume mailers are the major target of the ZIP + 4 program, the readability improvement plan should also provide for adequate technical assistance to these mailers. The Service should, using OCRs, demonstrate to these mailers how they can improve the readability of their mail. CSRs and associate office postmasters are the Service's key link with large mailers, and with small mailers as well. These staff members need additional training and readily available technical support to effectively communicate with mailers about OCR readability of mail.

Finally, the Service needs to:

--Develop policies and procedures for the acceptance of ZIP + 4 discount mail.

--Train and equip the Service staff responsible for determining whether ZIP + 4 mail is eligible for the discount.

--Use OCRs to monitor implementation of the ZIP + 4 rate incentive program.

RECOMMENDATIONS TO THE POSTMASTER GENERAL

To ensure that the Service has timely and adequate criteria to improve the OCR readability of mail, and to properly determine whether mail qualifies for the ZIP + 4 postage rate incentive (should such an incentive be established), the Postmaster General should expedite the collection of mail rejection data through the OCR readability study and make the issued criteria as complete as possible on the basis of that data.

We recommend further that to improve the OCR readability program and the attendant rate incentive program, the Postmaster General:

--Issue written guidance clarifying organizational responsibilities for these programs and establishing management responsibilities for program oversight, including oversight of budget support and training.

--Provide technical support to large-volume mailers by

(1) Establishing an orientation program to analyze mail from large-volume mailers and to demonstrate to these mailers the OCRs' capabilities and limitations.

(2) Providing training for CSRs and associate office postmasters to enable them to effectively communicate OCR readability problems to mailers.

(3) Making technical support available to CSRs and associate office postmasters.

--Develop policies and procedures for:

(1) Determining whether mail is eligible for the ZIP + 4 discount.

(2) Training and equipping acceptance unit staffs to check for compliance with OCR readability criteria.

(3) Using actual OCR readings to monitor implementation of the ZIP + 4 rate incentive program.

AGENCY COMMENTS

In commenting on our draft report, the Service said it will give continued management emphasis to programs to improve the optical character readability of mail and to administer the postage rate incentive proposed for large-volume mailers. The Service said improvements were underway along the lines we recommended. (See app. VI, p. 76.) We believe the improvements listed will, if fully and effectively implemented, accomplish the intent of our recommendations.

CHAPTER 4

POSTAL SERVICE'S MARKET STUDY ON POTENTIAL ZIP + 4 USAGE PROVIDES QUESTIONABLE RESULTS

In 1982, in preparation for filing with the Postal Rate Commission for a ZIP + 4 postage rate incentive, the Postal Service commissioned a market study to determine the proportion of First-Class Mail that would bear ZIP + 4 codes and otherwise qualify for a postage rate incentive, or discount, of 0.5 cent per letter, if such an incentive were available. The Service coupled the study's findings with certain assumptions and estimated that almost 12 billion pieces of First-Class Mail would qualify for the incentive in fiscal year 1984. After reviewing the market study and the Service's application of study findings, we are unable to endorse the 12-billion-piece estimate. Although the study found mailer interest in ZIP + 4 use, we cannot say, on the basis of the study data we reviewed, what the estimate should be.

HOW MARKET STUDY WAS CONDUCTED AND WHAT IT REPORTED

The Service's market research was designed primarily to determine proportions of First-Class Mail that would qualify for the proposed ZIP + 4 rate incentive in March of fiscal year 1984, the "test" year for the proposal submitted to the Postal Rate Commission. To meet the criteria, mail must be--among other things--(1) mailed in volumes of 500 or more pieces, (2) OCR machinable and readable, and (3) addressed with ZIP + 4 codes.

The Service used study data and the resulting 12-billion-piece estimate to demonstrate to the Postal Rate Commission, for the test year, the potential market for and use of the proposed rate incentive, and the resulting effects on postal revenues. The Service believes the market study indicates (1) a positive mailer reaction to a 0.5 cent postage reduction and (2) that the proposed reduction should generate sufficient ZIP + 4-coded mail to ensure that ZIP + 4 benefits to the Service exceed costs.

The market study was performed by R. H. Bruskin Associates, a contractor which was responsible for interviewing officials from a sample of firms and establishments located in certain Standard Metropolitan Statistical Areas (SMSAs)[1] and tabulating

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[1]An SMSA consists of a large population center--a city or urban area of at least 50,000 inhabitants--and adjacent communities that have a high degree of economic and social integration with the center. The Office of Management and Budget, Executive Office of the President, designates geographic areas as SMSAs.

the answers received. Major decisions concerning the market study--sample design and methodology, for example--were made by the Postal Service. With the aid of a standardized questionnaire, personal interviews were held with mail operations managers of 808 businesses and nonprofit organizations. Answers to the questions were statistically weighted and projected to all businesses and organizations in the sample universe of approximately 174,000 firms.[2]

According to the study report:

--About 60 percent of the First-Class Mail from the sample universe was mailed in volumes of 500 or more pieces and, of that mail, approximately 95 percent would be OCR machinable and readable by 1984.

--Of the machinable and readable mail mailed in batches of 500 or more pieces, about 50 percent would be addressed with ZIP + 4 codes by March 1984 if a postage discount of 0.5 cent per piece were provided. The percentage would be about 17 percent if no discount were given.

The study was not intended to arrive at a mail volume estimate for the proposed ZIP + 4 rate incentive; it was only intended to determine percentages of First-Class Mail from the sample universe that would be converted to ZIP + 4 and otherwise meet the criteria for the incentive. Using certain data and assumptions, the Service estimated that firms nationwide with more than 10 employees would send about 40 billion pieces of First-Class Mail in fiscal year 1984. The Service then applied the study-produced percentages to the 40-billion-piece estimate and concluded that nearly 12 billion pieces would qualify for the ZIP + 4 rate incentive in 1984.

Service officials considered the 12-billion-piece estimate conservative because, for example, it did not include mail from some businesses which would "pool" their mail to qualify for the incentive. The officials emphasized that more than 12 billion pieces would be addressed with ZIP + 4 codes but that not all would qualify for the rate incentive.

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[2]The sample universe consisted of firms, in selected business categories, which were located in the 50 most populous SMSAs and employed 10 or more persons. The business categories were: mailing oriented (that is, mailing services, publishers, and mail order firms), financial, utilities, department store headquarters, manufacturing headquarters and subsidiary headquarters, wholesaler headquarters, nonprofit headquarters, and business services.

MARKET STUDY RESULTS AND POSTAL SERVICE PROJECTIONS ARE QUESTIONABLE

We have several causes for concern regarding study methodology and Service projections, but two are paramount--the low response rate from firms contacted for an interview and the inclusion in the study universe of only the largest SMSAs. Because of these study characteristics, we are unable to determine whether study results are representative of businesses and organizations in the Nation or even in the 50 SMSAs the market study covered.

We essentially limited our work to reviewing the statistical methodology of the market study and, in doing our work, compared the methodology with commonly accepted statistical practices and procedures. We also held discussions with Postal Service and Bruskin Associates personnel and reviewed information they supplied in response to questions from us and from participants in the ZIP + 4 rate incentive proceedings.

Response rate too low to assure valid conclusions

Only about 48 percent of the firms contacted provided an interview. A response rate this low provides, in our opinion,[3] little assurance that any estimates based on the 808 completed interviews are valid, either for the 50 SMSAs or the Nation.

What percentage constitutes an acceptable response rate is judgemental and must be gauged on a case-by-case basis. However, when the nonresponse rate is high, as we believe it is for the ZIP + 4 market study, the uncertainty is also high as to how the results would be affected had answers been received from all or most of those sampled. This high degree of uncertainty is the reason for our questioning the projection of study findings beyond the 808 firms interviewed. However, as discussed on pages 34 to 36, the Service believes evidence from secondary sources supports the projections.

Study universe not representative of the Nation

We believe market study results were not representative of the Nation because not all SMSAs had a chance to be selected for the study. As noted above, the study covered businesses located in 50 SMSAs (the study universe), and the Service projected study results to the whole Nation. We believe it was reason-

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[3]Our opinion is based on experience gained in reviewing other Government studies, examination of literature on the subject of statistical sampling and response rates, and a test of possible effects of a 52 percent nonresponse rate on the Service's 12-billion-piece ZIP + 4 estimate.

able to limit the study to firms located in SMSAs inasmuch as almost 75 percent of the Nation's population reside in SMSAs and 74 percent of the business establishments are located there. However, by Service design, only the largest 50 of the more than 300 SMSAs were made part of the study universe. All other SMSAs were excluded and, as a result, firms located in these SMSAs were not represented in the study.

According to the Service, the study was limited to businesses in the 50 largest SMSAs because of practical considerations. From this universe of 50 SMSAs, 25 were selected in which to actually contact businesses for interviews. We believe the 25 SMSAs should have been selected from all SMSAs rather than from only the 50 largest SMSAs. This would have assured that the sample of firms was representative of firms (with 10 or more employees) in all SMSAs.

We estimate that about 62 percent of all First-Class letters and cards mailed in fiscal year 1982 originated in the 50 largest SMSAs. Although this percentage may be overstated because the ZIP Code areas associated with the respective SMSAs often extend beyond SMSA boundaries, it does suggest that the 50 largest SMSAs contribute heavily to First-Class Mail volume.

It does not, however, make the 50 SMSAs representative of all SMSAs because, as pointed out above, not every SMSA had a chance to be selected for the study. The exclusion of most SMSAs assumes even greater significance when coupled with the low response rate from firms contacted for an interview. That is, not only were most SMSAs excluded from the study but, as stated earlier, in those that were included only about half of the firms contacted participated.

POSTAL SERVICE CITES OTHER EVIDENCE TO SUPPORT STUDY RESULTS

The Postal Service maintains that study results do represent the mailing practices and ZIP + 4 positions of the Nation's larger businesses and organizations. To support this position, the Service cites evidence from secondary sources, compares this evidence with certain study results, and, from these comparisons, concludes that all study results are valid and applicable nationwide. The evidence the Service cites follows.

--The study report says that in a typical month, about 60 percent of the First-Class Mail generated by large businesses is sent in batches of 500 or more pieces. Using data from other sources, the Service estimated that about 54 percent of the First-Class Mail generated by large businesses nationwide in fiscal year 1982 was mailed in volumes of 500 or more pieces.

--On the basis of certain results of the market study, the Service estimated that 6 percent of all businesses nationwide "currently" send some First-Class Mail in batches of 500 or more pieces. (To compute this percentage, the Service adjusted market study data to compensate for businesses with 10 or less employees.) The "Nonhousehold Mailstream Study," an authoritative study conducted by researchers from the University of Michigan, estimated that 8 percent of all businesses had, at some time, sent mail in batches of 500 or more pieces.[4]

--About 32 percent of the First-Class Mail volume in the market study was presorted.[5] The Service adjusted the study's volume figure to account for businesses with 10 or less employees and computed a presort percentage of about 26 percent. The Service then calculated a presort percentage based on data from its Revenue, Pieces and Weight system--which provides the Service's "official" data on mail volumes--and the Nonhousehold Mailstream Study. Using this method, the Service estimated that presorted mail pieces comprised about 25 percent of the First-Class Mail sent by all businesses nationwide during the 12-month period ending June 1982.

--Officials who were interviewed for the market study judged that on average, better than 90 percent of the First-Class letters and cards their firms sent in batches of 500 or more pieces were OCR readable. Service officials pointed out that such a readability rate is consistent with the 90 percent OCR readability rate the Service expects to obtain on large-volume mailings. (OCR readability of mail was discussed in chapter 3.)

We did not examine the above comparisons in depth to verify their accuracy. This secondary evidence would seem--without in-depth examination--to support the cited study results, and the study results may, in fact, be accurate. However, because of the methodology deficiencies we discussed above, we cannot endorse the study results as being accurate and having nationwide applicability. The cited similarities between the two sets of data are not sufficient evidence that the Service's bottom line--that 12 billion pieces of First-Class Mail will be

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[4]Kallick, M.; Converse, M.; et al: Nonhousehold Mailstream Study, Final Report, Prepared for Mail Classification Research Division, U.S. Postal Service. The final report is dated July 1980. The Service used Table 5.27 to provide the 8-percent figure.

[5]Presort means the mailer has grouped pieces in a mailing by ZIP Code or other separation recommended by the Postal Service in order to bypass certain postal operations. Mail that meets presort criteria qualifies for postage discounts.

eligible for the proposed ZIP + 4 rate incentive in 1984--is accurate.

CONCLUSIONS

On the basis of our examination of the statistical methodology used for the ZIP + 4 market study, we cannot conclude with any confidence that the study results--and the Service's mail volume projections which were based on the study results--are representative of the Nation's larger (10 or more employees) firms. We cannot say whether the Service's estimate that 12 billion pieces of First-Class Mail would qualify for a ZIP + 4 incentive in fiscal year 1984 is too high, too low, or on target.

The study shows an interest among some of the mailers interviewed in addressing their mail with ZIP + 4 codes if a 0.5 cent per piece postage rate incentive is provided. We have no doubt that other mailers across the country who were not interviewed would also add ZIP + 4 codes to their addresses if a 0.5-cent incentive were provided. However, at this point it is not clear how many pieces of First-Class Mail would be ZIP + 4 coded and would otherwise qualify for the proposed rate incentive by the end of fiscal year 1984.

AGENCY COMMENTS AND OUR EVALUATION

In commenting on our draft report, the Service maintained that the ZIP + 4 market study is valid. Regarding the interview response rate, the Service said that when the interview sample was drawn, the research contractor selected more than double the number of businesses required for projection purposes. (The Service wanted approximately 800 interviews, and a sample list of over 1600 businesses and organizations was drawn.) The Service said that this doubling was done because the contractor anticipated that many businesses would not respond to an interview request. (See p. 76.)

The Service said that nothing in the way businesses were selected and solicited for interviews would have prejudiced them for or against ZIP + 4. It said, further, that comparisons between study data and data available from external sources indicate that businesses which were interviewed have representative characteristics. (See p. 76.)

We disagree with the Service's contention that, because the "required" number of interviews was obtained, the 48 percent response rate does not detract from the validity of the study's results. Although the number of interviews the Service wanted was obtained, the low response rate casts a serious doubt on the representativeness of these interviews. The fact that the

sample was doubled to compensate for an expected 50-percent response rate does not remove the doubt.

In effect, businesses which agreed to provide an interview were substituted for businesses that could not be interviewed, and the substitution continued until the 800-interview objective was reached for the study. The firms which could not be interviewed were "in business" but generally refused to be interviewed or were not interviewed because of an appointment problem.[6] No data was collected as to the reasons for the refusals and appointment problems, but the statements interviewers were instructed to make when requesting interviews would not, in our opinion, prejudice businesses contacted for or against ZIP + 4. However, because so many businesses could not be interviewed and were replaced with substitutes, we believe there is little assurance--Service-claimed similarity of data from nonstudy sources notwithstanding--that nonrespondents would have answered the ZIP + 4 study questions in the same manner as the substitute respondents.

The Service said that the ZIP + 4 market study was limited to the top 50 metropolitan areas because trade-offs were necessary between sample size and geographic coverage in order to conduct personal interviews. The Service said that when making the trade-offs, it believed that mailer characteristics, such as mail volume and mailing size, which would be learned from the study would be more important than where the mailer was located. (See p. 77.)

We understand the practical needs for trade-offs. Earlier (see pp. 33 to 34), we said limiting the study to SMSAs was reasonable and offered a method by which the Service could have obtained a representative SMSA sample without increasing the number of SMSAs in which interviews were conducted.

The sample for the study was drawn from among firms with 10 or more employees in selected business categories. (See p. 32.) Aside from these criteria, the sample was based on location and not mailer characteristics. Because the sample was based essentially on location, the Service does not know whether businesses located outside the 50 largest SMSAs share the same mailing characteristics and ZIP + 4 attitudes as those located within these 50 SMSAs.

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[6]Appointment problems occurred because the person who could speak for the business contacted either (1) was not reached during the appointment scheduling period, (2) did not return a call to schedule an appointment, or (3) did not keep the scheduled appointment and another had not been set before the interview period ended. About 37 percent of the nonrespondents were in the appointment-problem category. About 59 percent of the nonrespondents refused to be interviewed.

CHAPTER 5

TEST SUGGESTS RESIDENTIAL ADDRESS DATA IN ZIP + 4 DIRECTORY IS REASONABLY ACCURATE

The Postal Service, at our request, compared the residential addresses of approximately 700,000 postal employees nationwide with the National ZIP + 4 Directory. The comparison, although not conclusive, suggested that the national directory contained substantially all of the Nation's residential mailing addresses and that residential data in the directory was reasonably correct. Nonetheless, directory improvements are still attainable, and the Service is working to accomplish these improvements.

NATIONAL ZIP + 4 DIRECTORY: CONSTRUCTION AND MAINTENANCE

As part of the ZIP + 4 program, the Postal Service divided the Nation into small geographic units--for example, a side of a street, a commercial or apartment building, ranges of apartment units, and post office boxes--and assigned a four-digit code to each unit. Generally, these four digits were added to the existing five-digit ZIP Code. The need to pinpoint small geographic areas, together with the sheer size and dynamics of the Nation, resulted in a national directory of over 32 million ZIP + 4 codes, more than 800 times the number of five-digit codes.

After developing the National ZIP + 4 Directory, the Service established over 190 Address Information Systems units which have--among other tasks--the difficult task of keeping the directory updated and accurate.

The Postal Service wants a National ZIP + 4 Directory that is at least 99-percent accurate. Such accuracy, according to the Service, can be achieved only if each of the following conditions exists:

--Every address with a five-digit ZIP Code has been assigned a ZIP + 4 code.

--Names of streets and buildings are correctly spelled.

--Street designators (for example, Avenue, Court, Place, Street) and directional indicators (for example, North, NE) are correctly entered.

--Listed address ranges (for example, 2900 to 2999 for a street and apartments 1 to 10 for an apartment building) reflect the actual ranges found within a ZIP + 4 segment.

The above criteria, we believe, can be separated into two distinct categories. One category is completeness of the directory itself; that is, whether all mailing addresses are in the directory. The other is correctness of the elements of each address contained in the directory; that is, whether the address is correctly spelled and includes, for example, the correct street designator, directional indicator, and range of house numbers. We made this distinction between categories of criteria in our review of the directory.

SERVICE-REPORTED COMPARISON RESULTS PORTRAY ZIP + 4 DIRECTORY AS VERY COMPLETE AND CORRECT

The Postal Service compared about 700,000 employee addresses with the ZIP + 4 directory. The Service-reported results portray the directory as very complete and correct with regard to coverage of the employee addresses.

Purposes of comparison

In our January 1983 report, we concluded that on the basis of limited tests by us and three firms, the National ZIP + 4 Directory appeared to be reasonably complete. To test the directory's completeness further, we asked the Postal Service to compare its employees' addresses with the directory and, for each address that did not match exactly, determine why an exact match failed to occur. The primary purpose of the latter step was to dispel uncertainty as to which was in error--the employee address, or the directory. Another purpose was to provide an indication of the correctness of address elements contained in the directory. The Postal Service's employee address list was suitable for the comparison not only because of its ready availability but also because it represented a wide geographic dispersion of addresses throughout the Nation.

Steps the Service followed to make comparison

The Service performed several steps to compare employee addresses with ZIP + 4 address records.[1] First, using a computer, it attempted to match employee addresses with ZIP + 4 address records. Next, employee addresses that failed to match exactly were sent to Address Information Systems units to determine why.

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[1]In preparation for the comparison, the Service attempted to "clean up" the employee address list. The computerized list was compared with the five-digit ZIP Code directory, and where addresses did not match, some attempt was made to review them for accuracy and conformance to Postal Service addressing standards. The ZIP + 4 directory was not used in this effort.

The computerized comparison produced essentially three levels of results exact matches, nonexact (that is, not-quite-exact) matches, and nonmatches. Nonexact matches occurred after the computer "adjusted" the information being compared. For example, an employee address may have said "Main Street" while the ZIP + 4 directory said "Main Avenue," although both had the same five-digit ZIP Code. The computer "dropped" the designators "Street" and "Avenue" and then compared all remaining address elements. Or, the employee address said only "Main" and the computer dropped "Avenue" from the directory to make the comparison.[2]

Even though Postal Service officials believed the computer probably assigned the appropriate ZIP + 4 code to addresses in the nonexact match category, we asked that Address Information Systems units review such addresses together with addresses in the nonmatch category. In instances of nonexact matches, the likelihood was good that the address in the employee file and the address recorded in the ZIP + 4 directory both referred to the same location. However, because there was some degree of difference between the two ("Avenue" versus "Street," for example), we wanted to know which was correct--the ZIP + 4 directory, or the employee address file. With this knowledge we could gauge how complete and correct the National ZIP + 4 Directory was.

Address Information Systems units determined, for each nonexact match and nonmatch address received, which of the following categories best explained why an exact match had not occurred:

--Employee address error.
--ZIP + 4 directory error.
--Computer software (instruction) error.
--Other (none of the above or the reason was ambiguous).

Comparison results

The Postal Service reported that the ZIP + 4 directory was in error for only 1.6 percent of the nearly 700,000 employee addresses compared with the directory. The errors, which the

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[2]The computer attempted to achieve a nonexact match for each employee address that failed to match the ZIP + 4 directory exactly. Nonexact matches involved the dropping of directionals as well as street designators and the phoneticizing of street names. However, no concessions were made to facilitate the matching of house numbers and ZIP Codes; they had to match exactly. The technique of adjusting selected address elements is a tool commonly used by the mailing industry to match computerized address files.

Service said were corrected, included missing addresses, incorrect spellings, wrong street designators, and incorrect or improperly placed directionals. Service-reported data showed, for exact and nonexact matches combined, a match rate of about 85 percent, which the Service believed was in line with mailing industry experience with "average" address lists. The following table, which we developed from Service-reported data, provides the comparison results.

Overall Comparison Results

Match level	Number of employee addresses	Error category: "ZIP + 4 directory"	Error category: "Employee," "Software," and "Other"
Exact	446,542	-0-	-0-
(Percentage)	(65.1%)		
Nonexact	133,666	7,079	126,587
(Percentage)	(19.5%)	(1.0%)	(18.4%)
Nonmatch	105,348	4,028	101,320
(Percentage)	(15.4%)	(0.6%)	(14.8%)
Total	a/685,556	11,107	227,907
(Percentage)	(100.0%)	(1.6%)	(33.2%)

a/This total excludes 25,550 employee addresses which the computer was unable to compare with the directory primarily because the addresses lacked sufficient information. Also excluded are 166 addresses that did not match the directory exactly but for which no information was provided explaining why.

OUR LIMITED VERIFICATION SUGGESTS COMPLETENESS AND CORRECTNESS MAY BE NEAR CITED LEVEL BUT IMPROVEMENT STILL ATTAINABLE

We verified the Service-reported results by:

--Selecting a sample from the approximately 700,000 employee addresses, manually comparing the addresses to the National ZIP + 4 Directory, and comparing our percentage of exact matches with the percentage the Service reported.

--Visiting several Address Information Systems units and checking a sample of nonexact matches and nonmatches to determine whether the units had identified and reported

all instances in which the ZIP + 4 directory was in error.

The percentage of exact matches we achieved compared favorably with the Service's figure. Results from our visits suggested a directory error rate somewhat greater than the Service's 1.6 percent; nevertheless, address coverage appeared to be very good.

Service-reported level of exact matches valid

To verify the percentage of exact matches the Service reported, we used a random sample of 386 employee addresses from the same list the Service used to make the comparison. (On the basis of our sample size, we would consider the Service-reported percentage to be valid if it fell within 4.8 percent above or below our exact-match percentage.) We compared the sampled addresses with the ZIP + 4 directory, and about 61 percent matched exactly. This percentage supports the 65 percent exact-match rate that Service-reported data produced (see table, p. 41).[3]

Address Information Systems units visited were, overall, reasonably accurate in identifying directory errors

At each of the six Address Information Systems units we visited (see p. 5), we took a random sample of 100 addresses (50 in Fort Worth) from the nonexact matches and nonmatches the unit had received and, using various information sources (for example, letter carrier route listings and commercial maps), determined whether the ZIP + 4 directory was in error.

Overall, we found the Address Information Systems units visited had been reasonably--but not totally--accurate in identifying instances in which ZIP + 4 directory errors caused nonexact matches or nonmatches. The directory errors we identified were mainly wrong street designators (for example, "Avenue" rather than "Street"), directionals not in the proper address location (for example, "E. Main Street" rather than "Main Street E."), and incorrect spelling.

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[3]The exact-match rate of 65 percent excludes certain addresses, as shown in the table on page 41. However, we could not exclude these addresses from our sample universe, and in our verification work we achieved an exact-match rate of 61 percent. If these addresses had been used in the calculations shown in the table, the exact-match rate resulting from those calculations would have been 63 percent.

Our verification results suggest that the directory error rate the Service reported --1.6 percent--is understated. Furthermore, Postal Service Headquarters instructed Address Information Systems units to select either the ZIP + 4 or the employee error category when both the employee address and the directory were in error. Although not the case among addresses we sampled, we believe that nationwide some units may have selected the employee error category in such situations.[4] Because our verification was limited, we are unable to determine the actual directory error rate from a national perspective.

However, we developed a ZIP + 4 directory error rate--relative to employee addresses--for the six Address Information Systems units visited. The overall rate was about 4 percent. The estimated error rates for the individual units varied. The six rates ranged from roughly 3 percent to 13 percent; most were around 3 percent.[5]

Essentially all employee addresses were in the directory

According to Service-reported data, only a small percentage of the nearly 700,000 employee addresses was missing from the ZIP + 4 directory. That is, missing addresses accounted for only a portion of the 1.6 percent directory error rate reported by the Service. Further, missing addresses were not the major cause of the additional ZIP + 4 directory errors we identified in the six locations visited. Perhaps many or most of the ZIP + 4 directory errors we and the Service identified would not prohibit a mailer from obtaining the appropriate ZIP + 4 code. However, all the errors stand between the Service and its goal of producing a ZIP + 4 directory that is at least 99-percent accurate.

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[4]One unit we visited, however, used the "Other" category (see p. 40) when both the employee address and the ZIP + 4 directory were in error. We do not know how many addresses nationwide were placed in the "Other" category in like situations. If every address in the "Other" category were counted as a ZIP + 4 directory error, the directory error rate would increase from 1.6 percent to about 2.5 percent.

[5]The percentages are based on all employee addresses--exact matches, nonexact matches and nonmatches--associated with each Address Information Systems unit visited and the number of addresses the unit reported in the directory error category plus the number we found and projected.

FURTHER STANDARDIZATION OF DIRECTORY WOULD MAKE IT EASIER TO USE

We identified two ways in which the computerized directory could be standardized to aid mailers, and the Service has initiated corrective actions.

Our verification work disclosed that the way some addresses were "written" in the directory could cause mailers difficulty when performing a computerized ZIP + 4 address-list match. That is, inconsistencies in how addresses were written increased the possibility that when a mailer compared addresses to the directory, nonmatches would occur unless the mailer broadened his computer instructions to cover all the directory variations. Resolving a large number of nonmatches or writing computer instructions to cover all directory inconsistencies would effectively increase mailers' comparison costs.

To illustrate the types of inconsistencies we noted Words or abbreviations generally used as directional indicators (such as "N." in "N. Texas Avenue") were sometimes also used as an integral part of a street name (such as "North" in "North Carolina Avenue"). Also, parts of street names were sometimes spelled out and sometimes abbreviated. For example, "Saint" was spelled out and abbreviated. Such variations occurred within ZIP Code areas as well as from city to city.

For computer matching purposes, the computerized directory would be improved if "Saint," for example, were listed only one way and if all words suggesting direction were retained in the directory but separate from the remainder of the street name--in others words, if there were greater standardization. This would permit mailers to know more exactly how the directory is constructed and to make more matches at less cost. We brought the matter of directory inconsistencies to the attention of Service officials. They had already begun to take corrective action on directional indicators in street names and agreed to take corrective action on the inconsistency in use of abbreviations. The Service had also initiated or was planning other actions to achieve greater standardization within the ZIP + 4 directory.

CONCLUSIONS

The comparison of Postal Service employee addresses to the National ZIP + 4 Directory did not--and was not intended to--provide conclusive evidence of the directory's overall completeness and correctness. However, comparison results do provide an indication of completeness and correctness with regard to residential mailing addresses. The results suggest that

--The directory is substantially complete; that is, it contains most residential mailing addresses.

--The directory is reasonably correct; that is, most of the residential address data it contains is correct. However, the directory's level of correctness lags behind its level of completeness, and improvements are still attainable.

Our conclusions are based on a nationwide average of comparison results and our work in the six Address Information Systems units. Because comparison results differ by individual locality, conclusions drawn by locality may differ as well.

Because even a small percentage of missing addresses or other errors in the ZIP + 4 directory represents such a large number of addresses, the Service should continue its efforts to improve the accuracy of the directory.

In addition to improving the directory by increasing its accuracy, the Service could improve it by making it easier for mailers to use. When the Service developed the directory, its aim was to reflect the Nation's addresses as they appeared on street signs and as stipulated by local government bodies. However, because of the different addressing practices among localities, the directory contains inconsistent address data. Increased standardization of the directory through changes such as those suggested above would reduce these inconsistencies and thereby aid mailers. The Service had begun or was planning actions to further standardize the directory.

AGENCY COMMENTS

The Service made no comment on our findings and conclusions except to say that it was making a number of changes that will make the ZIP + 4 directory even more accurate than the current level of accuracy suggested by our report. (See p. 77.)

APPENDIX I

House of Representatives
Committee on Post Office
and Civil Service
Washington, D.C. 20515

October 1, 1981

The Honorable Milton J. Socolar
Acting Comptroller General
General Accounting Office
441 G Street, N.W.
Washington, D.C. 20548

Dear Mr. Socolar:

Public Law 97-35 prohibits the U.S. Postal Service from final implementation of its proposed ZIP + 4 program before October 1, 1983. This legislation was passed in part because of the concerns of some Members that the added cost to the Postal Service and the business mailers by the additional four digits may not be offset by the estimated cost savings and proposed rate discount.

The Congress wanted to be assured that the optical charater readers and the bar code readers will work as claimed by the Postal Service and that the savings assumed in the use of the additional four digits to the present ZIP Code are correct. In addition, we are interested in the accuracy of the Postal Service's return on investment calculations and the value of the whole proposed system.

The Conference Report on this legislation requested the General Accounting Office to study these issues in order to help Congress resolve these questions. The study should not only focus on the accuracy and reliability of equipment used in the nine digit system, but on all other aspects of the system, including possible benefits to the mailers and consumers.

APPENDIX I

Your findings and suggested improvements, if any, are requested by December 1, 1982.

With best wishes.

Sincerely,

Hon. William D. Ford, M.C.

Hon. William V. Roth, Jr., U.S.S.

Hon. Edward J. Derwinski, M.C.

Hon. Thomas F. Eagleton, U.S.S.

Hon. William L. Clay, M.C.

Hon. Ted Stevens, U.S.S.

Hon. Mickey Leland, M.C.

Hon. Charles McC. Mathias, Jr., U.S.S.

Hon. David Pryor, U.S.S.

CHRONOLOGY OF EVENTS IN EVOLUTION OF ZIP CODES

The following are significant events in the evolution of ZIP Codes

--1963: Five-digit ZIP Code was implemented.

--1976 Deputy Postmaster General's Task Force on Future Mail Processing Systems recommended automation of mail processing and expansion of ZIP Code to nine digits.

--1978: Postal Service announced the intention to expand ZIP Code to nine digits in 1981.

--1980: Postal Service began "coding the Nation"; that is, dividing the Nation into nine-digit ZIP Code locations or areas.

--1980 (Nov.): Postal Service presented a proposal for automation (supported by an economic justification) to its Board of Governors. Proposal was approved in December 1980.

--1981 (Apr.): Postal Service filed with the Postal Rate Commission a proposal for (1) two new subclasses of First-Class Mail for volume mail bearing the ZIP + 4 code and (2) a 0.5-cent-per-piece rate incentive for volume ZIP + 4 mail. (The Service later withdrew the proposal, following congressional action prohibiting ZIP + 4 implementation before October 1, 1983, stating it would refile later.)

--1981 (June): Postal Service awarded contracts totalling $182 million for purchase of 252 optical character reader/channel sorters (OCR/CSs).

This was the first equipment purchase in Phase I of the two-phase ZIP + 4 automation plan. Delivery was scheduled to begin in the fall of 1982.

--1981 (Aug.): Postal Service notified 15 million businesses and post office box holders of their nine-digit ZIP Codes and urged them to begin using the new codes

at their convenience. Omnibus Budget Reconciliation Act of 1981 (P.L. 97-35), enacted August 13, prohibited implementation of ZIP + 4 before October 1, 1983, but permitted the Postal Service to proceed with actions necessary to prepare for implementation.

--1981 (Dec.): Postal Service awarded an approximate $22 million contract for purchase of 144 bar code sorters (BCSs). This was the first of two purchases of this equipment in Phase I of the automation plan. Delivery was scheduled to begin in the fall of 1982.

--1982 (Aug.): Postal Service completed awarding of four contracts for testing OCR/CSs for Phase II of the automation program. Tests were to be conducted during the spring and summer of 1983.

--1982 (Sept.): Postal Service awarded an approximate $12 million contract for 104 bar code sorters. This was the second of two planned purchases of this equipment in Phase I of the automation plan.

--1982 (Oct.): Acceptance of initial OCR equipment in Phase I purchase delayed by testing and contractor delivery problems.

--1982 (Oct.): Contractor began delivery of bar code sorters under the first contract awarded in December 1981.

--1982 (Oct.): First bar code sorter was accepted by the Service.

--1982 (Dec.): Postal Service refiled a request with the Postal Rate Commission for (1) two new subclasses of First-Class Mail for volume mail bearing the ZIP + 4 code and (2) a 0.5-cent-per-piece rate incentive for volume ZIP + 4 mail.

--1983 (Jan.): First Pitney Bowes OCR/CS was accepted by the Service at an operational post office.

--1983 (Feb.): First Burroughs OCR/CS was accepted by the Service at an operational post office.

--1983: (June) Postal Service began OCR/CS equipment tests in preparation for awarding contracts for Phase II of the automation program.

--1983: (July) As of July 15, 1983, the Service had accepted:

--14 Burroughs OCR/CSs.
--51 Pitney Bowes OCR/CSs.
--139 Bell & Howell bar code sorters.

HOW AUTOMATION AND ZIP + 4 WOULD CHANGE MAIL PROCESSING

The current mail processing system requires an individual to visually observe the ZIP Code or address on a mail piece at each mail processing step. Under the proposed system, properly prepared ZIP + 4 mail will not be read by a postal employee until it reaches a carrier. An optical character reader/channel sorter (OCR/CS) will "read" the ZIP Code and print on the mail piece a bar code representing the five- or nine-digit ZIP Code. Bar code sorters (BCSs) will subsequently read the bar code and sort 5-digit mail to the destinating post office and 9-digit mail directly to the carrier. Stamped or handwritten mail with a 9-digit ZIP Code will not be initially read by an OCR/CS or BCS. However, in the future if 60 to 80 percent of the mail pieces have an expanded ZIP Code, the mail pieces will be more efficiently sorted to the carrier by a clerk operating an Expanded ZIP Retrofit (EZR) letter sorting machine.[1]

If the Service were prohibited from expanding the ZIP Code it could still utilize the OCR and BCS equipment but could sort the mail only down to the destinating office. Sorting to carrier routes would continue to be done either manually or on a letter sorting machine by a clerk recalling the carrier route servicing a specific address.

THE ZIP CODE DISTRIBUTION SYSTEM

The five-digit ZIP Code is an integral part of the current mail processing system. The five-digit ZIP Code was implemented in 1963 and is now used on over 97 percent of all mail. Use of the code is mandatory on all presort and bulk mail (about half of all mail) but is voluntary on all other mail pieces.

The current five-digit code identifies specific geographical areas as illustrated on the next page.

The nine-digit code

The Postal Service has assigned about 34.9 million nine-digit codes.[2] The first five digits of the expanded code will usually be identical to the present ZIP Code and will continue to designate areas served by a post office. The first two

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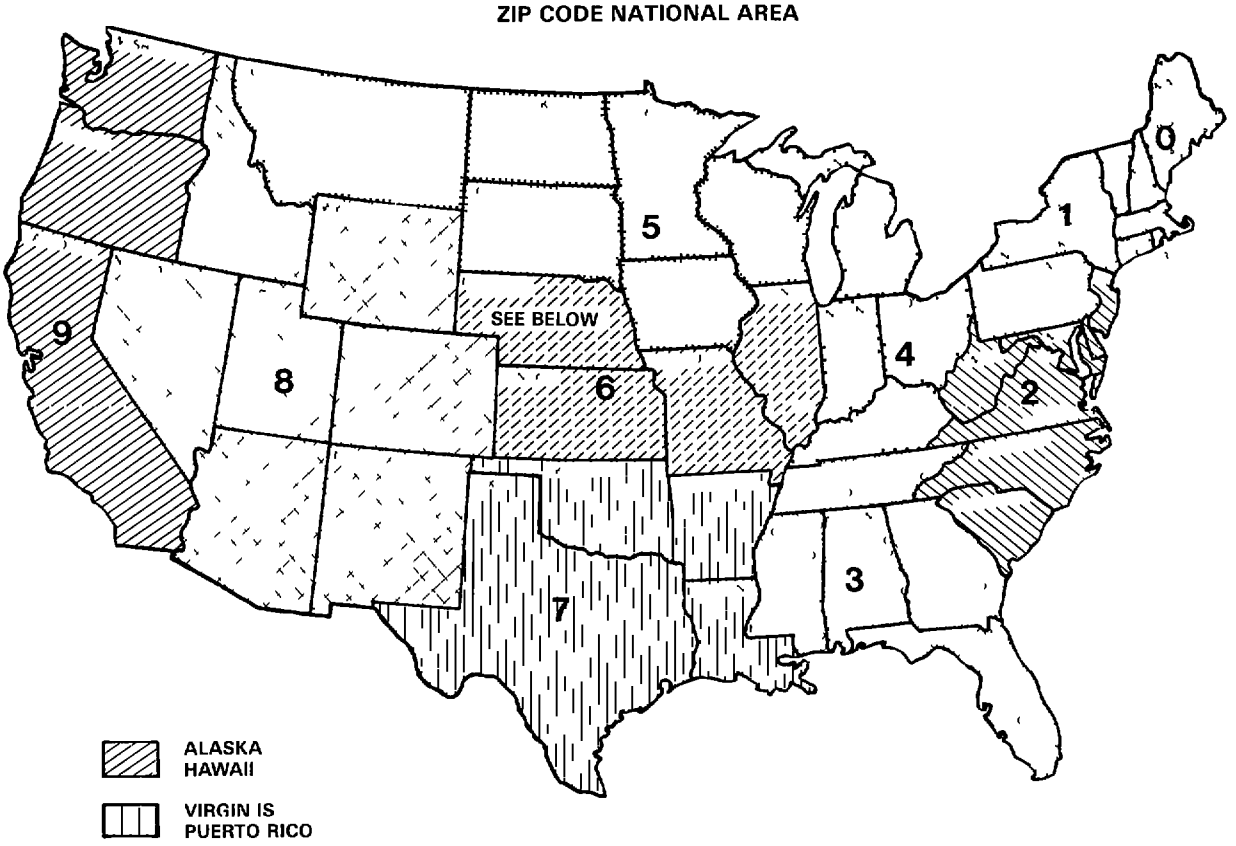
[1]For definition of EZR letter sorting machine, see glossary.

[2]The Service's ZIP + 4 directory contains approximately 21.5 million records, or lines, of address information. Some records, however, such as those identifying post office box numbers, contain more than one ZIP + 4 code.

APPENDIX III

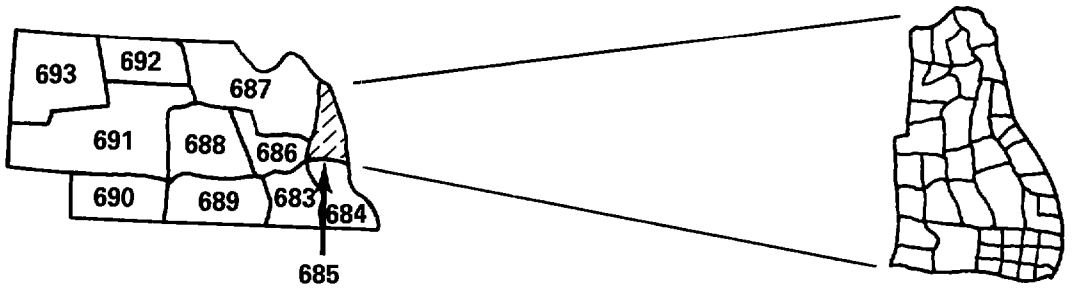
ZIP CODE NATIONAL AREA



The first digit of a ZIP Code divides the country into 10 large groups of States numbered from 0 in the Northeast to 9 in the Far West

Sectional Center Facilities or Large Post Offices

Smaller Post Offices or Geographical Areas Within Post Offices



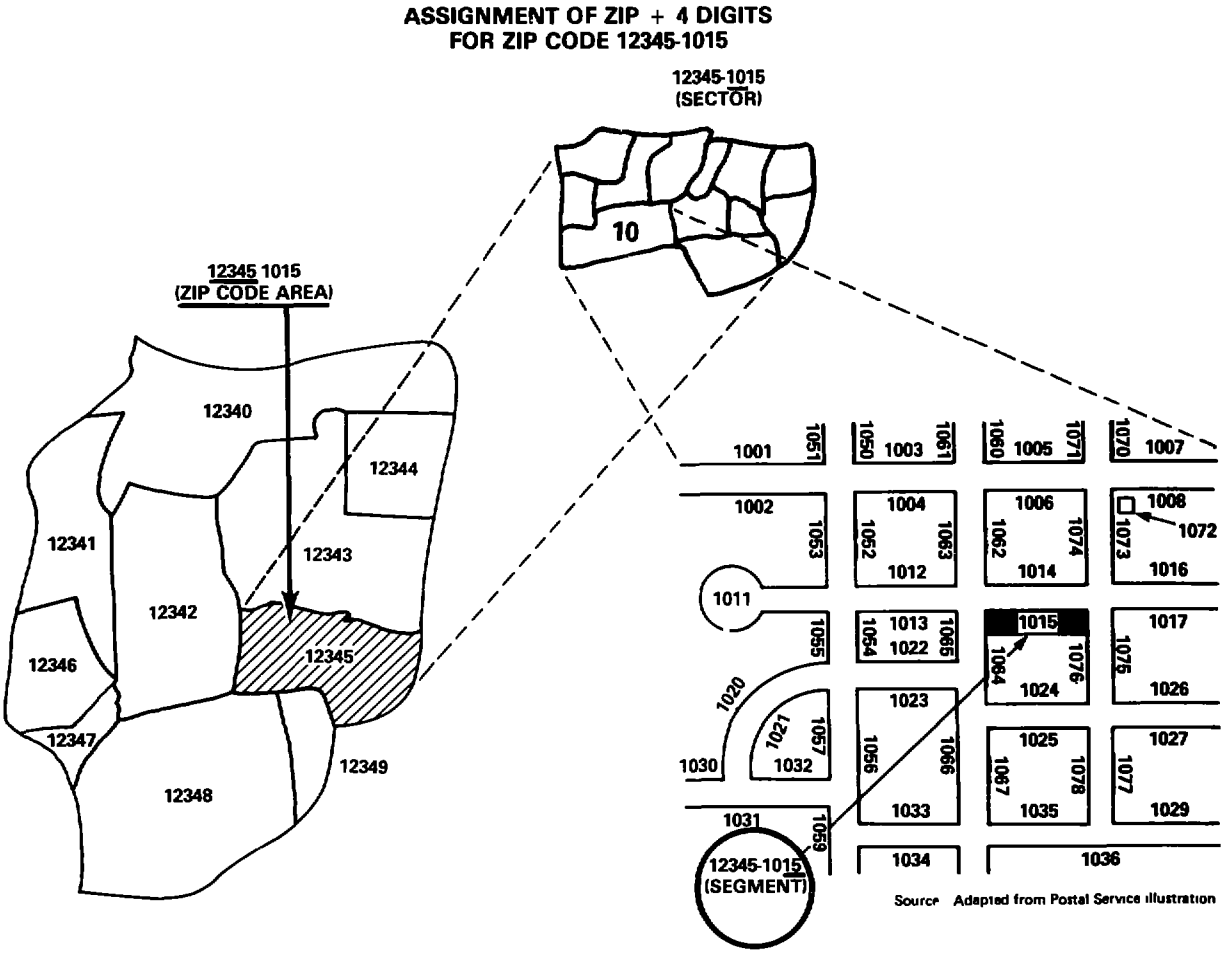
Each State is divided into an average of 10 smaller geographical areas, identified by the 2nd and 3rd digits of the ZIP Code The two digits can represent a large city, a post office or a geographical area

The 4th and 5th digits identify a delivery area or location It can represent a small town a post office within the corporate limits of a large city, or a geographical area

Source Adapted from Postal Service illustration

digits of the add-on code (digits 6 and 7) designate a small geographical area called a sector. The last two digits (digits 8 and 9) designate a segment within a sector. A hyphen will be used to separate the five-digit code from the add-on numbers.

The following diagrams illustrate how sector and segment numbers are assigned.



Sectors

Sector boundaries do not cross state or county lines, and the numbers are generally assigned as follows:

00-09 to postal boxes and box sections.

10-97 to streets, firms, and rural routes.

98-99 to business reply and special codes.

Sectors in commercial areas are much smaller than they are in residential areas and can be completely contained within a single building or within a single city block.

Segments

A segment--the last two digits of the add-on code--can be one side of a street between intersections; both sides of a street, including cul-de-sacs; a company or building; a floor or group of floors within a building; a cluster of mailboxes; sections of post office boxes; or any other designated delivery point.

CURRENT MAIL PROCESSING SYSTEM

The current mail processing system requires letters to be handled at a number of facilities prior to delivery. These facilities can be referred to as originating offices, transit offices, and destinating offices. The originating office is the office where the mail receives its first handling or is accepted. A transit office (for example, an area distribution center) is an office which performs an intermediate handling before the mail reaches the destinating office. The destinating office is the office where the mail receives its final handling prior to delivery.

Letter mail

Most of the First-Class letter mail processed by the current system is either stamped or metered mail.

Stamped mail is usually sent by individuals and dropped in collection boxes or picked up from the mailers by carriers. The stamp must be cancelled and the mail piece must be faced (oriented in the same direction with all pieces right side up so that all addresses are located in the same general area) for manual or machine sorting. The addresses on these pieces are frequently handwritten.

Businesses normally "meter" their mail, which can be dropped in collection boxes, delivered to post offices in trays, or picked up by a postal employee at the mailer's facility. Metered mail usually has typed addresses, and the pieces are faced in trays the same way. Because these pieces have meter strips rather than stamps, they do not need to be cancelled.

Metered mail, depending on volume and other characteristics, can be presorted by mailers down to the three-digit location (for example, the transit office), the five-digit location (for example, the destinating office), and--when a two-digit carrier route number appears on the envelope--to the carrier route. Mailers receive a 3-cents-per-piece discount for sorting First-Class mail to the three- and five-digit locations and a 4-cent discount for sorting First-Class mail to the carrier route. The Service has requested from the Postal Rate Commission a 0.5-cent incentive for all properly prepared ZIP + 4

mail. This incentive would also be given to mailers sorting to three- and five-digit ZIP Codes but would not be given to mailers sorting to the carrier route.

How letter mail is currently processed

Under the current mail processing system, stamped First Class Mail is initially processed by a model M-36 or Mark II Facer-Canceler. The equipment cancels the stamp and faces the mail piece in the proper direction. First-Class meter mail does not require cancellation but must be faced prior to sorting. Presorted mail bypasses facer-canceler operations.

Non-presorted stamped and metered mail is sorted in a primary operation at the originating office. Machinable mail[3] is sorted on a multiple position letter sorting machine (MPLSM) --a machine with 12 input operator consoles (see photograph, p. 56). Using a portion of the ZIP Code, an MPLSM operator keys a mail piece to one of 277 bins. Nonmachinable mail is handsorted to manual letter cases. (See photograph on p. 56.)

Mail for destinations outside the immediate area is generally dispatched to a transit facility where it is again distributed on MPLSMs or manual cases. At the destinating office, mail is distributed in an "incoming secondary" operation to carriers, boxes, or firms. This final sortation is made through the use of scheme[4] knowledge by an MPLSM operator who reads the street address and number, recalls the carrier route number associated with the specific address, and keys into the MPLSM a code representing the carrier route number. MPLSM operators must continually relearn portions of carrier route schemes because of changes resulting from annual route inspections, new delivery points, and fluctuations in mail volume.

To illustrate the complexity of carrier route schemes, a small portion of the Palatine, Illinois, carrier route scheme for ZIP Code 60067 is shown on page 57. This scheme has a total of 793 items (128 shown) which the operator must memorize. Many schemes require operators to memorize as many as 1,000 items.

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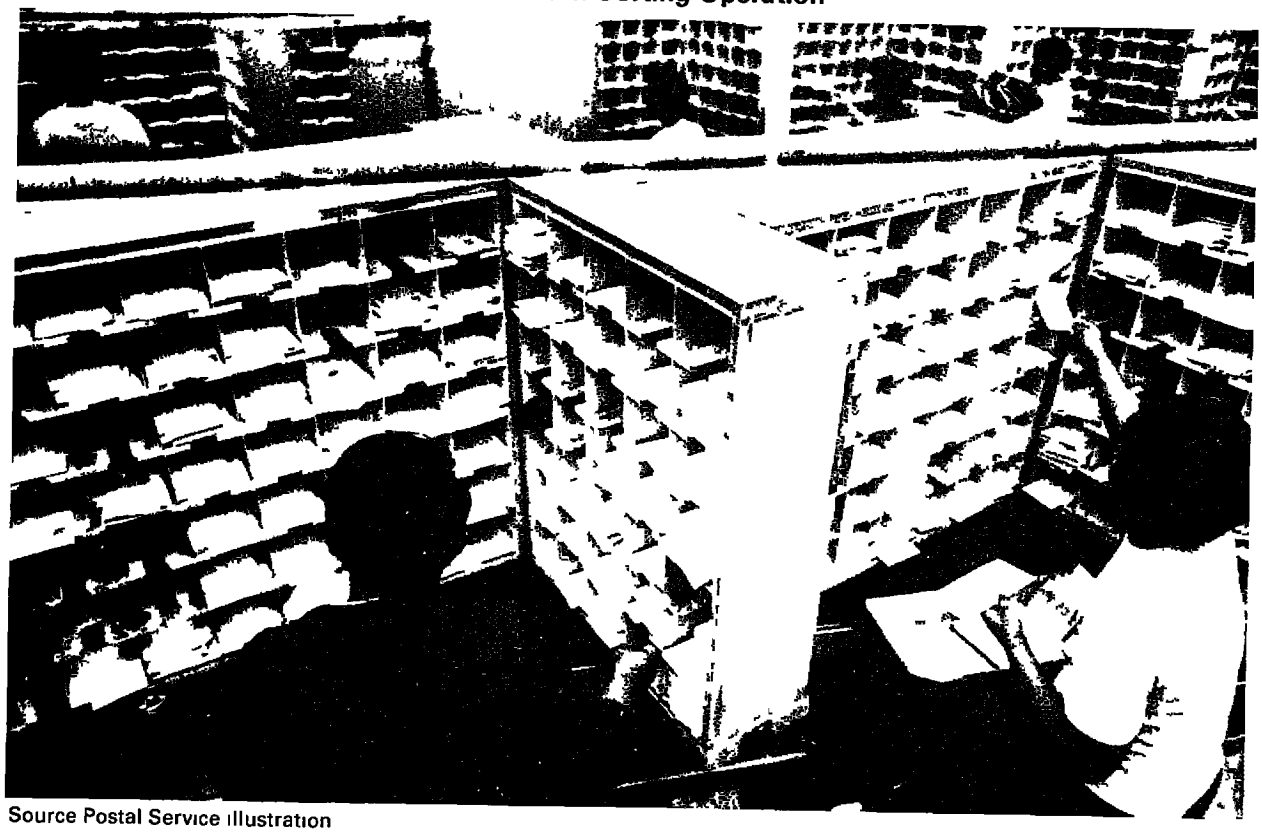
[3]Machinable mail is letter mail which conforms to the length, width, thickness, and weight requirements enabling it to be processed on the Postal Service's letter sorting machines.

[4]A scheme is an officially published list of elements of address. It is used as a systematic plan to guide mail to its destination.

APPENDIX III

Source Postal Service illustration

MPLSM Sorting Operation



Source Postal Service illustration

Manual Sorting Operation

APPENDIX III

PORTION OF A CARRIER ROUTE SCHEME

STREET	ROUTE
Abbeywood Ct.	44
Aberdeen Rd.	6
Aldridge Ave.	11
Alison Dr.	39
Almond Ct.	12
Alva St.	33
Amherst	27
Anderson Dr.	
800-999	29
1000-1299	28
1300-1499	19
1500-1599	14
Appleby Rd.	15
Ardmore St.	15
Apple Tree Ln.	36
Arlene Ave.	34
Arlingdale	48
Arlington Rd.	15
Arlington Fgts. Rd.	RR1
Arrowood Dr.	24
Ash St.	10
Ashland Ave. N.	
1-199	2
800-899	22
1200-1399	27
Ashland Ave. S.	1
Aster Ln.	27
Austin Ln.	20
Ayreshire Ln.	6
Azalea Ln.	44

B

Babcock Dr.	
1-325	16
326-999	21
Baldwin Ct. (1500's)	16
Baldwin Ln. (1600's odd)	12
Baldwin Rd. E.	
100-799	47
800-999	16
Baldwin Rd. N.	
1200's ev	46
Baldwin Rd. W.	
1-199	48
200-799	9
800-1199	
(ex 1200's even)	33
1200-1299 even	38
1400-1599	6
Baldwin Way (2200's)	44
Balmoral Ln.	45
Balsam Ln.	40
Banbury Rd.	6
Bannockburn.	45
Barberry	44
Barrington Woods Rd.	9
Baybrook	34
Bayer Dr.	9
Bayside Dr.	41
Beaver Pond Rd	15
Bedford Dr.	20
Bellaire Ter.	29
Belle Ave.	34
Bennett St.	5
Benton St. N.	
1-119	18
120-599	4
600-799	22
Benton St. S.	
1-599	3
600-1699	23
Berwick	45
Big Oak Rd.	9
Bishop St.	32
Bissell Dr.	
160-327	16
328-out	21
Blackburn Dr.	6
Bon Aire Ter.	29
Bonnie Ln.	6
Borders Dr.	20
Bothwell St. N.	
1-54	13
55-399	8
Bothwell St. S.	26
Boynton	16
Bradley	12
Bradwell Rd.	15
Braeburn Rd.	6
Brandon Ct.	48
Brentwood	9
Briarwood Ln.	7
Brice Ln.	43
Brighton Ln. & Ct.	20
Bristol Ct.	20
Brockway St. N.	
1-99	13
100-499	8
500-599	48
Brockway St. S.	
1-299	26
600-1399	11
1600-2300	23
Brookdale Ln.	7
Brookside Ln.	10
Brookview Ln	23
Brown Rd.	RR1
Bryant St.	
1-99	48
100-out	11
Burno Dr.	5
Butterfield	45

C

Cady Dr.	16
California St.	23
Cambridge Ct.	44
Campbell Cir.	15
Candlenut Ln.	44
Canterbury Ln. & Trl.	43
Capri Dr.	
(ex 812-868 even)	27
812-868 even	12
Carlton Ave.	11
Carmel Dr.	24
Carol Ct.	41
Carpenter Dr.	
200-499	36
500-799	24
800-1129	25
1130-1399	37
Carriage Ln.	12
Carriageway Ln.	48
Carter St. (ex 500)	48
500	8
Cascade Ln.	43
Castle Ct.	12
Castlewood	45
Cedar St. N.	13
Cedar St. S.	
1-500 (ex 17 & 326)	17
17	26
326	11
501-699	5
700-out	11
Cedarwood Ct.	31
Center Rd.	9
Charlotte St.	8
Chatham Dr.	20

Source: Postal Service illustration

Under the ZIP + 4 system, MPLSM clerks would not need to memorize schemes such as this. Proponents of ZIP + 4 point to this as a primary advantage of ZIP + 4, stressing that it would result in fewer sorting errors.

Presort mailings require less processing than that described above. For example, mail presorted to five-digit ZIP Codes by the mailer bypasses primary and transit distribution that non-presorted mail receives. At the destinating office, however, three- or five-digit presorted mail receives the same incoming secondary distribution that non-presorted mail receives.

In summary, the present mail processing system requires an individual to read the ZIP Code or address on each piece of mail and manually sort the mail or key a code into a letter sorting machine. The current system requires these procedures to be repeated each time the mail piece is sorted on its way to the carrier route. Mail received by a carrier is in random order and must be sorted by the carrier into delivery sequence.

PROPOSED MAIL PROCESSING SYSTEM

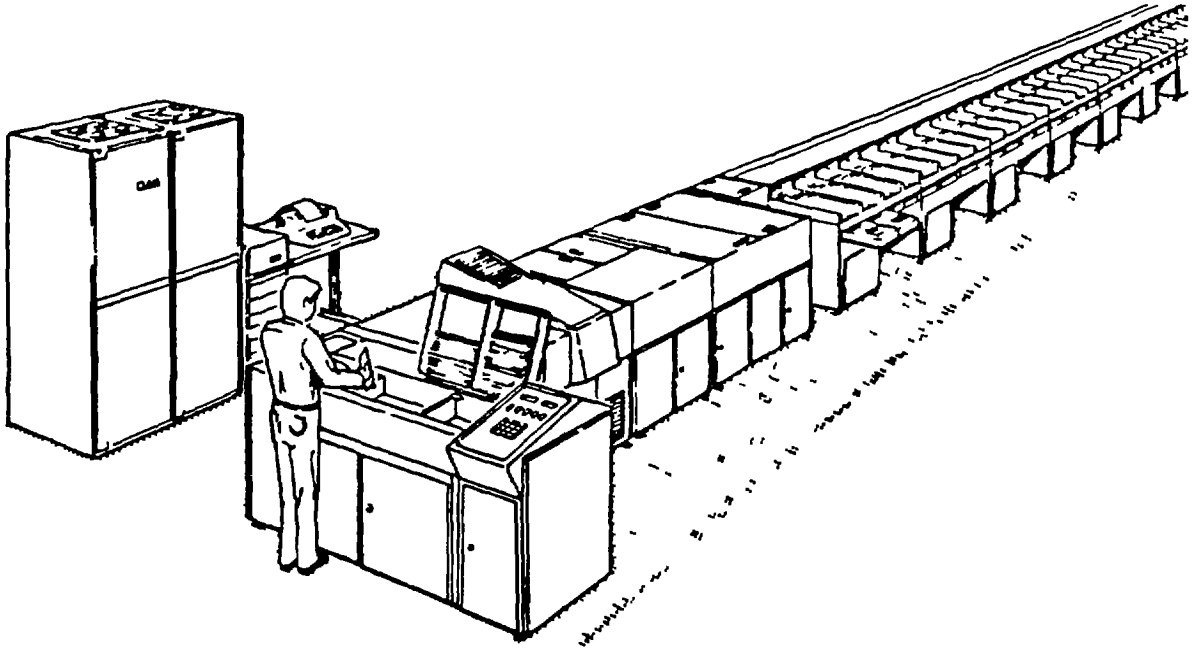
Under the proposed system, properly prepared nine-digit OCR readable mail will not be read by a postal employee until it reaches a carrier. An OCR/CS will read the five- or nine-digit code and print on the mail piece a bar code representing the ZIP Code. BCSs will thereafter be used to read the bar code and sort five-digit mail to the destinating office and nine-digit mail directly to the carrier.

Under Phase I of the automation plan, the Postal Service purchased 126 OCR/CSs manufactured by Pitney Bowes, Inc., under a licensing agreement with Elettronica San Giorgio (ELSAG) of Genoa, Italy, and 126 OCR/CSs manufactured by Burroughs Corporation under a licensing agreement with the Nippon Electric Company (NEC) of Tokyo, Japan. (See diagrams of equipment on p. 59.) In addition, the Service purchased 248 BCSs from Bell and Howell.

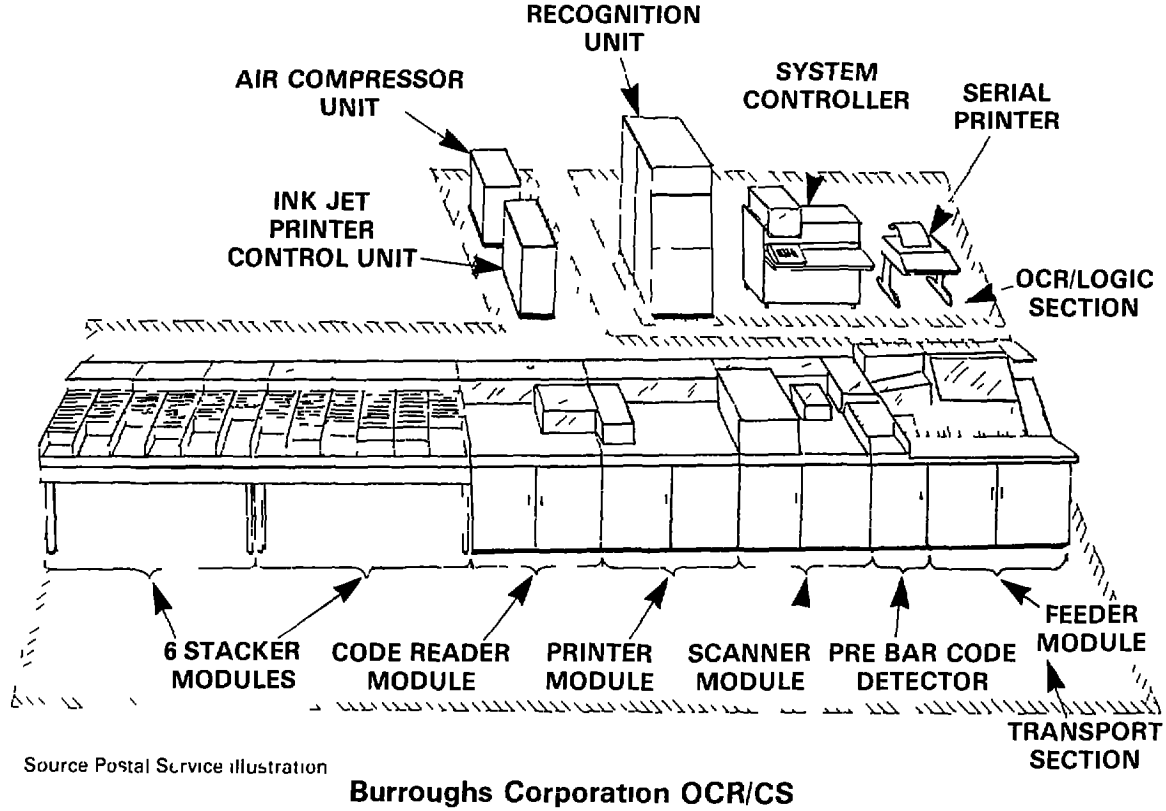
How letter mail will be processed under the ZIP + 4 system

Under the proposed mail processing system, all non-presorted metered mail received at the originating office will be processed on an OCR/CS. As designed, the OCR will read the ZIP Code on each metered piece of typed, foundry printed, or computer generated mail; verify that the first five digits of

APPENDIX III



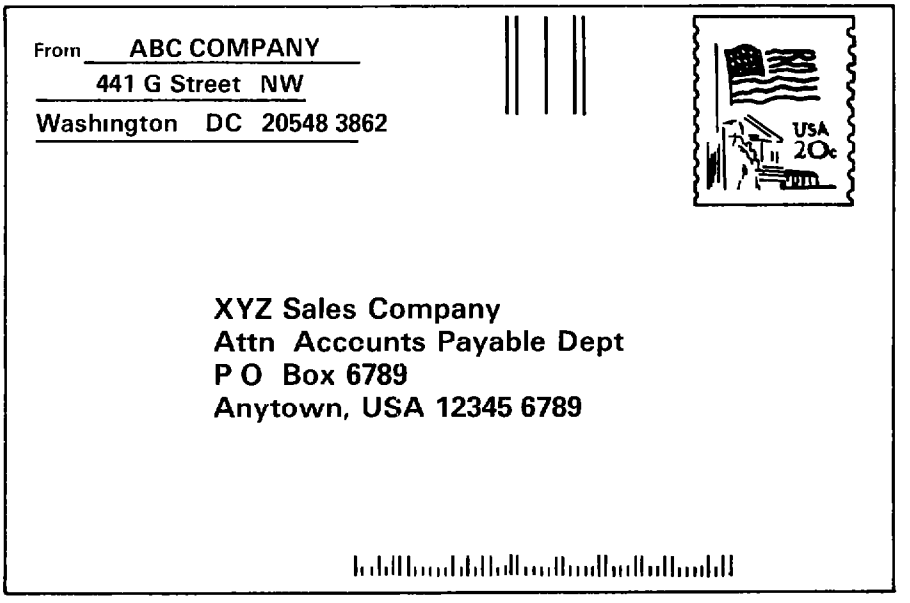
Pitney Bowes OCR/CS



Source Postal Service illustration

Burroughs Corporation OCR/CS

the code correspond to the city and state address; and print on the lower edge of the letter a bar code representing the ZIP Code. (See illustration below.)



Source: Adapted from Postal Service Illustration

The OCR/CS will sort the mail (into 32, 44, or 60 separations) for dispatch to destinating offices or to the local sorting operation for sorting to carriers. On the basis of the Postal Service's equipment test results, the Service estimated that 60 to 80 percent of all meter mail would be successfully read and initially sorted by the OCR/CS. Mail pieces rejected by the OCR/CS will be sent to an MPLSM and will be handled in the same manner in which mail is handled by the current system. This will include pieces that are unreadable and pieces with unverifiable ZIP Codes.

Presorted mail (presorted to three and five digits) received at an originating, transit, or destinating office must be processed through an OCR/CS to obtain a bar code for sorting to the carrier route.

All nine-digit stamped mail and all mail rejected from the automated system will be processed with an MPLSM in a manner very similar to current processing procedures. Once about 60 to 80 percent of the mail pieces has a ZIP + 4 code, MPLSM operators will no longer have to memorize schemes for sorting to the carrier route. Instead, as a result of an EZR assembly attached to the MPLSM, operators will sort the mail by keying the last four numbers of the nine-digit ZIP Code.

All nonmachinable mail will continue to be processed with today's manual system.

Comparison of productivity rates of current and proposed systems

Productivity rates of OCR/CSs and MPLSMs cannot be compared because OCR/CSs both read and sort mail, while MPLSMs can only sort mail. However, the following table shows examples of the Postal Service's current and expected productivity per work-hour under the current and proposed systems, as indicated in the Service's proposal.

Work-hour Productivity of Current and Proposed Systems

Current operations	Productivity in pieces per hour
MPLSM (outgoing primary sort)	1,600 to 1,850
MPLSM (incoming secondary sort)	1,300 to 1,450
Manual (incoming secondary sort)	700 to 1,000
Proposed operations	**Productivity in pieces per hour**
OCR/CS (all operations)	10,000
BCS (all operations)	4,000
EZR (incoming secondary sort)	1,300 to 1,450

HOW AUTOMATION WOULD BE USED WITH A FIVE-DIGIT ZIP CODE ONLY

The Postal Service is prohibited by the Congress from implementing a nine-digit ZIP Code before October 1, 1983. However, the Service may take steps necessary to prepare for the implementation of the expanded code and may process five-digit mail on automated equipment.

Mail with the five-digit code can be sorted down to destinating offices using the OCR/CSs and the BCSs. However, the sort to the carrier route must be made manually or on an MPLSM by operators with scheme knowledge.

APPENDIX IV

REPORT DIGEST

ZIP + 4 REPORT ISSUED JANUARY 6, 1983

COMPTROLLER GENERAL'S REPORT TO THE CONGRESS

CONVERSION TO AUTOMATED MAIL PROCESSING SHOULD CONTINUE, NINE-DIGIT ZIP CODE SHOULD BE ADOPTED IF CONDITIONS ARE MET

D I G E S T

Congress put a hold on the Postal Service's implementation of the proposed nine-digit ZIP Code program ("ZIP + 4") and asked GAO to review its soundness In particular, GAO was tasked with reviewing the

--accuracy of the Postal Service's financial projections,

--likelihood that the new automated equipment intended for use with the program--especially optical character readers and bar code sorters--would perform as intended, and

--potential impact of ZIP + 4 on mailers

OVERALL CONCLUSIONS

After a wide-ranging and in-depth examination of these and a number of related issues, GAO is unable to give an unqualified "yes" or "no" answer to the central question of whether the Postal Service should move forward with ZIP + 4 There are some risks involved that cannot be adequately assessed at this time

GAO does, however, endorse the acquisition of the new equipment and its use to automate the processing of five-digit ZIP Code mail, provided that the Postal Service demonstrates that the equipment will perform adequately Sufficient results of acceptance tests to determine actual equipment performance are expected to be available by April 1983

GAO recognizes that even if the equipment performs adequately (that is, meets contract specifications), there will still be risks associated with its use in processing five-digit mail However, given the Postal Service's labor intensive operations and the opportunity that automation offers to reduce labor costs through greater productivity, GAO considers these risks acceptable

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Because the cost effectiveness of ZIP + 4 would hinge heavily on voluntary participation by business mailers--and such participation is not certain--GAO can give only a qualified endorsement to the Postal Service's move to the nine-digit ZIP Code

however, GAO believes that the potential incremental gain to the Postal Service in moving from automated use of the five-digit code to automated use of the nine-digit code is so great in comparison with the incremental cost that if certain conditions are met, the move to ZIP + 4 would be more than justified, as shown in the following table

Incremental projects	Incremental costs	Incremental benefits		
		Gross	Net	ROI a/
	- - -	(millions)	- - -	(%)
5-digit	$1,988	$3,404	$1,416	16.3
9-digit				
If rate incentive remains fixed	873	6,128	b/3,466	36.4
If rate incentive is escalated for inflation	873	6,128	c/1,718	23 5

a/Return on investment (The ROI method of analysis is discussed on pp. 21 and 24.)

b/Benefits of about $5.26 billion less about $1.79 billion returned to qualified mailers through a fixed rate incentive of one-half cent per piece

c/Benefits of about $5.26 billion less about $3.54 billion returned to qualified mailers through an escalated rate incentive

The Service should proceed with the nine-digit code if and when--in addition to having demonstrated that the equipment will perform satisfactorily (that is, at contract specifications)--it has (1) an established postage rate incentive and (2) reasonable assurance that the established incentive will result in ZIP + 4 usage sufficient to ensure that the system's benefits exceed its costs

A usage level sufficient to meet the above test cannot be determined until the amount of the rate incentive--if any--is established by the Service's Board of Governors This is expected to occur before October 1983.

Householders' use of the nine-digit ZIP Code would help the Postal Service reduce mail processing costs but would not be critical to the cost effectiveness of the ZIP + 4 program (See pp 121 to 126)

HIGHLIGHTS OF PLANNED AUTOMATION AND ZIP + 4

The planned automation, if used with the current five-digit ZIP Code only, would reduce mail processing costs involved in intermediate mail processing, and is thereby expected to contribute to postage rate stability (that is, smaller or less frequent rate increases) (See pp. 1 and 47.)

Used with the nine-digit code, the new equipment could further reduce mail processing costs substantially, primarily by providing automated mail sorting down to carrier routes --with fewer errors than now occur with manual and machine sorting. (See pp 42 and 46.)

The Postal Service does not claim that automation and ZIP + 4 would result in faster mail delivery The number of letters sorted to the wrong destination would be reduced, enabling such letters to be delivered on time. But, in general, delivery time for ZIP + 4 mail and five-digit ZIP Code mail are not expected to differ (See pp. 127 to 129.)

As currently designed, ZIP + 4 would be targeted to First-Class letter-size mail and primarily to business mailers, whose voluntary use of ZIP + 4 would be essential to its cost effectiveness. (See p. 2 and pp. 44 to 47.)

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To secure such use, the Postal Service will seek permission from its Board of Governors to lower the First-Class Mail rate by one-half cent per piece for mailers who mail, at one time, 500 or more pieces of First-Class Mail suitable for processing on the automated equipment. It is reasonable to assume that mailers will add ZIP + 4 codes to address files if savings in postage from repeated use of the lower rate exceed the cost of file conversion and maintenance.

The Omnibus Budget Reconciliation Act of 1981 (P.L. 97-35), enacted in August 1981, prohibited implementation of ZIP + 4 before October 1, 1983, but permitted the Postal Service to proceed with preparations. These preparations include the purchase of automated mail processing equipment, primarily optical character readers and bar code sorters

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In assessing the potential performance and reliability of automated equipment, GAO was aided by a team of engineers of the National Bureau of Standards, Department of Commerce

EQUIPMENT RISKS AND UNCERTAINTIES REQUIRE ATTENTION

There are risks and uncertainties associated with the advanced optical character reading equipment that the Postal Service is acquiring to process five- and nine-digit mail For example

--Performance assumptions which the Service used in its economic analysis to justify the automation program were based to a significant extent on assumed future improvements in machine readability of addresses through mailer cooperation in upgrading addressing of mail pieces At the time of GAO's review, it was too early to assess programs the Postal Service was planning toward achieving these improvements. (See pp. 56 to 61.)

--Testing and evaluation procedures are not adequate to measure the performance of automated equipment or determine the need for design changes. Because foreign licensors of the U.S firms manufacturing equipment

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for the Postal Service have demonstrated competence in optical character reading technology (see p. 55), GAO believes that any equipment that fails to perform up to expectations after acceptance because of inadequate pre-acceptance testing can probably be made to eventually function well in U.S. postal operations However, corrective measures could entail additional cost and the need for operational adjustments. (See pp. 61 to 73.)

--The Postal Service may have initial problems in maintaining its new automated equipment. However, strong management actions can limit the extent and duration of these problems Service officials were aware of most of the potential problems GAO identified and had recently taken steps, or planned to take steps, to minimize them. (See pp. 73 to 79)

THE AUTOMATED SYSTEM-- ANALYZED AS THREE SEPARABLE PROJECTS

GAO analyzed the proposed automated system on an incremental basis, considering separately and in turn the following three projects, or options (1) improvements to existing letter processing equipment, (2) an automated system using the five-digit ZIP Code; and (3) an automated system, with expansion of the ZIP Code from five to nine digits

GAO's analysis of costs and benefits on an incremental basis for each option shows that

--When considering both investment and operating expenses, improving the existing equipment would reduce costs by about $105 million--that is, from $718 to $613 million--over the Service's 16 year project evaluation period, and would produce a return on investment (ROI) of about 48 percent. (See pp. 36 and 38.)

--Acquiring and operating the new optical character reading and other equipment and using it with the five-digit ZIP Code would yield a total positive net cash flow of $1.4 billion for the 16 year evaluation period at an additional cost of $2.0 billion, and would provide an ROI of about 16 percent (See pp. 37 and 38.)

--Under an automated system, the move from a five-digit to a nine-digit ZIP Code would yield a total positive net cash flow of $3.5 billion for the evaluation period at an additional cost of $873 million, and would result in an ROI of about 36 percent on this incremental investment. This assumes a fixed rate incentive of one-half cent for each qualifying piece of mail If the rate incentive were escalated to keep pace with inflation, the ROI would be about 23 percent (See pp. 37 and 38)

Viewed in this way, the incremental move from five to nine digits would seem to be more than justified by the potential added net benefits. There are, however, major uncertainties regarding mailer usage which cause GAO to qualify its endorsement of this move

MAILER BEHAVIOR IS UNCERTAIN

The major uncertainties regarding mailer usage concern

--whether the Postal Service will be successful in establishing reduced rates for volume ZIP + 4 mailers, and

--whether the amount of such an established incentive would be sufficient to result in a usage rate which, in turn, would be adequate to make the ZIP + 4 program cost effective

GAO found that many large-volume mailers were taking a wait-and-see position on the use of the ZIP + 4 code They were waiting mainly to see what postage rate incentive--if any--will be offered and what other mailers will do (See pp. 106 and 107.)

According to the Postal Service, use of the nine-digit code would be voluntary. Mailers' decisions on moving to it would, to a great extent, be based on the economics of their particular cases--the sum of costs, such as adding ZIP + 4 codes to their address files and keeping the codes current, versus benefits such as reduced postage and improved mail service.

GAO's questionnaire survey of major mailers disclosed that, although some would convert to

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ZIP + 4 regardless of whether a rate discount were offered, most would require an adequate rate discount to offset their ZIP + 4 conversion costs before they would be willing to add the nine-digit code to their address lists (See pp. 105 and 106.)

Given the ROI's extreme sensitivity to usage levels (see pp 44 and 45) and the uncertainty of mailer cooperation at this time, GAO lacks a basis to give an unqualified endorsement to the move from a five-digit to a nine-digit code or, conversely, to rule out the chances of its success

THE ROI--NOT A COMPLETE PICTURE

The picture painted by the ROIs computed by GAO for the ZIP + 4 project is not complete without disclosure of potential savings to mailers resulting from reductions in Postal Service operating costs if the ZIP + 4 code is used extensively by large-volume mailers.

With a ZIP + 4 usage rate of 90 percent, the automated system, using the nine-digit code, could sort mail down to the carrier route and --over a 16 year project evaluation period-- potentially reduce net operating costs by about $5.3 billion (over and above the benefits of using it with the five-digit ZIP Code). The ROIs computed by GAO are based on this number less the cumulative amount of the proposed rate reduction considered necessary to obtain extensive use of the ZIP + 4 code.

A fixed postage rate reduction of one-half cent per piece would return to qualified mailers $1.8 billion [1]/ of the above $5.3 billion in savings, leaving the Postal Service with a net cash flow of about $3.5 billion over the 16 year project evaluation period and an ROI of 36 percent. An escalated rate reduction would return about $3 5 billion to qualified mailers, leaving the Postal Service with a net cash flow of about $1.7 billion and an ROI of 23 percent

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[1]/ Calculated on the basis of the Postal Service's estimate of an annual volume of 28 billion pieces of mail qualifying for a ZIP + 4 discount.

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The $1.8 billion (or $3.5 billion) returned to mailers will serve to offset their file conversion and maintenance costs, and provide a net saving if postage reductions from repeated and frequent use of the lower rate exceed the costs of file conversion and maintenance. GAO cannot estimate such costs but major mailers consider them significant enough to decline to convert their address files without a rate reduction. GAO believes it reasonable to assume that, over time, the cumulative amount of the rate reduction received by mailers will exceed mailers' costs. The benefits measured by GAO's ROI are understated to the extent that mailers realize net savings.

How soon a mailer breaks even and begins to realize net savings--and the amount of these savings--will be determined by the frequency of use of each ZIP + 4 coded address. Large-volume mailers who use each address frequently will recover conversion costs and begin realizing net savings earlier than low-volume mailers qualifying for the ZIP + 4 discount. (See pp. 102 to 106.)

AGENCY COMMENTS AND GAO'S EVALUATION

Postal Service comments on GAO's draft report appear in appendix XIV. GAO discusses the Service's comments in individual chapters of the report.

GAO recommends Postal Service actions to·

--Improve the optical character readability of mail. (See p. 60.)

--Improve the testing and evaluation of new equipment. (See pp. 71 and 72.)

--Broaden assistance to mailers in converting their mailing lists to ZIP + 4. (See p. 132.)

--Maintain at least the current quality of delivery service for five-digit ZIP Code mail after ZIP + 4 is implemented. (See pp. 132 and 133.)

--Provide mailers necessary information about the ZIP + 4 program. (See p. 133.)

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The Postal Service concurred in general with GAO's recommendations and described current and planned actions to comply with them. In one significant decision, the Service accepted GAO's recommendation to extend the testing of new equipment and said it would conduct its own 8- to 12-week test on one of the first optical character readers delivered to a postal facility from each contractor. Data from these tests will enable the Service to better assess the performance and reliability of the new equipment

Regarding GAO's conclusion that business mailers lacked necessary information about the ZIP + 4 program to enable them to make informed decisions about whether to convert to ZIP + 4, the Service agreed. It said that following enactment of the 1981 Omnibus Budget Reconciliation Act, it had cancelled aggressive ZIP + 4 education and information programs to comply with the intent of the act It said such programs would be reinstated

Although the potential ROI calculated by GAO was favorable for the ZIP + 4 project, the Postmaster General considered it understated, primarily because of the methodology GAO used in calculating the ROI The Postmaster General disagreed with GAO's treatment of the assumed one-half cent rate reduction for ZIP + 4 mail as a program cost in computing the ROI. He held the view that the rate reduction represents a distribution of savings to mailers, as required by law, and that it should not diminish the ROI. (See pp. 171 to 173.)

GAO holds to the position that because the proposed rate discount will be a necessary incentive to induce large-volume mailers to use ZIP + 4, it should be treated as a program cost for purposes of computing the ROI. The Service is, in effect, buying mailers' usage of the nine-digit code. Without this usage, the program would not succeed, and there would be no savings to distribute (See pp. 34 and 52.)

However, the benefits measured by GAO's ROI are understated by the extent to which, over time, the cumulative amount of the rate reduction received by mailers exceeds mailers' costs of adding the ZIP + 4 code to their address files. GAO cannot estimate such costs.

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Although some mailers will add the ZIP + 4 code to their addresses for non-monetary reasons (such as the expectation of improved mail service), it is reasonable to expect that most mailers will not add the code unless they can realize monetary savings from repeated use of the expanded code.

The Postal Service disagreed with GAO's assumption that the Service's contract for a toll-free "800" telephone inquiry service would remain in force for the full 16 year project evaluation period at a total cost of $500 million. (See p. 172.)

There is no evidence to support the Postal Service's assumption that the volume of calls requesting nine-digit ZIP Codes would drop markedly after fiscal year 1985, causing costs for this service to drop. On the contrary, evidence points to a sustained large volume of calls. As GAO stated in the report (see pp. 28 and 29), in 1980--17 years after the five-digit ZIP Code program began--the Service estimated that it was receiving about 100,000 ZIP Code inquiry calls a day. The great increase in the number of ZIP Codes resulting from the expansion to nine-digit codes makes it likely that the volume of inquiries will increase significantly. With the expansion to nine digits, the number of ZIP Codes will increase approximately 800 times over the current level.

The Postal Service contended that, although GAO recognized in its report a number of additional savings potentially available through the use of automation and ZIP + 4, it failed to include these savings in its ROI calculations. (See pp. 178 to 180.)

As GAO pointed out in the report (see pp. 48, 49, and 53), it did not include these potential additional savings in its ROI calculations because it was not possible to quantify them with sufficient accuracy. The savings depended on planned actions which were still uncertain and tenuous at the close of GAO's review. Where possible, GAO did indicate the possible magnitude of savings on the basis of available information, but GAO continues to believe it would not have been prudent to include them in the ROI calculations. For the same reasons, GAO did not include in its ROI

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calculations certain potential additional costs to the Postal Service which it identified in the report.

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POSTAL SERVICE OCR READABILITY CRITERIA FOR BUSINESS MAILERS

1. The entire post office, state, and ZIP Code should be located within an imaginary rectangle, which is the OCR read area, on the front of the mailpiece formed by the following boundaries:[1]

   a. 1 inch from the left edge.

   b. 1 inch from the right edge.

   c. 5/8 inch from the bottom edge (bottom line of rectangle).

   d. 2-1/4 inches from the bottom edge (top line of rectangle).

2. Within the OCR read area, the entire space on or below the delivery address line should be clear of printing other than the address itself. This includes such information as tic marks, underlines, boxes, advertising, computer punch holes, or similar nonaddress information. In addition, no printing should appear in the bar code read area. This area is reserved for the application of bar codes.[1]

3. The address should have a uniform left margin and be legible. To conserve character spaces, punctuation is not required in the address.

4. Address formats:

   Optional line--non-address information
   Top line--name of recipient
   Next line(s)(optional)--information/attention line
   Line above last--delivery address
   Last line--post office, state, ZIP Code

5. Use unit, apartment, mail receptacle, office, or suite number in the address. Place that information directly above or below the name-of-recipient line.

6. The preferred location for the ZIP Code is on the post office, state, and ZIP Code line. However, if this is not possible, the ZIP Code may be placed at the left margin, on the line immediately below the post office and state.

7. The complete address must always be visible. There should be a minimum of 1/8-inch (1/4-inch is preferred) clearance between the window and both sides and bottom of the address throughout an insert's full movement inside an envelope.

8. Type styles such as italic, artistic, script and certain dot matrix styles cannot be read by the OCR. Characters or numbers should not touch or overlap within a word or ZIP Code.

9. The use of upper case characters is preferred but only required when the line spacing is 8 lines per inch. Preferred spacing is 6 lines per inch.

10. The character pitch should be in the range of 7 to 12 characters per inch.

11. The character height must be within the range of .08 inch to .20 inch. All characters on the City, State, and ZIP Code line should be of the same height.

12. The character height-to-width ratio should be from 1.1:1 up to 1.7:1.

13. The space between words and between the state and ZIP Code should be 1 to 2 character spaces.

14. The space between address lines should be no less than .025 inch. That is the vertical distance from the bottommost point of either an upper or lower case character to the highest point reached by the tallest character in the line below.

15. Maximum character and line skew relative to the bottom edge of the mailpiece should not exceed five degrees.

16. Black ink on a white background is preferred, but color combinations may be used which provide a Print Reflectance Difference of at least 40 percent. Reverse color printing should not be used.[1]

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[1]The Postal Service plans to make compliance with this criterion mandatory in the ZIP + 4 rate incentive program.

APPENDIX VI

THE POSTMASTER GENERAL
Washington DC 20260-0010

August 19, 1983

Dear Mr Anderson·

This refers to your proposed report, "Conversion to Automated Mail Processing and Nine-Digit ZIP Code - A Status Report."

This report finds (1) performance of the automated equipment is still uncertain, (2) improvements are needed in programs to improve the optical character readability of mail and to administer the postage rate incentive for large-volume mailers of ZIP + 4, (3) the Service's market study is questionable because the response rate was only 48% and the study was limited to the 50 largest metropolitan areas, and (4) the Service's National ZIP + 4 Directory is reasonably accurate.

Equipment Performance

The start up problems Pitney Bowes and Burroughs experienced with their optical character reader/channel sorter (OCR/CS) equipment are to be expected in an undertaking of such magnitude. Both manufacturers have overcome their initial problems and their equipment is now consistently passing acceptance tests The more extended performance tests you recommended for the OCR/CS's are underway, but not yet complete. Preliminary results from the current test phase indicate the equipment will perform up to expectations.

Although the report regards our acceptance tests for the Bell and Howell bar code sorters (BCS) as too short, BCS's have consistently performed reliably in field usage and no significant design defects have been identified. We used contractor personnel in our initial testing because Postal Service people were not yet trained in the operation of the equipment, and we did not want the tests to be adversely affected by untrained operators But we agree that manufacturer personnel should be phased out Future tests will be conducted with postal personnel, using the same staffing as anticipated for actual operations.

We shall, as you recommend, conduct an extended test on a bar code sorter as soon as the OCR tests are completed and staffing is available to conduct the BCS test

Program Improvements

We shall continue to give heavy management emphasis to our programs to improve the optical character readability of mail and to administer postage rate incentives proposed for large volume mailers Improvements are now underway, along the lines you recommend·

1. The Postal Service Research and Development Laboratories will give appropriate emphasis to the collection and analysis of mail rejection data in our continuing study of equipment recognition characteristics with the aim of refining existing OCR readability criteria as expeditiously as possible

2 A Management Instruction will be issued delineating organizational responsibilities for these programs, including budget support and training

3. An orientation program for large-volume mailers whereby they can visit facilities and see our new equipment in action is now being tested in several installations. It will be expanded as we gain experience using it.

4. A number of training sessions have been held for customer service representatives (CSR's) and associate office postmasters to train them to effectively communicate OCR readability problems to mailers. Other workshops, presentations and training materials are being planned.

5. We are now working on a plan to select and train OCR readability technicians for the field We are also developing training for mail processing personnel at OCR sites. These people will provide technical support for our CSR's and associate office postmasters.

6. Policies and procedures for determining whether mail is eligible for ZIP + 4 discount have been drafted and are now undergoing internal review The acceptance, verification and administration of ZIP + 4 rate mail will be virtually identical to that for First Class presort mail which is already in place The training required will be minimal and will be accomplished by supervisors.

7 OCR's will be used as a diagnostic tool to evaluate OCR criteria and determine how well mail that has been accepted actually performs. Criteria may be adjusted if experience shows a need to do so. We do not believe it is feasible to use OCR's to qualify particular mailings.

Market Study

We think our market study is valid. When our research contractor, R H. Bruskin and Associates, drew the study sample, they selected more than double the number of required interviews, because, based on their experience with other business studies, they expected many businesses would not respond.

There was nothing in the mailer recruitment method that would prejudice mailers for or against the proposed ZIP + 4 program They were told only that the subject would be ZIP + 4. A comparison of the characteristics of the mailers interviewed with external data sources on non-householder mailers indicates that the mailers interviewed have representative characteristics.

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The study was limited to the top 50 metropolitan areas because we had to make some trade offs between sample size and geographical coverage We believe mailing characteristics, such as volumes and mailing size, are more important than where the mailer is located.

ZIP + 4 Directory

Your tests show our ZIP + 4 Directory is reasonably accurate We are making a number of changes that will make it even more accurate

To sum up, we are pleased with the way our equipment tests and supporting programs are going and we are confident our market estimates will be realized once the program goes 'live.'

Thank you for the opportunity to review your report and for your helpful recommendations throughout the development of this important program.

Sincerely,

William F. Bolger

Mr. William J. Anderson
Director, General Government
Division
U.S. General Accounting Office
Washington, D. C 20548

DOCUMAIL SYSTEMS DIVISION
9801 Industrial Boulevard Lenexa Kansas 66215 (913) 888 8775
BELL & HOWELL
7100 McCormick Road, Chicago, IL 60645 (312) 673-3300

12 August 1983

Mr. William J. Anderson
United States General Accounting Office
General Government Division
Washington, D.C. 20548

Subject GAO Report to Congress - Zip + 4 Program

Bell & Howell welcomes this opportunity to respond in writing to those areas in the draft of the report to Congress on Zip + 4 which address the BCS program. Based on our understanding of the points raised, it is felt that certain clarifications are in order.

Bell & Howell concurs with the basic concept that--only through adequate testing and observation can the Postal Service assure itself of the product performance it is procuring. However, it is Bell & Howell's contention that GAO's application of this concept to the BCS program has disregarded some critical issues.

First, potential design deficiencies, if they exist, should be surfaced prior to the procurement process. This is clearly not the purpose of acceptance tests. Design deficiencies should be identified through extensive testing before the equipment selection is made. To address this aspect the Postal Service conducted tests during the Summer and Fall of 1981. It was based on the results of these tests that a vendor was selected. From this point, contractual requirements were established to assure USPS that the equipment purchased under the production contract was functionally identical to the equipment tested and therefore would meet the same performance criteria. The purpose of the acceptance tests, then, is to verify that production equipment would perform to the contract specifications.

Secondly, this contractor did perform thorough testing on a first article unit as a major element of the Quality Assurance Program. A first sorter was produced entirely from vendor parts to drawing specifications. This took place six months prior to production so that time period could be used for testing of the first article. The conduct of this preproduction effort was discussed in some detail previously with GAO and, in fact, was mentioned in the initial GAO Report to the Congress (page 64).

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> "With regard to the small BCS contract also, the Postal Service did not require a standard first article test. However, the contractor followed good procedures, and planned to conduct its own tests..."

It would appear that the reference to Bell & Howell's program is no less valid in this context and its ommission from the follow-up report is not understood. It should also be noted that the Postal Service was keenly aware of the first article portion of our QC Program and monitored (through the Defense Contract Administration Service) the results of the testing and performance of this first unit.

In addition to the first article portion of the Quality Procedures, Bell & Howell also conducted extensive testing on every production unit manufactured. This required that each machine process no less than 1 million pieces of mail and pass the "acceptance test" in the plant prior to shipment. It is because of this thorough testing effort in the factory that the units were acceptable at the installation site--not because of some perceived deficiency in the conduct of the acceptance test. It is not through some quirk that 144 machines have been produced and accepted on Schedule. It is because each unit has been extensively tested before shipment.

Bell & Howell is unaware of "potential design defects" in the BCSs delivered to the Postal Service. During in-plant testing, nearly 1/4 billion pieces of mail have been processed through production sorters to determine the operating characteristics of each and every machine. This testing has not revealed design defects. Consequently, GAO's contention about defects is questioned and Bell & Howell suggests that, from a statistical standpoint, the limited nature of the sampling technique employed may have led to an inaccurate conclusion.

This is also the case in the "higher than normal reject rate" cited in the draft. It is not sufficient to observe the reject bin filling up to determine that a reject problem exists. The mail has to be studied as the Postal Service has done. Analysis indicated that much of the mail contained non-readable bar codes as noted in the GAO draft. From a mail processing point of view, it is preferable to use the BCS to cull for "non-readable codes," "out of schemes," and "no codes" than to have people perform this task. In studies conducted by USPS the true reject rate approaches 2% and therefore is well within contract specification.

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GAO further indicated that there may be shortcomings in the acceptance test procedures on the BCSs which, by implication, has put the procurement process in doubt. Bell & Howell acknowledges that there are both pluses and minuses but in total the tests should adequately serve the Postal Service's requirements. Some examples should be noted here. Due to the delay in the OCRs, the bar code reading tests have, for the most part, been performed on test decks, this would lead toward a lower reject rate, but it is a more "controlled" media to read. On the other hand OCR delays have also caused the sorters to process "dock mail"--there is no assurance that it is even machineable when presented to the sorter for test. GAO has questioned Bell & Howell's direct involvement in the acceptance test. However, it may be suggested that greater participation by the contractor can provide a more objective test. Under present conditions the equipment is run by inexperienced operators. This interjects a significant element of subjectively which can adversely impact true performance. Is it the equipment that is to be tested or the operator? It is Bell & Howell's position that to accurately test the equipment the contractor should be allowed to test with the contractor's experienced personnel. Such testing would clearly be more representative of mid-stream equipment performance. Laying these points aside, Bell & Howell feels that on balance the acceptance tests procedures established adequately meet the needs of both the customer and the vendor--they demonstrate that the individual piece of equipment can measure up to the standards fixed in the procurement process.

While feedback has been continually sought from the Postal Service, this vendor was unaware that the Service had "expressed concern about the performance of the BCSs" to the extent indicated in the draft report. Where any "concerns" have been identified Bell & Howell has responded promptly to thoroughly test for the true cause and provide solutions. While it may be true that elements of the sorter design can be improved or enhanced, the extensive testing programs have made this vendor prudently cautious in approaching any changes. A complete understanding of the exact cause and effect implication of any redesign must be ascertained before action can be undertaken. With this as a premise Bell & Howell anticipates a continuing positive relationship with the Postal Service towards the goals of this successful program.

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Please feel free to contact the undersigned should you desire any additional information on the Bar Code Sorter segment of the program.

Sincerely,

William T. Cost
Contract Administration

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APPENDIX VII

SDC

System Development Corporation

P.O. Box [illegible]

16 August 1983
1460(-HJZ-707

Mr William Anderson
United States General
Accounting Office
Washington, DC 20548

Reference GAO letter Dated 1 August 1983

Dear Mr Anderson

We have completed our review of the draft followup report to Congress on the ZIP + 4 Program which you provided us under the referenced cover letter The contents of your draft are generally accurate, however, a certain amount of clarification is required The second paragraph notes the first delivery date as January 1983 when in fact the first machine was accepted by the USPS on 13 December 1982 The next to the last sentence in the same paragraph should indicate that three (3) machines, (Norman, OK I & II and Washington, DC I), were accepted under the original test criteria

In the fifth paragraph you note that "Burroughs staff found a series of design and manufacturing problems" in the extended test site machine We understand that the extended test site machine is located in Washington, DC If this is the case, it should be made clear that the Washington machine had experienced only minor problems which were corrected by inserting an improved air filter in the feeder unit and repositioning the prescanner and Bar Code Reader to allow for a wider range of adjustments. In addition, we made several other changes aimed at eliminating possible component malfunctions The major changes made to the test machine were precautionary in nature This machine was accepted by the USPS on 4 March 1983 The problems experienced by Burroughs, which necessitated the need for the suspension of the acceptance testing, were discovered, afterward, during the acceptance tests in several other cities During the suspension period, Burroughs resolved these problems with two acceptance tests resulting and being successfully completed during the week of 6 June 1983 After proving that the above problems were solved, we incorporated the appropriate changes into the aforementioned test machine along with other machines which had already been accepted All machines now being tested also include these changes resulting in a favorable trend in machine performance and acceptance

Should you have any questions concerning the contents of this letter, please forward them to the undersigned

Very truly yours,

SYSTEM DEVELOPMENT CORPORATION
--A BURROUGHS COMPANY

Frank J. Zuccola
Manager, Contract Administration
Automation Systems Division

APPENDIX VII

Pitney Bowes
Director OCR/CS Program
OCR Scanner Division

August 16, 1983

Mr William J Anderson
Director of General Government Division
United States General Accounting Office
Room 3866
441 G Street, N W
Washington, DC 20548

Dear Mr Anderson

We appreciated the opportunity provided by your August 1, 1983 letter to review the draft of the sections of the forthcoming GAO report pertinent to PB/FISAG OCR/CS equipment

We find that there is a small conflict between Paragraphs 1 and 4 Paragraph 1 states that as of July 15, 1983, PB was behind schedule Paragraph 4 states that as of July 1983, we were back on schedule Perhaps this could be rephrased for more clarity by saying that as of July 30, 1983 the contractor was on schedule

We would also appreciate it if it could be mentioned that the several beneficial hardware and software changes, and the extra week of pre-acceptance test preparation time was provided by PB on its own volition at no cost to the Postal Service

Although it is probably unimportant, there is one other item I would like to call to your attention The opening sentence reads "The number of OCR/CS' and BCS' accepted " We are not sure that the number of BCS' accepted equaled (or is supposed to equal) the number of OCR/CS' accepted In any event, however, we fail to see the connection here between OCR/CS' and BCS' Perhaps you should have your staff check this out

The foregoing paragraphs contain our comments on the draft as written We feel, however, that the draft does not reflect the true extent of PB's dedication and commitment to the OCR/CS program We have taken the opportunity to rewrite the GAO draft and have appended it hereto for your consideration (See Attachment I)

Again, thank you for your courtesy

Very truly yours,

J J Keough
Director, OCR/CS Program

/agf
Attachment

Commerce Park Danbury CT 06810 203 792 1600

APPENDIX VII

Attachment I

Status of Current
Equipment Contracts

As of July 30, 1983, Pitney Bowes is on schedule for delivery, installation and acceptance of OCR/CS Systems Fifty-one systems were required under the contract and fifty-one were accepted

Pitney Bowes encountered difficulties in getting systems accepted in the early stages of the program The first unit was installed in Los Angeles, CA in September, 1982, and failed its acceptance test on two successive occasions At that time it was realized by the Contractor that the acceptance testing criterion included in the contract was not completely realistic due to different mixes and conditions of live mail, differences in directory size and complexity, operating personnel, etc , at operational sites vs the more controlled test environment under which acceptance testing criteria was developed Accordingly, the U S Postal Service agreed that if the cost for processing one thousand letters by the operational machines was equal to or less than that achieved by the initial test machine, their return on investment (ROI) objectives would have been achieved This proved to be the case and subsequently the U S Postal Service agreed to revise the contract to reflect this criterion We agree that the new plan is properly drawn to fairly test the equipment

Since the acceptance test criteria was modified, Pitney Bowes machines have been passing the acceptance tests with regularity During February and March, 1983, eight PB OCR/CS' were accepted in a row It is now rare that a PB machine does not pass the tests on the first try As with any system of high complexity, however, an occasional machine will have some minor defect which must be corrected

Statistically, the new Acceptance testing criteria has proved that all machines accepted have performed as well as, or better than, the machine tested in the Phase I release-loan testing program The processing cost is computed using a weighted average of throughput, read rates and error rates

As would be expected, some mechanical and software problems have surfaced during mail processing operations after a machine has been accepted In this case, the contractor has been completely supportive to the U S Postal Service in diagnosing the problem and correcting it For example, the feeder section was redesigned to provide more positive feed action, and this improvement was retrofitted into previously deployed machines at no cost to the Postal Service Service and contractor officials told us of several other changes to hardware and software to enhance performance have been implemented or are under consideration

Service officials stated that Pitney Bowes machines were experiencing fewer problems at each succeeding test site and in subsequent mail processing operations The contractor has voluntarily increased his pre-acceptance test preparation time from two to three weeks, again at no cost to the U S Postal Service, to permit a more thorough check-out of each machine prior to the formal acceptance testing by U S Postal Service personnel Service officials believe that all problems currently being identified are minor and easily correctable

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