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ABSTRACT

The state of Washington studied ways to deliver library materials by mail, with patrons ordering from a Sears-type catalog of materials. Investigation techniques included a literature search, on-site observations, personal interviews, statistical analyses, mathematical modeling, and computer simulation. It was concluded that mail order book delivery could best be supplied through a single state center and that private vendors of catalogs and books should be used if available. This report discusses these procedures and findings and also contains recommendations and technical appendixes. (Author/WH)

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STUDY FOR THE DESIGN OF AN OPTIMUM SYSTEM FOR MAIL ORDER BOOK DELIVERY SERVICE IN THE STATE OF WASHINGTON

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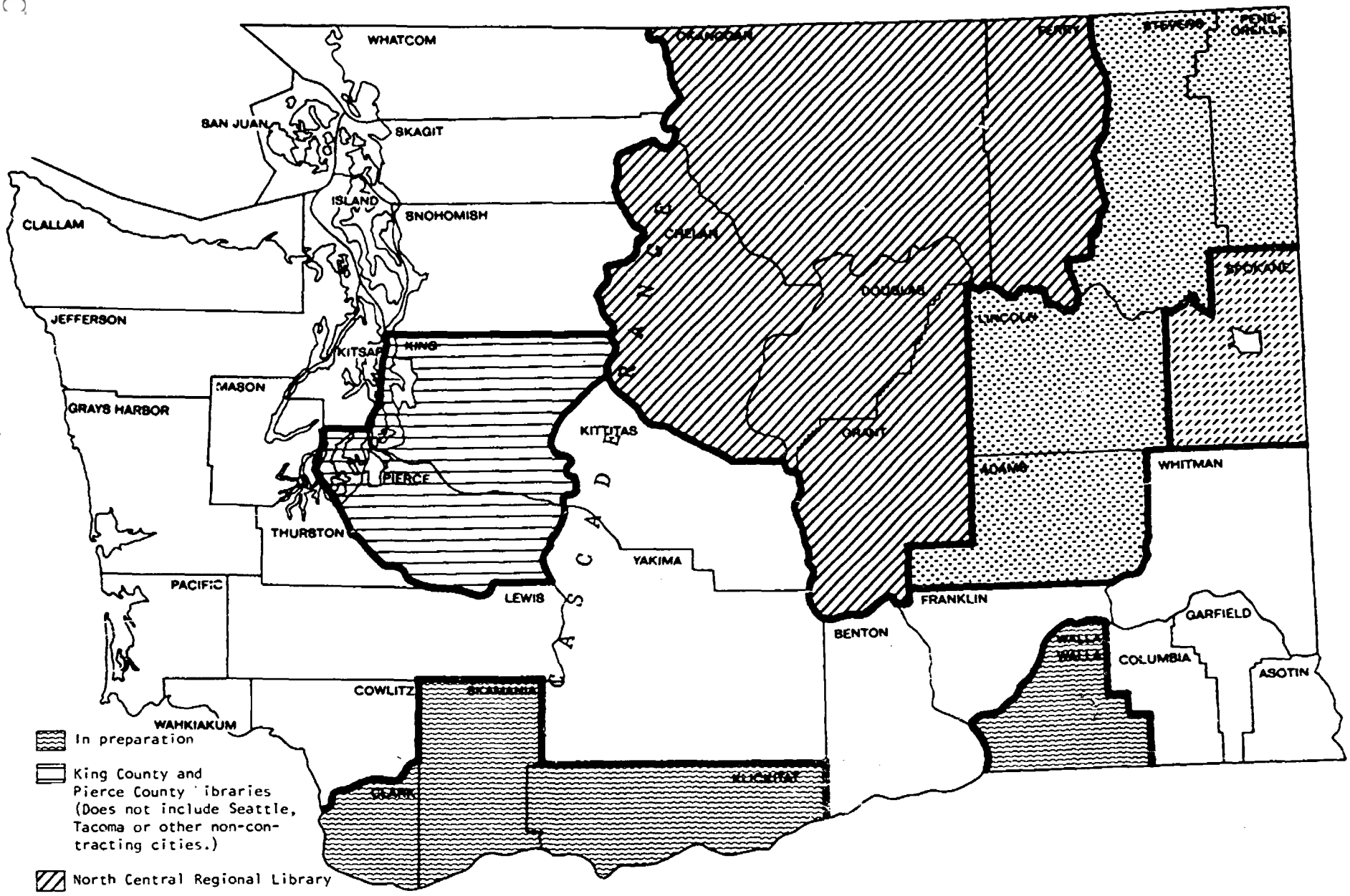
EXISTING MAIL ORDER CATALOG SERVICES IN WASHINGTON STATE, MARCH 1974



PREFACE

This study has been undertaken with the support of the United States Office of Education as authorized by the Higher Education Act, Title II-B, Library Research and Demonstration.

Acknowledgment of advice and assistance is owed to numerous individuals and institutions, only a few of whom can be listed here. Helpful suggestions and encouragement were offered by the staff of the Washington, D.C. office and 10th regional office of the United States Office of Education, Bureau of Libraries and Learning Resources. The personnel of the three Mail Order Delivery centers operating in Washington State have been generous in time and information-gathering and -forwarding; this study has leaned heavily on their willing cooperation. The availability of computer services at the Washington State Department of Motor Vehicles and the assistance of Motor Vehicle personnel (especially John Lawson, Assistant Manager, Information Systems; and Richard Carl, Supervisor, Computer Operations) has facilitated the computer simulation of various configurations of operations for statewide service. Hugh T. Vrooman, Manager, Systems Analysis and Management Services, Illinois State Library, and consultant for this study, provided valuable technical assistance, especially in computer simulation procedures. Kristy L. Coomes, Library Specialist, Washington State Library, contributed considerable effort in gathering data and in control of the report's production. Other members of the Washington State Library staff contributed design and editorial advice to the study.

Genesis of this study came from the directors of district library systems of Washington State, at a meeting in August 1973. The topic of serving users via mail order delivery (MOD) was discussed. The experiences of the three centers in Washington (King-Pierce Counties, North Central Regional, and

Spokane County) using this device were so positive that other directors were impressed to the point of considering the application of this technique in their own systems. The State Librarian, Maryan Reynolds, suggested that the ramifications of extending service to all the state should be studied, to determine how the goal might be best achieved.

The directors of the district libraries charged the investigators with the task of supplying information on alternative patterns for library mail order delivery to serve patrons throughout the state. This study was undertaken to evaluate present methods in the districts now offering mail order library services, and to provide information on which can be based decisions on number of centers, operational techniques, cost projections, organization for ongoing policy and fiscal control, and methods for periodic evaluation.

This report is organized as follows: First, following this preface, an abstract is provided. Next is a short introduction, after which procedures and findings are discussed. A section describing conclusions and another listing recommendations conclude verbal description. A selected bibliography, exhibits, and appendices complete the report. Many readers will find the abstract and conclusions sufficient for their needs; others may wish to read the mid-portions of the report, and a durable few may wish to investigate the appendices which offer technical support and detail but are not necessary for understanding the study and recommendations.

ABSTRACT

This report describes an approach to the problem of how best to service the citizens of the state of Washington through delivery of library materials by mail, with patrons ordering from a Sears-type catalog of materials. Investigation techniques included literature search, on-site observations, personal interview, statistical analysis, mathematical modeling, and computer simulation. This report discusses these procedures and findings and also contains recommendations and technical appendices.

INTRODUCTION

The primary question enunciated in the district directors' meeting is whether all districts will be best served by one MOD center, or by some larger number of centers; this project is intended to determine some parameters of the most likely form that such a service system might take, providing facts and analysis on which the directors' decisions can be based. The charge for this study does not include a cost analysis of mail order versus other methods of service, though some figures of this nature are included herein. Mail order delivery service is not seen as a substitute or competitor for the range of services available to a walk-in library patron; rather, on evidence of experience it is felt that MOD service reaches patrons who would otherwise be unserved. This study does not address the question of the most efficient way to supply materials for library users, but investigates the problem of the most efficient pattern of mail order delivery, to extend service to certain types of citizens who are now either unserved or served with difficulty.

While this study was designed to offer answers to a specific problem, it is recognized that many assumptions not questioned demand investigation. Some of these are mentioned later in this report, in hope that at some future time the necessary funds and energy might be available.

The initial approach to the study was made through a literature search, to gather information on experiences in mail order delivery elsewhere. Reports were gathered from mail order delivery services throughout the country, and from the Conference on Books by Mail Service, sponsored by the American Library Association in Las Vegas on 23 June 1973. From analysis of these reports,

information was drawn to be compared with findings related more closely to Washington State.

The three existing mail order service centers in the state of Washington were examined on-site. Directors and staff members were interviewed, financial and statistical data were collected, and subsequent telephone calls and letters elicited additional information as required. There has been no attempt to study the systems from the users' viewpoint, nor to assess the collections qualitatively, though these inquiries are recommended for subsequent action. The efficacy of mail order delivery service has not been questioned, since the charge given for the study was based on a positive desire to extend such service to all or most of the state. The problem addressed has been which organizational pattern can best achieve statewide service.

In addition to the three on-site observations of mail order delivery centers, the investigators interviewed a number of Washington State librarians, who provided helpful information and guidance. Furthermore, the Fort Vancouver Regional Library (Vancouver, Washington) began during the course of the study to offer mail service to portions of its service area. Considerable up-to-date information had been accumulated by the library's assistant director, John Legry, and this information was made available to the investigators.

Experience in Washington State has formed the backbone of this study, and information from elsewhere has served to corroborate or modify the findings in Washington. Out-of-state operations which were especially considered included operations in the states of Vermont, Pennsylvania, and New York.

Analysis for population scatter and educational level in the state was based on the 1970 U.S. Census and figures published by the State Office of Program Planning and Fiscal Management.

A major factor in the quality of any mail order service is the behavior of packages in the U.S. Postal System. While the internal operations of the working centers offered a means for analyzing costs of such service, an analysis of mail delivery patterns was necessary in order to assess rapidity of service to the user. For an empirical test of postal delivery patterns, the three existing centers mailed packages to district library directors throughout the state, keeping records as to times en route from center to home and return.

The methods for this study have been of a traditional nature with the exception of computer simulation. The classical techniques included literature search, on-site observations, personal interview, statistical analysis, and mathematical modeling. The statistical and mathematical data provided input for the simulation model which described the interrelationships of components and procedures of the mail order delivery systems in a format that could be processed by computer. The generalized model was constructed on the basis of systems at the three presently operating centers, and the model was exercised to simulate service to the state's MOD library users from various alternative configurations of centers.

PROCEDURES AND FINDINGS

LITERATURE REVIEW

Before the decision to undertake this study, a literature search was made to ascertain whether the desired information might already be available. While a recent study in Pennsylvania (Hu, 1973)[1] had investigated the relative merits of bookmobiles and mail order delivery, and the report had implied that a statewide MOD service might best be organized from one center, this large-area pattern had not been directly addressed. Also, the Vermont State Library had begun a mail order delivery service which was to expand to cover the state, but there had been no analysis of what might be the best organizational pattern; intuitively the one-center concept was used. The other states with some activity but little available evaluative information are New York and Illinois.

The two ALA conferences on this subject, one in San Francisco in 1967 and the second in Las Vegas in 1973, demonstrated strong interest throughout the profession. This is also documented by the publication of Tomorrow's Library; Direct Access and Delivery, (Jordan, 1970) a thorough presentation of the history, current status and future of such service programs.

The literature review revealed two basic types of service patterns: the mailing to a patron of any available book requested, and a Sears Roebuck style system with special mail-order catalogs, staff, and collection. In this study, mail order delivery (MOD) refers to the latter pattern only. The strong opinion of the staffs operating present mail order delivery services in Washington is that a well-designed catalog with illustrations and good annotations is the main factor in building circulation. This aspect is emphasized by Robert Jordan.

1 Full citations are given in Bibliography, pp. 45-46.

"It is no coincidence that the low cost ($2.00) book catalog distributed without charge by Sears, Roebuck is an integral and essential part of the nation's model...retailing operation. Few of the thousands of retail mail order services (representing every conceivable type of commodity and service) could exist without a catalog. Similarly, it is unlikely that a direct access and delivery library service can successfully exist without a catalog.[2] Collectively, the libraries of the nation have the capacity to develop patron-oriented book catalogs comparable in potential to commercial catalogs." (Jordan, p. 74)

Mail order delivery is a relatively recently developed technique for library service. The literature search made it clear that most mail order delivery systems do not publish evaluative or statistical reports, or thorough descriptions of operations. However, the North Central Regional Library in Wenatchee, Washington, which established its mail order delivery system in 1968, has maintained early and on-going evaluation programs. As a contribution to the profession nationally, this has been most beneficial, and in the present study the data are invaluable.

FINDINGS FROM OTHER STUDIES

The 1973 study for the State Library of Pennsylvania by Hu, Booms, and Kaltreider, compared bookmobile and mail order delivery cost-benefits. Some of the data from that report can be employed in the present analysis as a basis for arriving at a reasonable range of costs for mail order operations. Table 6.13 (Hu, p. 202) in that report gives per circulation costs for eleven libraries throughout the U. S. After eliminating those for which incomplete information is given, the cost figures for seven centers, as given in Exhibit 1[3] of this study, show considerable agreement. The monthly circulation figures have been calculated from figures given in the Pennsylvania study for longer periods of time. If each of these seven cost-per-circulation figures is multi-

2 Italics supplied.

3 All exhibits are contained in

plied by the corresponding monthly circulation figure and that total is divided by the total circulation for the seven operations, the mean is then calculated at $ .65. As stated on page 204 of the Pennsylvania study: "...a cost per book circulated of $ .60 to $ .70 is a good estimation of what libraries considering the establishment of a MOD service can expect in the way of operating costs." This could be used as a general measurement for existing mail order delivery operations, so long as there is some attempt to calculate costs on a fairly standardized basis. Carrying the inference a step further, a standard deviation of $ .06 can be related to the $ .65 average cost. If this can be accepted as reasonably valid, it will provide managers with a rough measurement of the cost area in which a mail order center should operate: one standard deviation above and below the mean will give a range of $ .59 to $ .71. If the cost per circulation for a given operation lies above $ .71, investigation should reveal ways of reducing costs--or some special services may be included which would make the general level of cost inapplicable. This range must of course be modified as monetary values change; even at the present writing, in early 1974, some upward revision should be made: the Monthly Labor Review reports the Consumer Price Index for January 1974 as 11.5% higher than the Index for 1972, which brings the upper limit of the range to $ .79, since the calculations are based on 1972 cost figures.

Exhibit 2 shows graphically the figures in Exhibit 1 and the above calculated range of cost expectations. Exhibit 3 shows the possible existence of a curved rather than a straight-line estimate of costs, with higher cost-per-circulation related to lower circulation figures. This is one of the hypotheses underpinning the present study, and is further supported by data gathered in the Washington state MOD operations and analyzed later in this report. This is

mentioned but not analyzed in the Pennsylvania report: "The findings here seem to imply that a large (statewide) operation will result in lower costs than can be obtained by having many (local) MOD operations." (Hu, p. 231)

Some further comments on the Pennsylvania study should probably be made here. The benefit figures constructed by Hu, et al., should be questioned. They result from inquiring of users how much time is saved for them by the bookmobile or MOD service, how much they would be willing to pay for the service, and the number of books they would buy if the service were not available, and estimating from frequency of use and income how much time is saved for them and what it is worth. The price users would be willing to pay would seem influenced by how much they think the specific service costs, and bookmobiles look more costly, and are more prominent and self-advertising. How many books would be bought might well be exaggerated in the same manner as the usual reader's estimate of the number of books read; so also might frequency of use of library services. Hu, Booms, and Kaltreider are to be lauded for attacking the benefit analysis problem; the above comments are intended not to disparage their findings but to offer a caveat.

The Pennsylvania study concludes that while cost per book circulated by bookmobile is less than cost per book for MOD[4], the benefit for MOD is higher (Hu, p. 275). The derived benefit/cost ratios for total costs are .58 (.36/.62) for bookmobiles and .65 (.45/.69) for MOD service.

In the analysis of marginal costs for bookmobile and MOD services, one additional circulation for bookmobiles would cost $ .14 while an additional circulation via MOD would cost $ .01. "Unlike the case of bookmobiles, it appears practical to increase the scale of MOD operations." (Hu, p. 231) And

4 This is contrary to the experience of the North Central Regional Library in Washington, as described on p. 9.

on page 288: "...the figures used in this study may be underestimates of the actual cost of operating a bookmobile."

Perhaps the most startling recommendation in the Pennsylvania study is that advocating user charges for both bookmobile and MOD services. Pennsylvania users of both indicated a willingness to pay $ .22 and $ .21 respectively per book borrowed. (Hu, Table 8.7, p. 257)

The report on the Las Vegas Conference on Books by Mail Service (Kim, 1973), indicates the potentiality of such programs for reaching the hitherto unserved. In rural areas this unserved segment may amount to from 10 to more than 50 percent of the population, the report points out, whereas in urban areas the unserved are perhaps 4 to 6 percent ("homebound, elderly, institution-bound, and people who work during the library hours"). This is at least partially substantiated by experience in Washington state: the North Central Regional Library serves a predominantly rural population and has built an ever-growing readership, while the two centers serving individuals close to urban areas have not yet been able to elicit an equal response. In terms of circulation per catalog mailing address, the North Central system shows an average of 7 items per year against 2.5 and 3.7 respectively for King-Pierce Counties and Spokane County mail order delivery programs.

The Pennsylvania study relates a cost factor to this urban-rural balance; population density affects bookmobile costs much more than it does MOD costs. "Thus, some bookmobiles have to travel a good deal further to get a reasonable level of circulation, and thus cost per unit is very much higher for some operations." (Hu, p.204) This is not true of MOD operations: "...unlike transportation costs for bookmobiles where costs are a function of distance, postage rates are a flat rate based on weight and do not vary by distance"

(Hu, p. 204). This was paralleled by findings at the North Central Regional Library, where bookmobiles were serving the sparsely scattered population at a cost per circulation of $1.05, while MOD cost per circulation was $ .73 for the first 8 months of MOD operation and now stands at $ .64. It would seem that many people in urban districts can get to a library or at least to a bookmobile stop, and that bookmobiles are efficient in the urban situation where stops are frequent and each stop reaches more people. This present study concentrates on MOD service to the light-density rural population, plus the elderly, housebound and institutionalized in urban areas--those members of the total population who experience difficulty in reaching the library building. It is not considered that bookmobile and MOD services are competitive, but rather that they are different methods of service, with varying economic efficiency under various circumstances. It is in the rural service areas that bookmobiles have proved more costly than the MOD approach. With the onset of the necessity for economizing on gasoline, the balance may tend henceforth toward MOD service, even in more densely populated areas.

Another interesting finding of the Pennsylvania study: 62 percent of MOD users who responded to a questionnaire had borrowed from a library in no other way within the preceding year, as against 55 percent of bookmobile users giving the same response (Hu, p. 154). Of these, 71 percent of the MOD respondents and only 50 percent of the bookmobile respondents did not feel they could use a library's material if MOD/bookmobile service were not available. "If the objective of these two services is to reach the disadvantaged (meaning users who would otherwise be unable to use a library service because of distance, location, or time), then...it seems that MOD is more effective than bookmobiles" (Hu, p. 9). (The definition given for disadvantaged should be expanded to include the housebound, such as physically handicapped and aged.)

A further implication here is that MOD is not in competition with regular library service. As stated in the Las Vegas conference report:

> There is a growing evidence that both rural and urban books by mail programs are in fact helping the use of standard library services in the same and/or nearby communities. In some cases the books by mail program was instrumental in making people want a regular library in their community. Thus, the books by mail program is complementing rather than competing with (let alone replacing) the existing standard library services. (Kim, p. ii)

MOD service is a supplementary service for those who cannot avail themselves of the full service of an established library, and has also (specifically in the North Central Region of Washington) provided the inducement for development of new local libraries.

The report from the Las Vegas conference (Kim, 1973) attempts to amalgamate a heterogeneous set of attitudes as represented by the participants in that conference. Some statements seem highly questionable: "Rural reading interests are found to be largely in the areas of recreation, pleasure, home and family life." And "Urban books by mail uses reflect to a large extent the general reading interests of the regular library users in the local area where, in sharp contrast with the rural reading, non-fiction reading predominates." (Kim, p. i) Since these statements were contrary to the expressed impressions of staff in the mail order centers of Washington, as well as other library personnel, an analysis of the state's total circulation figures was made. Predominantly urban areas showed non-fiction titles to be 50 percent of total circulation, while rural areas showed 44 percent non-fiction. The disparity of 6 percent seems insufficient to warrant the statement in the Las Vegas report. Perhaps the generalization is more pertinent elsewhere; Washington has one of the highest average levels of high school completed in the nation, and the level of average grade completed does not vary greatly between urban and rural. (Exhibits 4, 5, 6, 6a). Urban areas are indicated in Exhibit 9.

Findings of the reports at the Las Vegas conference relative to costs are that staff costs may be on the average 30 percent of costs in a rural program and 50 percent in an urban program. The second largest cost factor is the collection cost (a median of 24 percent)--it is not clear whether this is inclusive of start-up cost, or whether start-up is amortized over a number of years. Third ranking cost factor is production and distribution of catalogs--a median of 12 percent of total costs. Comparable figures for Washington's MOD centers are given in Exhibit 7, with start-up figures in Exhibit 7A.

MOD IN WASHINGTON STATE

During the month of October 1973, on-site observations were undertaken at the three extant mail order centers in the state of Washington.

The internal operations of all three centers were very similar, probably due to the fact that the North Central Regional Library's early pattern had been highly successful and could readily be adapted by the more recently starting centers. There were some differences in policies on overdue materials and in files that were kept, but overall procedures were basically the same.

The staff members in all three centers were enthusiastic about their service and enjoyed the feeling of accomplishment which they derived from the work. Misgivings were expressed as to the advisability of a one-center statewide system for mail order: a question of whether size would create inefficiency, possible delay in processing so many new books, concern for special reading needs and interests for each area of the state, large backlogs of reserve lists for high-demand titles, book selection and annotation as requiring local know-how. While some of these objections have possible validity, they have not been heard from other librarians with whom the study has been discussed--which leads to the surmise that these people in the mail order cen-

ters are happy in their work and want to continue it rather than be supplanted by one center to serve the entire state.

Monthly circulation for all three centers is shown in Exhibit 8. The Spokane and the King-Pierce operations each circulate materials at a much lower rate than does North Central, which also shows a lower cost per circulation than do the first two. It seems possible that the greater throughput and experience of North Central's operation will account for much of the cost differential; though the higher rate of throughput may have implications for the usefulness of MOD services in urban or metropolitan areas.

The services appear to be successful, as judged by reports of user appreciation, continued requests, growth of allied services (i.e., reference) and demand for further local services. This success and enthusiasm are the factors which led to the request that the present study be made.

Reports on the three visits are given in Appendix A.

Under present funding patterns, all but 4.5 percent of Washington State citizens are said to be served by public libraries--which should mean that nearly all Washington citizens could expect convenient access to library resources and information services for their self-enrichment, economic well-being and entertainment. In actuality, a considerable portion of this group that might be library users are denied the opportunity to benefit from their tax investment on a fair and/or equal basis, because of domicile location or other factors preventing travel to a library.

It is the assumption of the library profession in Washington State that the totality of library information and recreation services in the state is a statewide resource which, as with the education system, should be sustained and made available equally and fairly to the maximum degree possible in the public interest, and that a continuing program should exist to enhance access

for all funded citizens to library resources. One technique for enhancing such access is the ordering and delivery of library materials by use of the postal service.

Washington librarians are agreed that while the service is not an adequate substitute for strong comprehensive in-library programs, mail order delivery service does fill a clear need for specific individuals who cannot for various reasons come into the library, and furthermore is not in competition with regular library services but instead promotes the use of the libraries' other services. It is viewed as one of a gamut of techniques which enable library materials and services to be made available on a relatively equalized basis to all citizens regardless of location. This study does not question the value of this supplementary library service; the problems addressed are how and where does it fit in the gamut of services, and how it can be achieved most effectively on a statewide scale.

STATISTICAL STUDIES

Demographic Data

Demographic factors must play a major role in any statewide mail order delivery service, as they do in library service in general. For purposes of this study, data were desired relative to the state of Washington: population spread, the urban-rural distributions, education levels, and library statistics. Since the study seeks information on possible divisions of the state into areas covered by MOD service centers, the data is related to each county, assuming that divisions will be on county lines or that other segments can be approximated from this data. The reduced data are shown in Exhibits 9 through 14, and will be referred to later in this report as their information is pertinent. Sources for this information are listed in the Bibliography.

One segment of the population which could benefit from a statewide MOD service would be those persons living in areas presently unserved by libraries. Exhibits 12 and 13 display that segment as 153,755, or 4.5 percent of the state's population; twelve counties are members of no library district, and 50 municipalities are without public library service.

In addition to these obviously unserved persons, there is in the total population a hidden unserved group who are unable to access the library even though they live in a "served" area. A substantial number of persons in areas with library service, where per capita expenditures average $5.69 statewide, are unable for various reasons (distance, disability, etc.) to benefit from the investment of their tax moneys in libraries. Mail order delivery service can enable them to exercise the privileges to which they are entitled: MOD will aid in equalizing library services among taxpayers.

For the 4.5 percent unserved shown in Exhibit 12, a state-level supported MOD system can supply some library service. For the hidden would-be users in the served areas, MOD can be a strong assist, whether state or locally-supported.

While the majority of the state's population is concentrated in the area between the Cascade Mountains and the Pacific Ocean, the majority of rural postal boxholders is located on the eastern side of the mountains. According to projections for population growth, the western corridor will become more and more densely populated as the years go by--which should mean more city delivery routes there and fewer rural routes which are currently the primary service points for MOD.[5] Thus the requests for MOD services can be expected to originate increasingly from the eastern part of the state. The areas of sparse population, where a higher ratio of people find libraries inaccessible, are the service grounds for MOD. It might well be added here that bookmobiles would seem better justified financially in urban areas where more people can be reached with few and close stops. The long distances to be covered to serve a few people in the rural areas will make bookmobiles there more costly; while this dichotomy was not spelled out in the Pennsylvania study, there are supporting implications therein.

U.S. Postal Service Data

A second set of factors, in addition to the demographic, which are external to a mail order delivery system but which must affect plans and operations of such a system, have to do with the U.S. Postal System. One of the major ingredients in a mail order system, and one of the least controllable, is the speed of postal delivery. Librarians experienced in mail order operations emphasize the necessity for consulting early and often with the local postal authorities,

5 See Exhibit 14.

to be sure that their attitudes and routines will enhance the service. There are problems of forms to be filled out for special postal rates, tactical schedules for delivering packages and catalogs to the post office, the support which can be given by postal employees who understand the significance of the library service they are aiding in, efforts which the MOD center can make to avoid causing disturbance in postal routines, etc.

To derive latest accurate information for this study, interviews were held with U.S. Postal customer service personnel in Olympia. An additional source of information was the U.S. Postal Service Instructions for Mailers.

One factor which must be considered in planning the location of any major mailing operation is the pattern of primary mail-handling points. A mail order delivery center which is located in a community served by a primary mail point, so that mail can be taken directly to a primary mail point and received directly from a primary mail point, will gain about a day in mail time over a center which operates through a secondary mail point (i.e., a post office which receives and distributes mail only after sorting at the primary point). The primary points for the state of Washington are located in Seattle, Everett, Tacoma, Olympia, Wenatchee, Yakima, Pasco, Spokane, and Portland, Oregon, and Lewiston, Idaho. Exhibit 15 shows the areas served by the main points. Actual delivery to Seattle, Spokane, and Tacoma addresses is through a separate handling rather than directly from the primary center.

Patterns of mail delivery to households is an important factor in distribution of mail order catalogs. Mail addressed to "Occupant" or "Box holder" without full address goes under a low postal rate, and also costs less in staff time for preparation to mail.

Federal postal regulations prohibit the mailing of non-addressed materials on city postal delivery routes unless the mailing source is a state, county,

or municipal agency.[6] In Washington, since library districts are special districts and not part of county government, this will prevent use of this technique for city residences unless the MOD center is a state-level organization, or unless such mailings are made under the auspices of the State Library. However, on the basis of experience in the three present MOD centers, the planning for MOD service should be concerned first with rural areas where a higher portion of the population has difficulty accessing a library because of distance. There is some question whether broadside distribution of catalogs in urban areas will be worth the expense, even if non-addressed residential delivery is used. The proportion of active user responses can be expected to be much lower than for rural areas, possibly due to the proliferation of other communication and recreation resources. This does mean that an intensive effort would be necessary in urban situations, to make the MOD service known to people who might use it so that individual mailings of the catalog will be requested. For purposes of planning catalog distribution we must be primarily interested in rural routes. The number of rural routes by county is given in Exhibit 16. Data for post office boxes are also included, though use of this means of distribution is not recommended except in rural areas without delivery services, because of the number of boxes held for commercial purposes--again, the proportion of "live" responses seems too low to warrant the expense, particularly in the more predominantly urban areas.

An approximation of potential circulation can be derived by comparing total circulation against number of households receiving catalogs. For North Central this is 109,415 annual circulation, with catalogs going to 15,624 households, or a circulation of seven items per household receiving catalogs.

6 See U.S. Postal Service, Instructions for Mailers, p. 122.412.

This projects to a statewide annual circulation of 1,408,274. Using King-Pierce figures, we have 2.5 circulations per receiving household, or a statewide projection of 502,955. With Spokane figures: 3.7 circulations per household receiving catalogs and statewide projection of 744,373.

Probably for counties which are primarily rural and those currently unserved by library districts, the ratio of 7.0 can be used, while for urban counties the figure of 3.1 (averaging 2.5 and 3.7) may be more accurate. The rationale for such a difference lies in the fact that even though households may receive mail on a rural route, in an urban county they are likely to be much closer to a library than in a rural county, and closer to urban "distractions," therefore the single factor of distance will induce a higher response from residents of a primarily rural county.[7] Using this differential and using figures for boxholders in urban and rural counties, we have Exhibit 19, giving a projected statewide rural circulation of 926,421.

To this figure must be added the urban residents who should receive catalogs because of inability to go to a library. These potential users will be difficult to reach; they will be required to take the initiative in establishing themselves as users. The MOD service must be widely advertised (this is a marketing operation) so that the housebound will become aware of its possible benefits to them. The number of such potential patrons has been extrapolated to be 152,522. Since they are so difficult to reach, the ratio actually receiving catalogs is estimated at 1/3, or 50,841. These are individuals rather than households. If we have a state average annual circulation of

7 Possibly some "rural routes" are actually suburban, and will offer low response to the catalogs. If a method is built into the MOD operation so that statistics on specific routes' responses can be tabulated, such low circulation routes might be dropped from the distribution pattern, with the individual users maintained on a personally addressed basis.

4.6 items per household receiving catalogs, and each household averages 3.1 to 4.6 persons per household (1970 U.S. Census figure for Washington State), this gives an average annual circulation of about 1.5 items per individual. The estimated 50,841 housebound individuals receiving catalogs would on this basis add some 75,000 items per year to the rural circulation figure of 926,421, for a total annual circulation figure of 1,001,421. This does not assume 50,841 housebound users, but that of these individuals receiving the catalogs, some lesser number would request 75,000 items of the MOD center.

The final postal service factor has to do with specific patterns of delivery in Washington. That is, do distances or geographic obstacles or other factors extend the in-mail transport times, and if so how much? The Olympia postmaster estimated that mail would be delivered anywhere in the state within one to three days. For an experiential test of the postal delivery times, and to gain some indication of possible differences to and from various points in the state, a set of sample mailings was undertaken. Ideally, mailings would have gone from each district library to every other district as well as within each district. However, because the three mail order delivery centers were equipped for such mailings without much prearrangement or disruption, books were sent only from each center to the home addresses of each of the directors of the district and major municipal libraries, a total of 19 addresses throughout the state. Home rather than library addresses were used to approximate the type of delivery patterns which would apply to books sent to patrons. Each package included (1) a book, (2) a return label, (3) stamps, and (4) a form for recording the date sent from the center, dates received and remailed, and date received back in the center. Three packages were sent to each address from each of the three centers, on a Monday, a Wednesday, and a Friday, to take

weekly delivery and transport cycles into account, and the mailings were completed in late October to avoid entanglement in the post office's Christmas rush. The forms used in the postal study, addressee locations, and the raw data, are given in Appendix B.

Most of the library directors received their mail by residential rather than rural route delivery. However since there is no indication of a differential between city and rural delivery times, the figures are used to indicate in-mail transport periods for general areas of the state, whether addresses are urban or rural. In this and other interpretations of data, which are similarly indicated in this report, the investigators adopted a Bayesian approach, adding to the sample data further information already possessed about the sample, putting experiential data into the inferential process.

Comparing the mail times to the entire state from each of the three centers, no statistically significant differences appear: any one of the operating centers (or presumably any other primary mail point operation) will serve equally well to get materials out to patrons quickly in terms of mail times.

The mailing time from each center to home addresses throughout the state averaged two days for each center with 95 percent of the items arriving at destination within four days. The return times were longer, averaging three days for each center with 95 percent of the items delivered within six days at King-Pierce and Spokane and within eight days at North Central (Exhibit 20). The differential between outgoing and incoming mail times is presumably a reflection of the centers' systems for delivering outgoing packages to the post offices (all primary distribution points) at scheduled shipping-out times, compared with delays in residential pick-up and transport of the return packages.

It was hypothesized that the Cascade Mountains dividing the state from north to south might be such an obstacle to mail transport that the establish-

ment of one center for serving the eastern side and one for the western side might be mandated on the basis of delivery speed alone. This hypothesis was only partially supported by findings. Separating the recipient addresses into those east and west of the Cascades, Exhibit 21 shows mail patterns. The figures for North Central and for Spokane show no statistically significant differences; both are on the east side of the mountains, and means for the east side (3.1 and 3.2 days) and for the west side (5.2 and 5.4 days) are very similar. The mean times for King-Pierce, however, do show statistically significant differences from those for the other two centers. King-Pierce's mean mail time for the east side is 4.6 days, a significantly larger figure than those for the two eastern centers ($1\frac{1}{2}$ days longer, which means two full days with mail delivery only once per day), and for the west side is 3.6 days, a significantly smaller figure than the other two (again, a difference of two days mail time saved). These two days are absorbed by both the outgoing mail to patrons and the packages returned from patrons--the returning mail times are actually important only when a title has a reserve waiting list; otherwise, an extra day or two in the mail transit will have no effect on circulation of the item or operations at the center.

Analyzing outgoing mail times from the three centers to locations east and west of the Cascades, ignoring return time, we find no statistically significant differences among the service times of the three centers to all the state. Similarly, when tested for service to addressees on the eastern side of the state, there is *no* statistically significant difference among the three--that is, each of the three would serve the entire state or the eastern side of the state equally well. When tested for service to the western side of the state, one comparison did show as slightly significant: that between King-Pierce and Spokane. Both King-Pierce and North Central would achieve

delivery to patrons on the west side of the mountains with no statistically significant difference in time, but calculations indicate that Spokane would deliver in a significantly greater time. The term statistically significant must be emphasized; the mean difference is actually only one day. This may or may not be considered significant by the administrators making the final decision as to MOD service configuration for the state. Certainly it is not weighty enough to carry the decision alone, other pieces of evidence must be taken into account and may be much more influential in the decision.

An assessment was made of whether the delivery times within the immediate areas of the three present centers are sufficiently better to warrant an inclination toward the establishment of an MOD center for each library district. Again, the statistical evidence is inconclusive. The mailing times for the three centers within their own areas were combined; Exhibit 22 shows the data. No significant difference was found between the time for delivery in the local area and time for delivery on the same side of the mountains for each center. For each of the three centers, time for a book to be delivered to the patron in the local district is slightly improved over the time for a book to go elsewhere in the state. However, since all the average times are more than one day and less than two, they would all predict a two-day transit time for 50 percent of the patrons; practically speaking there is no difference. Taking standard deviations into account, we can see that for service to the entire state from any one of the three centers, 68 percent of the packages will be delivered within three days and 99 percent within four days. For the local area, 95 percent will arrive within two days and 99 percent within three days. Again, this one day differential may or may not seem significant to decision-makers; it is simply additional information on which to base the final choice.

Cost of service might be weighed more heavily than whether 50 percent of the patrons have to wait an extra day for their books.

While there is evident a gradation from the rapidity of delivery within the local area, to a bit slower throughout the center's side of the Cascades, to the longest times being required for points beyond the mountains--still the averages differ by only one day, and the aberrations for longest times in transit seem to relate not at all to distance (or any perceivable factor--random occurrences in the postal system are a rational explanation).

Analysis of the test mail data leads to the finding that there are no clearly significant differences in the dispatch of mail from any of the primary postal points in the state to serve the entire state, merely some shades of difference which might or might not pertain in the final weighting of pros and cons for choosing the MOD service configuration. The tentative conclusion must be that if other factors point to the wisdom of establishing two or more MOD centers to serve the state, at least one should be located east and one west of the Cascades. However, if one center seems most cost-effective, then the degree of cost differential to speed delivery by one day to cross-mountain patrons must enter the final decision on number of centers. And if one center is to be the final choice, then location should depend on costs for space and personnel in various primary mailing points of the state, and the location of most of the population it will serve.

Cost and Work Flow Data

Exhibit 23 shows a comparison of data relative to circulation and cost for each of the three presently operating MOD centers in Washington state The last column offers rough estimations of data for a statewide operation. The total annual circulation figure for statewide MOD service was developed on

the basis of rural delivery services and estimated housebound users (Exhibit 19). The calculation of circulation per household and per individual addressee is based on experiential data from the three MOD centers, as are the ratio for items per package mailed, the number of items processed annually per employee, and the cost per circulation. It should be noted that calculations are based on a paperback collection; the addition of other materials such as films and cassettes will increase costs.

Exhibit 25 gives expenditures ratios for the three Washington MOD centers during 1973, broken into major categories, and Exhibit 7 displays the proportion of each against each dollar expended. The statewide estimated expenditures shown in the final column of Exhibit 25 are derived from estimated data in Exhibit 23 and experiential data in Exhibit 24. There is considerable risk in extrapolating from the experiential data, since the proposed statewide service would experience a work flow about ten times the magnitude of North Central's. For example, average salary per employee was calculated at $7,000; this may be low, since such a large operation would require a higher-salaried manager. At the same time, the ratio of clerks to administrators might be higher than in a smaller operation. Again, the discount received on book purchases is not definite and would only become precise as actual negotiations with vendors ensued; an additional ten percent (perhaps too low) was used as increased discount for large annual purchases. Supplies and miscellaneous were estimated on a rough ratio of the total expenditures. Postage for North Central comes to an average of $ .30 per package and this figure was used for postage costs. Catalogs for both North Central and King-Pierce cost $ .054 each; this might be reduced to $ .045 on the basis of 251,182 copies, four times a year.

Data on internal work flow and times for operations were supplied by the three MOD centers. There has been an attempt to remove from the King-Pierce data the times for handling cassettes and films, as these are more time-consuming than paperbacks and the other two centers do not circulate these materials via MOD, except as special requests. The work load data supplied by the centers is used in the simulation model, and derived time data is used to establish functions for modeling the statewide system.

SIMULATION

The problem to be solved is essentially one of an organization's performance to achieve stated objectives within specified constraints: minimum cost for specific performance, maximum performance for specified cost, or some optimum balance. Often the problem is extremely difficult or impossible of solution by conventional techniques. Analytic approaches are effective but it is not unusual that in such approaches the problem is oversimplified or the necessary data unavailable. The use of intuition is sometimes resorted to, with obvious shortcomings. Often it is inadvisable or impossible to test a set of alternative systems in practice or to perturb an existing system in order to compare results.

A better approach when system indefinition exists and information is difficult to obtain directly is to attempt to construct an analog, a computer model with which a real world situation can be simulated and the action of different system variants compared. Simulation may be a useful tool when design problems are complex, poorly defined, and mathematically unpleasant. Complexity usually arises from the relationship between the components of a system and the process algorithm; that is, the interdependency of components and state variables cannot be fully described by analytical expressions nor

reduced to easily solvable functions. Purposes and procedures in the system are inadequately understood and considerable study is necessary to reach a definition as to the essentials of the system. Such study may be not feasible because of concomitant time and money expenditures. Mathematical unpleasantness is apparent in both the difficulty of expression necessary for analysis and in the inadequacy of available data. Inappropriate data is usually abundantly available; useful data is scarce and there is always some doubt as to its accuracy.

Simulation is a tool and the use of it is an art, demanding constant effort on the part of the analyst/designer to understand the problems, goals, and energy expenditures needed to effect an efficient or useful-in-context system. Computer simulation can aid in problem definition, factor relationships which influence design, measure sensitivity of the design to the change of system load parameters, predict alternative systems' performance, and aid in selection of final design from among alternatives.

The representation of the system, the dynamic analog, its rules and relationships, is defined as the model. The exercise of the model under various specific conditions is defined as simulation.

Model construction forces the designer to state explicitly his understanding of the system. Once a coarse model of the overall concept has been established, even though system insight be weak, by using speculative data ranging over the expected operational spectrum, areas of sensitivity can be noted as well as modifications necessary to bring system performance to specifications. By using the same work load and the same time interval, and altering process algorithm or construct, alternative systems can be compared by reference to work output levels. Or, as in the present study, an ideal

system can be constructed from existing operations and the effect of increased work loads can be observed, comparing alternative levels of load.

Once the model has been developed and confidence established that it is a valid description of the real system, then a series of parametric simulations can be run to gain understanding of system behavior and to gain feeling and insight into the effect of proposed changes that only system manipulation and operation can otherwise provide. Through the use of simulation, this exploration can be undertaken while the redesign is still a paper concept.

For the purposes of this study, the mail order delivery model was constructed on the basis of data derived from the three existing MOD centers in Washington State. Processes and functions were observed and discussed with the staffs, and work flow diagrams drawn up (Appendix C). Procedures at the three centers were sufficiently similar for construction of a common model. King-Pierce handles a variety of media; the model reflects book service only, since this is a common denominator and the relative costliness of other materials probably excludes them from a start-up program for statewide service.

On the basis of information supplied by the centers, a set of data on each center was built: quantities of orders and packages, and ratios of types of requests (items listed or not listed in the printed catalogs, items with reserve waiting lists). Each center supplied the times for processing each step of the operations. Design of the model permits these blocks of information to be interchanged in sequential computer runs.

The model was coded in Flow Simulator (FLOSIM), a Univac adaptation of IBM's General Purpose Simulation System (GPSS), and was run on a Spectra Series 70/45 computer. FLOSIM performs logical operations to simulate the flow of transactions (in this model, orders, books, and packages) through

facilities (workers and machines) in processing steps related to time units. Thus the model shows incoming packages and orders, the filling of orders for various types of requests and packing and shipping. The program listing is given in Appendix C; functions for rate of requests and packages and for processing times were calculated, coded, and input for each of the modeled situations.

First runs of the computer model simulated present MOD operations:

1. North Central Regional Library
2. King-Pierce County Libraries
3. Spokane County Library

Comparison of the results of these three runs with actual operations of the centers provided validation of the model. To determine the most efficient operation for use in the simulation of all-state service, the procedural times for each of the three centers were simulated against a standard workload. The workload for North Central was used as a standard, so that run 1 provided the needed results for North Central.

4. King-Pierce County Libraries work times against standard flow
5. Spokane County Library work times against standard flow

Comparing the results of runs 1, 4, and 5 showed that the operating procedures and times of the MOD center at NCRL required fewer personnel to cope with the standard throughput. Therefore, the model incorporated these procedures and times for simulating the hypothesized configurations of state service, with workloads calculated on the basis of demographic data and experience of patron response at the present MOD centers. The following runs simulated the statewide service situation, each for one center to serve the area designated. These divisions were drawn so as to balance somewhat the populations served by the centers. See Exhibit 26 for delineations of these areas.

6. All state

7. Area east of Cascade Mountains (East, W & E)

8. Area west of Cascade Mountains (West I, N and S, and West II)

9. Northern section of west side of state (West I, N & S)

10. Southern section of west side of state (West II)

11. Northeastern part of area described in 9 above. (West I, N)

12. South and west part of area described in 9 above. (West I, S)

13. Eastern section of east side of state (East, E)

14. Western section of east side of state (East, W)

15. 1/14th of state: average operation for 14 centers covering all the state

Since each of the present district libraries is a possible service center for its own district, their hypothetical operations were modeled. It should be noted that some areas of the state remain unserved under this pattern, since the districts do not cover all the state--run 15 is not a representation of the average district operation. The three present MOD operations were not included in this final group of simulations.

16. Asotin County Library

17. Fort Vancouver Regional Library

18. Kitsap Regional Library

19. Mid-Columbia Regional Library

20. North Olympic Regional Library

21. Sno-Isle Regional Library

22. Timberland Regional Library

23. Whatcom County Library

24. Whitman County Library

25. Yakima Valley Regional Library

Each computer run simulated the operation of a specific MOD center for a period of a month. At the end of the run, printed output reported on the condition of the model. Sample computer outputs are shown in Appendix C.

Personnel requirements for the functions modeled are calculated from the facility tables. An average of .7 utilization as a full-time equivalent for each of the facilities (employees) in the computer model is conventional for personnel calculations. This allows a margin for non-productive activities, and experience in operations research has shown this to be a valid ratio. Therefore, the sum of utilization of all facilities for a given process is divided by .7 to derive the number of staff needed for the function. The model does not include tasks related to acquisitions, catalog production, and administration. Because these supporting functions (with the exception of administration) are possible candidates for vendor contracts, and because they are not complex mathematically, they were analytically modeled rather than incorporated in the dynamic computer model.

Exhibit 27 shows the man-years required for each of the configurations modeled. Column A gives man-years as developed in the computer model, plus administration; column B shows man-years as needed if all support functions (selection, ordering, receiving, processing, catalog production, and mailing) were to be accomplished at each center rather than centralized or contracted to a vendor. If centralized, support functions for the entire state, with up to five centers in operation, would require seven man-years.

Thus one decision factor is somewhat clarified: if a vendor bid for one or all of the support functions is less than the costs projected for those functions, then there are financial advantages in a vendor contract. In other words, for centralized support functions the costs can be projected:

salaries	$ 49,000
catalogs	80,000
postage	94,000
supplies	5,000
space costs	1,000
	$199,000

Therefore the center's manager should seek a vendor who offers to supply the functions of ordering, receiving, and processing new materials, and producing and mailing catalogs--all for less than $199,000. Similar tables can be constructed for the separate functions, on the basis of data in Exhibits 23, 28, 29. Since the investigators were not in a position to ask vendors for solid bids on such contracts, comparative costs are not given in this report. However, if the decision is made to establish mail order centers, this is a major factor which could be readily defined for purposes of staffing and contract decisions. There are indications from at least one reputable vendor that an attractive arrangement could be made. If selection and annotation are contracted to a vendor, the administrator of this operation need not be a graduate librarian, but could be a manager reporting to an overseeing board of librarians.

Exhibit 28, derived from the projected loads for each of the simulated centers, shows the projected costs for statewide MOD service for situations of one to fourteen centers. Estimated costs rise as the number of centers increases, with the total circulation held constant.

Since the district library directors of Washington were interested in the possible establishment of district MOD centers (a desirable alternative in terms of local user-library relationships), the computer model was used to simulate the ten hypothetical MOD operations. Sets of data were developed on the basis of demographic information for each district, with the same task performance times as were used in the simulation of the statewide operation.

Manpower estimates for the districts were derived from the computer output; these estimates are shown in Exhibit 27. The total staff to serve the districts (including present MOD operations) totals 52 man-years: sixteen more than needed for one center to serve the entire state. Additionally, as can be seen in Exhibit 28, even with support tasks centralized, the cost of the district centers is estimated to be $683,400--$72,700 more than one center serving the entire state and $65,600 more than two centers.

It must be noted that the data for the statewide operation includes all citizens of the state, while these for the districts include only citizens in the areas currently served, excluding patrons of municipal and association libraries, counties not included in library districts, and the 4.5 percent of unserved citizens. If the total projected statewide circulation were allocated among the fourteen districts, to compare with the situation of one to five centers serving the entire state, a model representing the "average district" shows that fourteen centers serving the entire state would require a staff totaling 63 man-years (Exhibit 27)--27 more than needed for one center and 20 more than for five centers serving the state. Estimated costs would be $718,500--$107,800 more than one center, with support functions centralized so that the fourteen centers serving the entire state would require a staff of 42--thirteen more man-years than for one center and nine more than for five.

This information should assist in defining optimum approaches to mail order delivery service for the state of Washington. Should decision-makers require additional information which the model can supply, the computer program is stored and is readily available for further exercising. For example, if the administrator of one of the present centers should consider expanding its area of service, new traffic data can be input to the model to forecast personnel

needs for the added load. Or if procedures are to be altered, the model can be adjusted to reflect the change and its effect. Furthermore the model can be used for other states or regions, with data based on local information, and is readily translated into other versions of the GPSS language.

It is not possible to generalize comfortably to other states' situations vis-à-vis optimum mail order delivery patterns. There is considerable evidence that a single center would be most efficient in many instances (state or region of several small states). However, the major factors present in Washington may fall into different relative perspectives in other states, with values that result in different decisions. The model can be used in a variety of situations; the input data must be derived for each in terms of demographic, library, geographic, postal, etc., information. It is necessary to rewrite or modify the model itself only if some different pattern of operations is planned. The procedures modeled are basic to the form of mail order delivery operation envisioned and practiced in Washington.

CONCLUSIONS

This study has investigated methods for providing mail order delivery of library materials to many citizens who cannot ordinarily access a library. Such a service would utilize special facilities: work area, staff and collection, with presently established libraries as backup for titles not included in the printed catalog sent to patrons. The catalogs would be mailed quarterly to rural route addresses and to other individuals who might request the mail service.

It was anticipated that one or a few centers could serve the entire state more efficiently than could one in each district library or some similar multiple set. Centralization should result in economies of scale in the areas of collection costs (greater discount for larger annual purchases) and catalog production (annotations cost less when made only once per title, and printing costs per copy are greatly reduced in large quantity production). The budget items for staff salaries and physical facilities should also show economies in a large centralized MOD operation, compared with a number of smaller operations. Heavier traffic should permit more efficient use of personnel in the organization. Space for a given number of books (say 200,000) should be less if they are shelved in one continuous area than if each of ten locations stores one-tenth of the books, given that some surrounding space is necessary in each location for staff operations and movement of personnel.

The investigators did find that estimated costs increased as more centers were introduced. One center could serve the entire state at an estimated annual cost of $610,700, while the estimated cost for two centers would total $617,800, and for five centers, $643,100. There are of course other factors to be considered in the decision, such as a slight time lag in delivery (one

day, for 50 percent of the patrons on the opposite side of the Cascade Mountains from the center).[8] The individual library might enhance its local image by mounting such a special service--this factor must also be weighed in the decision balance against the fact that separate district MOD services, not covering the entire state, would cost an estimated $683,400 per year.

One of the major components of the proposed mail order service is the printed catalog. Minimum cost per copy is important, since the provision of four catalogs a year to some 250,000 addresses throughout the state is one of the largest segments of the budget for this service. A promising approach to this problem is that of vendor service. At least one paperback vendor advertises his services as catalog producer for mail order operations. This question was beyond the scope of the present study, but it seems probable that such commercial services might prove more economical than MOD-center-produced annotations and catalogs; this possibility should be investigated. The catalog cover sheets could be printed separately for various districts, to advertise specific libraries or offer other information applicable to that area. The vendor could also mail catalogs directly to patrons.

Procedures for receiving books and preparing them for the shelf should be kept to a minimum. Processing can consist of no more than an ownership stamp and an identifying number for each title; a vendor could provide shelf-ready books.

Selection of titles might also be assigned to a vendor. While a librarian can perform selection expertly, this seems an overqualified level of personnel

8 It is reasonable to assume same-day mailing of a requested book, if that title is on the shelf when the request is received. Subsequent to the internal efficiency of the mail order center, speed of delivery to the patron is dependent on the U.S. Postal system.

for the task. The character of the MOD service is such that current demand is the major factor in title selection, rather than the librarian's usual criterion of long-term collection building. Since all books in all libraries are backup for the MOD center(s), the MOD collection(s) can contain only those titles listed in current catalogs; that is, the collection should consist of much-in-demand current titles, subject to constant weeding as titles cease to move. A vendor in the course of his own management must maintain awareness of the probable demand for various titles; book selection for the MOD collection might be assigned to such a vendor on the basis of a profile establishing proportions of various types and subjects of books. Adjustments or special requests could be made from time to time; this procedure might well prove efficacious and less costly than the time of a librarian.

Should the directors decide in favor of local MOD operations, and should vendor contracts prove unfeasible, there are still some methods which can help hold costs to a minimum. Economies could be realized through the establishment of an ordering and processing center for the state, with materials and catalogs shipped from that center to as many MOD centers as are wished. That is, a vendor would give a larger discount if all orders were placed from one location. A central processing operation should increase efficiency, by readying many copies of the same book for the shelves and providing one annotation to be used by all centers. A uniform catalog to be used by all MOD operations would result in considerable savings; preparation of separate catalogs would increase total annual costs by an estimated $7,000. Sharing one catalog necessitates a uniformity of book ID numbers and some standardization of procedures. The major objection here will be that selections and annotations made for statewide con-

sumption do not serve the local readership as well as those made by a knowledgeable local librarian; these tasks might be rotated among participating libraries.

When a request arrives for a title not in the mail order collection, there are at least two main alternatives:

a) refer the request to the library nearest to the center and most likely to hold the title;

b) refer the request to the district or municipal library nearest to the patron.

The first alternative would lead to an overloading of certain libraries; the second would spread the load, with the district or municipal library either filling the request or referring it through customary channels. Another alternative, that of purchasing the title for the mail order collection, should be considered in light of the fact that this may be the first of a number of requests for the same title.[9]

Automatic ordering of many duplicate copies for every title, as is done in some MOD centers, is wasteful when there are methods for analyzing demand in advance, and thereby varying the number of copies bought between, say, 2 and 20. The three MOD centers in Washington State report that many titles never have more than two or three copies in circulation at one time.[10] Thus for these operations three copies might be the standard order quantity for new titles. Weekly analysis of reserve lists could indicate the need for acquisition of more copies of the most requested titles.[11] The pattern of paperback publication permits foreknowledge of the popularity of most titles, since

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9 Whatever method is adopted, a notice should be sent to the patron, explaining the situation and approximate delay time.

10 The centers also report that only 10-13% of requests were placed on reserve waiting lists.

11 Management information for this decision could be derived through computer modeling (Arms, 1974).

the market behavior of the same titles in hardcover is evident during the previous year. Also, there are lists of best sellers in paperback--the New York Times Book Review Section, for example, which are strong predictors of high demand titles. A conservative policy on duplicate copies would seem advisable, with reliance on local booksellers or telephone/airmail for acquiring extra copies to meet unexpected demand.

Library operations, in general, would benefit from applications of marketing techniques--and this is especially applicable in a mail order delivery operation. The display of wares for the public's choice has an obvious parallel with a mail order catalog, and the MOD center's operation closely resembles that of a mail order warehouse. The profit motive is lacking, but the basic purpose of moving as much merchandise as possible pertains in both instances. Librarians planning and managing such an operation might investigate techniques and theories used in the business world--for example, it should be possible to analyze the "reader market" as an onward-developing situation, to gather information for decisions on types of materials to be stocked and ratios of quantities of various categories of fiction and nonfiction. A wealth of research exists in the world of profit organizations; librarians could gain by use of these findings.

One example of such an approach is reported in Operations Research (Anderson, 1974), addressing the problem of optimal choice of brands and brand display in a supermarket, analogous to choice of types of materials and catalog display of library materials in a mail order delivery operation. A model is developed in the cited research; with adjustment to eliminate effect of the profit motive (the model advocates extra space for those brands with higher profit), such a model could be adapted to assist on-going selection of

materials for the collection as well as space allocated in the printed catalog for various types of materials.

Librarians have been loath to merchandise aggressively, apparently feeling that the genteel modest posture is sufficient for selling a product which is so incontrovertibly a basic good. The techniques of the commercial world can be adapted to library use; see Frederick Glazer's "Selling the Library" (Glazer, 1974). And there is no more obvious or natural place to apply these techniques than in the mail order delivery operation, where we do not meet the "customer" face to face but must rely on our powers of advertising and forecasting to build demand and to provide adequate quantities of the materials which will be most heavily demanded.

The user's viewpoint should be analyzed, as in any selling effort. In the present study, this omission has been due to lack of manpower rather than lack of desire; a telephone survey was considered early in the design of the study (though house-to-house interviews would have been preferred for validity of findings) but abandoned because of the magnitude of the effort required. It is hoped that such an evaluation will be made at some future date; the findings can be very valuable in future decisions as to MOD operations, even after the larger organizational decisions based on this study have gone into implementation. Such a user survey could contribute toward improvement of communications via the catalogs and toward more patron-oriented book selection.

The computer model of mail order delivery operations provided printouts too voluminous to be reproduced in entirety in this report; for readers who wish further information, copies of additional computer output are available from the investigators.

The model has further potential utility, as plans for statewide MOD service become more concrete. Thus, if one of the present centers is to be

expanded to serve other areas of the state, the model can simulate that expansion to aid management decisions prior to operation. Or if additional information becomes available regarding demographic, postal, or other data, the model can be adapted to the new knowledge and adjusted results provided. Furthermore, subsequent to the establishment of a MOD service, the model can be employed as a tool in on-going evaluation of the operations. There is also the possibility of adapting or rewriting the model to a change of operational systems so that a different approach to MOD service can be reflected and the effects be predicted.

The analytic tools of this study, including computer simulation, should be applied in periodic evaluation of any MOD operation which is established.

RECOMMENDATIONS

- One MOD center to serve the state will effect cost savings over multi-centers and provide good postal delivery time; political factors such as the local library's role may necessitate some modification of this pattern.

- Vendor services should be investigated in the areas of book selection, processing, annotation, and catalog production and mailing. Catalogs can be localized by inserts or by varying the cover content for each separate service area; the all-state catalog can be accomplished either by a vendor or by low bidding printer, regardless of the number of operating MOD centers established.

- If more than one MOD center is established, and no vendor is used, all possible operations should be centralized, including selection, ordering, processing of books, annotation, and production and mailing of catalogs.

- Prior to start-up of an MOD operation, considerable discussion should take place with personnel at the post office which will be handling the mail, to insure cooperation and coordination on the part of both the MOD center and the post office.

- In advance of establishment of an MOD service, the potential patrons should receive explanatory promotional material, so that they are alerted to the receipt of non-junk mail via the "Boxholder" mode of address.

- The MOD catalog should clearly state the pattern of catalog issuance, so that patrons will understand the length of time during which the titles in each catalog will be available, and when new listings can be expected to arrive.

- Catalogs should be mailed at a steady rate in small quantities so as to smooth out the response load for the staff.

- Four catalogs per year, containing about 500 titles each, seems about the rate and quantity of material to satisfy most users. Flyers listing newer titles should be inserted in each outgoing package.

- The MOD catalog should strongly emphasize the availability of materials not listed in the catalog, so that patrons whose reading tastes go beyond the regular MOD collection are encouraged to request other items.

- Titles not listed in current catalogs should not be held even though they might be requested by a few users per year; these should be transferred to a regular library or libraries, and sent from there as interlibrary loans if requested. From a cost viewpoint, every title in the MOD collection must be in some demand in order to justify its shelf space.

- The possibility of working out a "McNaughton Plan" arrangement with a vendor should be investigated, to obtain some credit on discarded books.

- Duplication of each title should be held to the minimum necessary to respond to requests without undue delay.

- The heavy emphasis on "popular" recreational reading by present MOD centers should be questioned; regular libraries of Washington State report that about half the circulation is in non-fiction titles, and it can be assumed that MOD users will follow the same pattern.

- Manual files in any MOD operation should be kept to a minimum. Reserve procedures and overdue routines are two area where simplification should be emphasized. Permissive borrower rules can ease the overdue and fines problem.

- Staffing pattern should permit same-day response to all requests for on-shelf items.

- Utilization of professional librarians should be minimized; the work of the MOD center can be accomplished largely or entirely by non-professionals.

- Once MOD service is established in an area, follow-up efforts should promote the full gamut of services available from local libraries -- or, in unserved areas, promote the development of local library service.

- Further investigations are needed in such areas as analysis of user needs, vendor services, alternatives in catalog production, collection analysis, optimum number of duplicate copies per title, evaluation of marketing techniques.

- Provisions should be made for on-going evaluation of the MOD operations, utilizing and adapting the model constructed for this study as well as more conventional techniques.

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E X H I B I T S

Exhibit 1

CIRCULATION AND COST COMPARISONS

Library	Monthly Circulation	Cost per Circulation
Wyoming County Library System, New York (1972 figures)	1,761	.73
North Central Regional Library, Washington (1972 figures)	8,132	.61
Dodge County Library, Wisconsin (1972 figures)	229	.60[1]
Vermont State Library (July 1972 - March 1973)	3,233	.68
Bur Oak Library System, Illinios (June 1971 - December 1972)	1,990	.65
Corn Belt Library System, Illinios (April - December 1972)	930	.87
Rolling Prairie Library System, Illinios (February - December 1972)	1,275	.63

Source:

Hu, Teh-wei, Bernard H. Booms, and D. Lynne Kaltreider. A Benefit-cost Analysis of Bookmobiles vs. Books-by-Mail in Pennsylvania. Tables 6.12.

[1]No special collection or staff

Exhibit 2

MEAN COST PER CIRCULATION

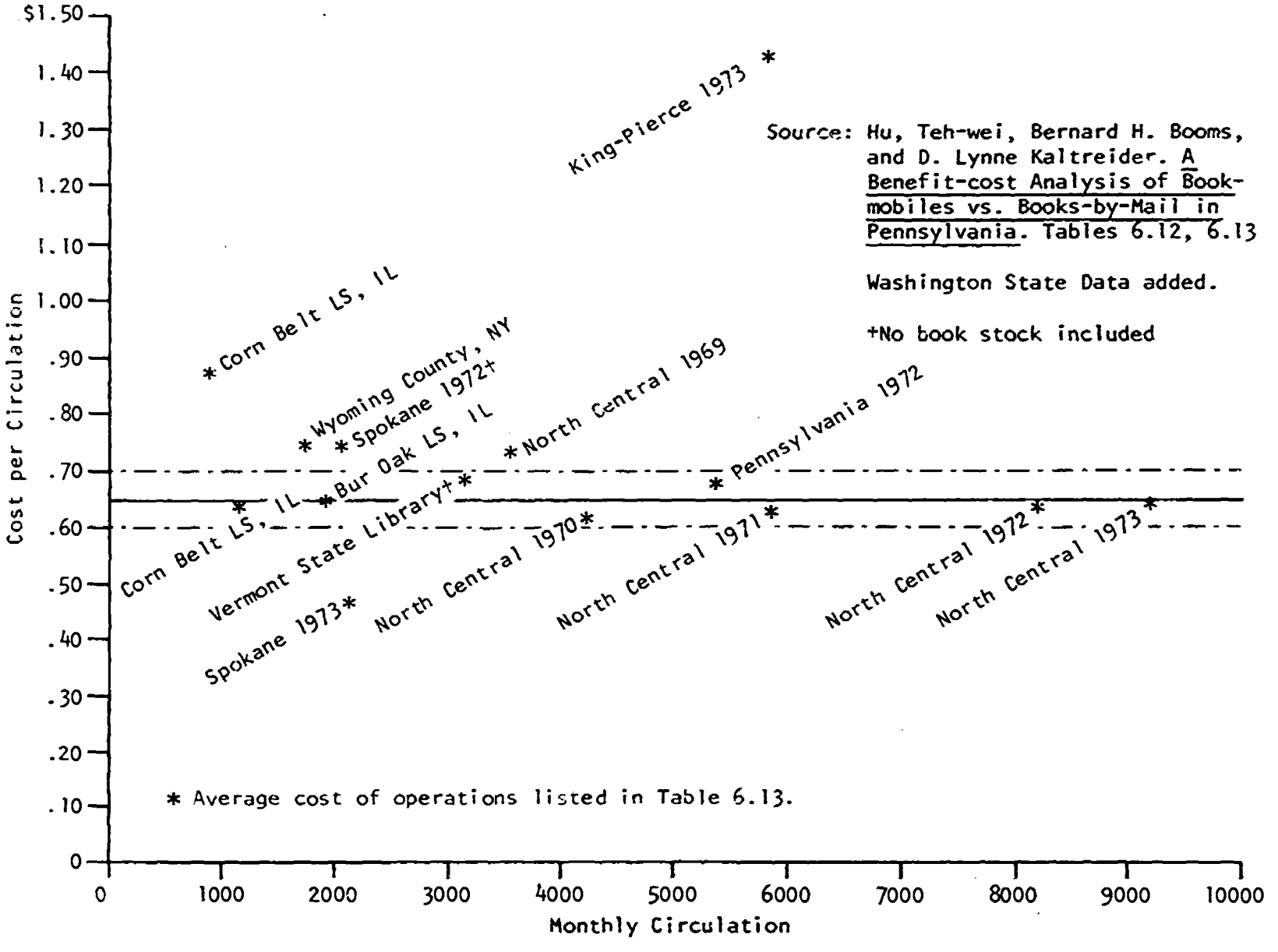
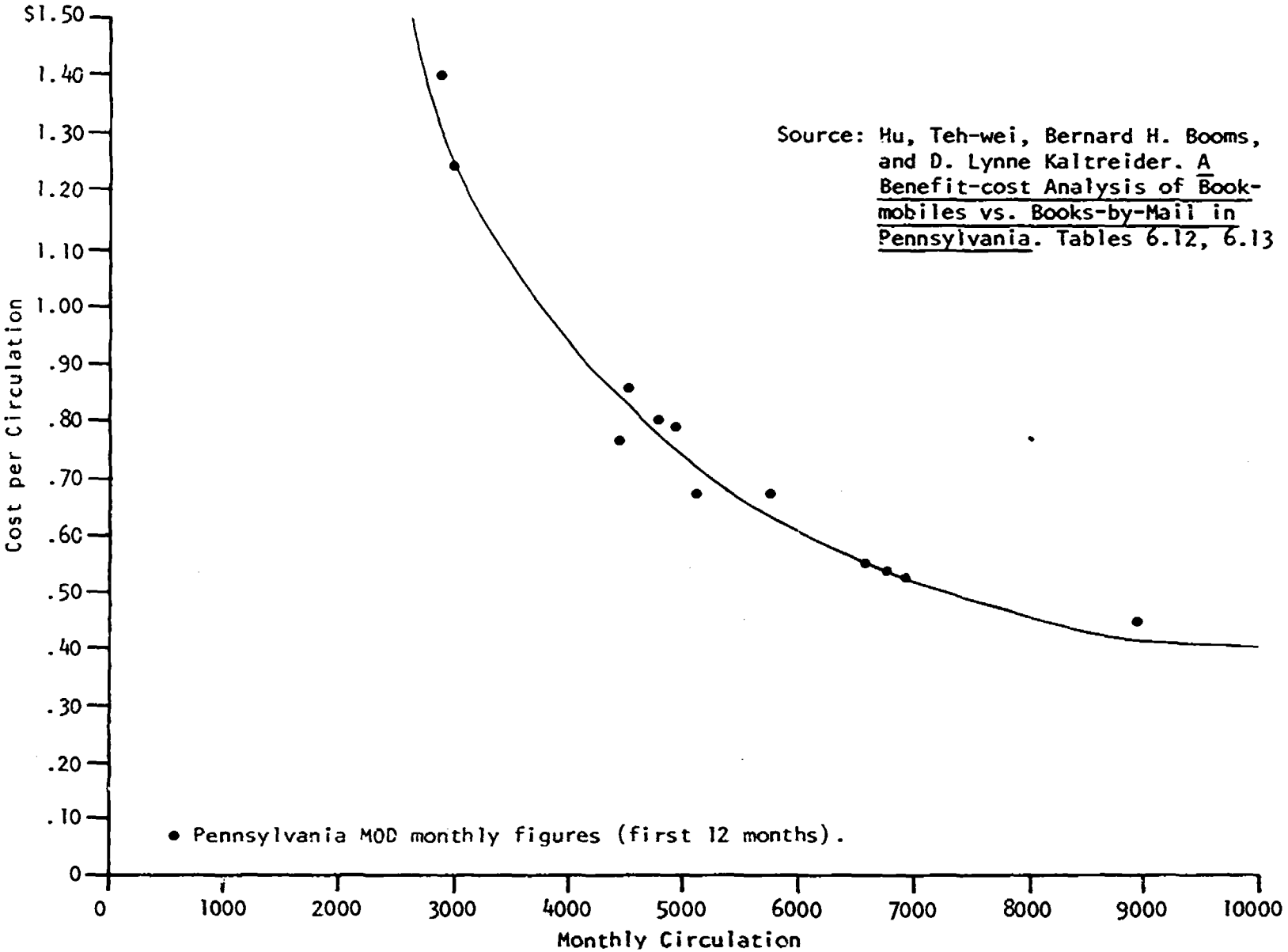


Exhibit 3

PROJECTED RELATIONSHIP BETWEEN COST AND CIRCULATION



Source: Hu, Teh-wei, Bernard H. Booms, and D. Lynne Kaltreider. A Benefit-cost Analysis of Bookmobiles vs. Books-by-Mail in Pennsylvania. Tables 6.12, 6.13

Exhibit 4

WASHINGTON STATE
PUBLIC LIBRARY CIRCULATION OF
FICTION Vs NON-FICTION
IN 1972*

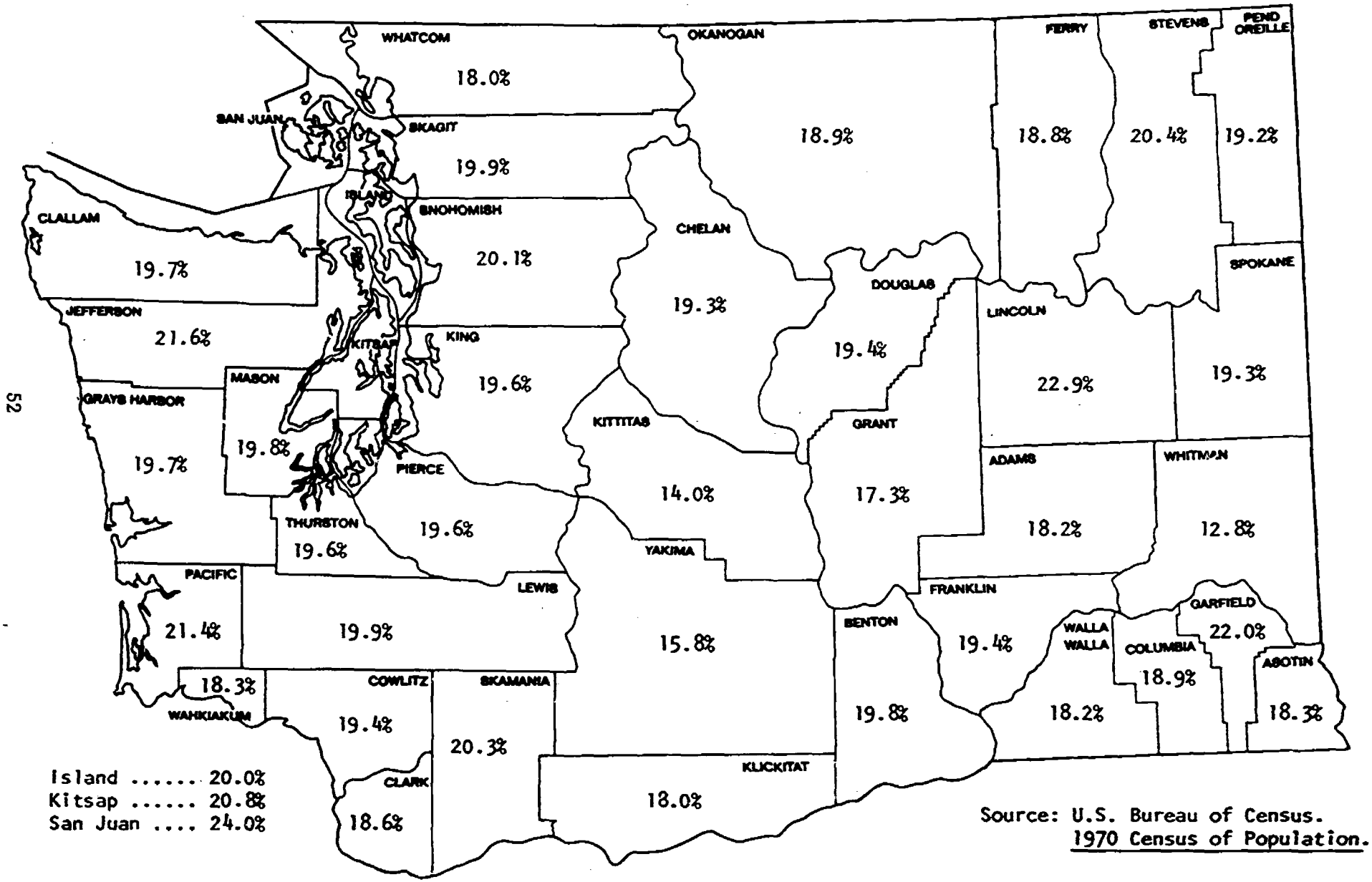
LIBRARIES SERVING:	RURAL COUNTIES		URBAN COUNTIES	
	Fiction	Non-fiction	Fiction	Non-fiction
Over 100,000 population (5 libraries)	52.9%	47.1%	47.2%	52.8%
25,001 to 100,000 population (3 libraries)	48.5%	51.5%	54.8%	45.2%
5,001 to 25,000 population (17 libraries)	56.8%	43.2%	57.2%	42.8%
Under 5,000 population (31 libraries)	68.5%	31.5%**	48.3%	51.7%
GRAND TOTALS	55.9%	44.1%	48.4%	51.6%

* Many libraries do not maintain separate circulation records for fiction and non-fiction. These statistics represent 56 of the 81 public libraries reporting to the State Library. (Missing are 7 of 12 in over 100,000 category; 4 of 7 in 25,001 to 100,000 category; 1 of 18 in 5,001 to 25,000 category; and 13 of 44 in under 5,000 category.)

** Although not investigated, it can be assumed that in many instances, higher circulation of fiction in the rural counties reflects an inability to purchase a wide variety of titles to keep a non-fiction collection current.

Exhibit 5

PERCENT OF COUNTY POPULATION (25 YEARS OF AGE OR OLDER) COMPLETING FOUR YEARS OF HIGH SCHOOL

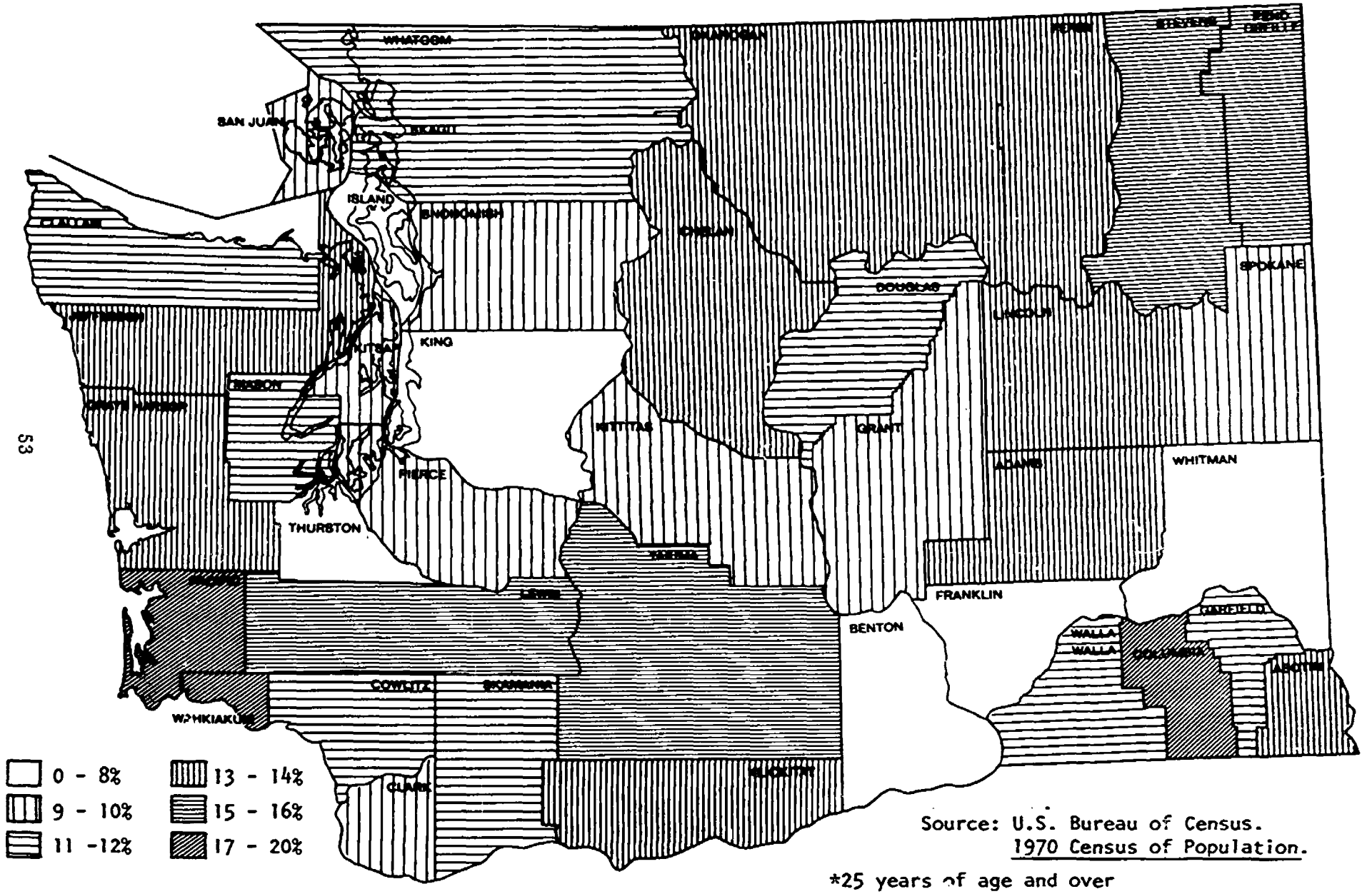


Island 20.0%
Kitsap 20.8%
San Juan 24.0%

Source: U.S. Bureau of Census.
1970 Census of Population.

Exhibit 6

PERCENT OF COUNTY POPULATION COMPLETING ONLY EIGHT OR FEWER GRADES*

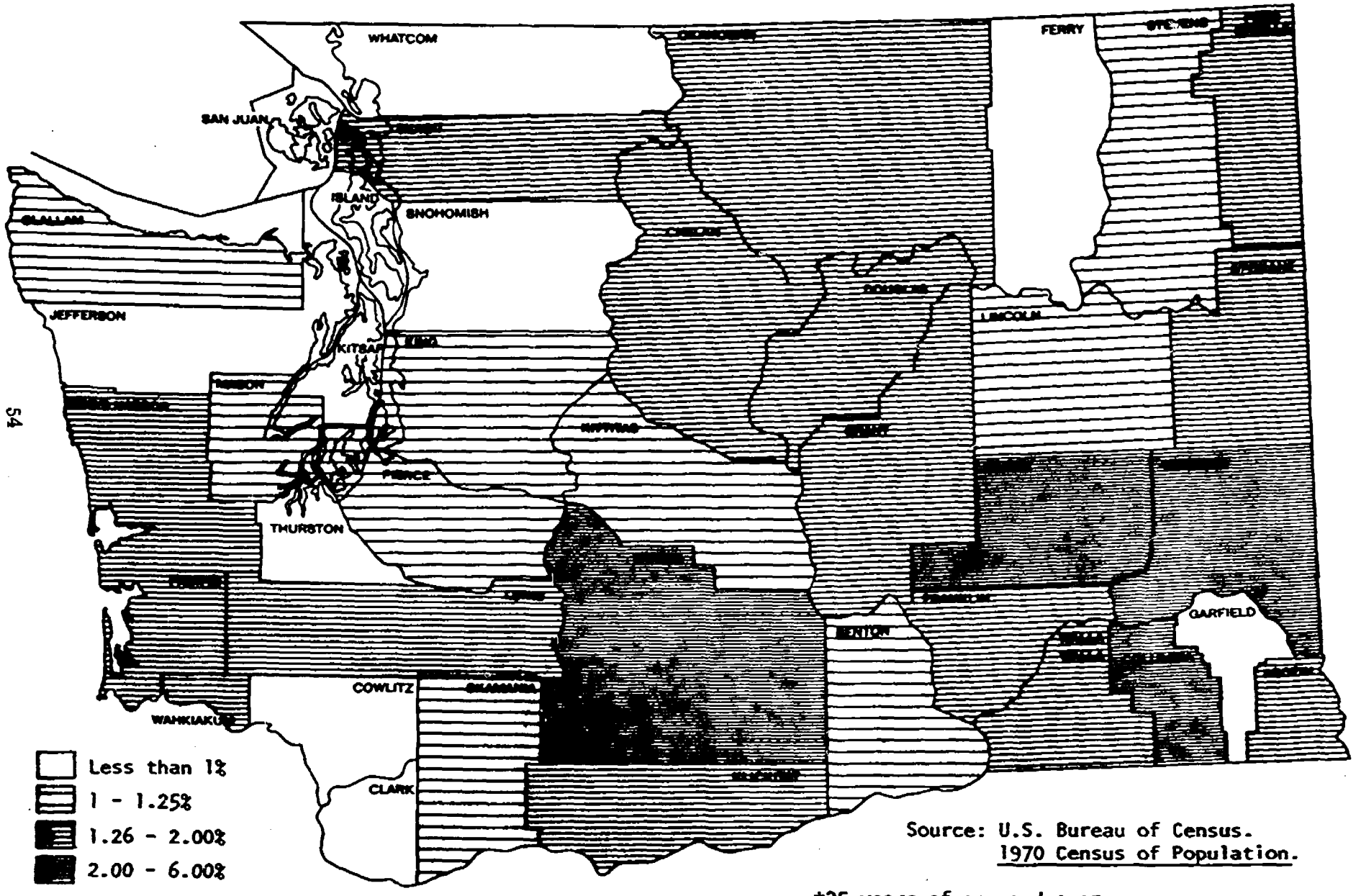


Source: U.S. Bureau of Census.
1970 Census of Population.

*25 years of age and over

Exhibit 6a

PERCENT OF COUNTY POPULATION COMPLETING ONLY FOUR OR FEWER GRADES*



Source: U.S. Bureau of Census.
1970 Census of Population.

*25 years of age and over

Exhibit 7

ALLOCATIONS FOR OPERATING EXPENDITURES, 1973

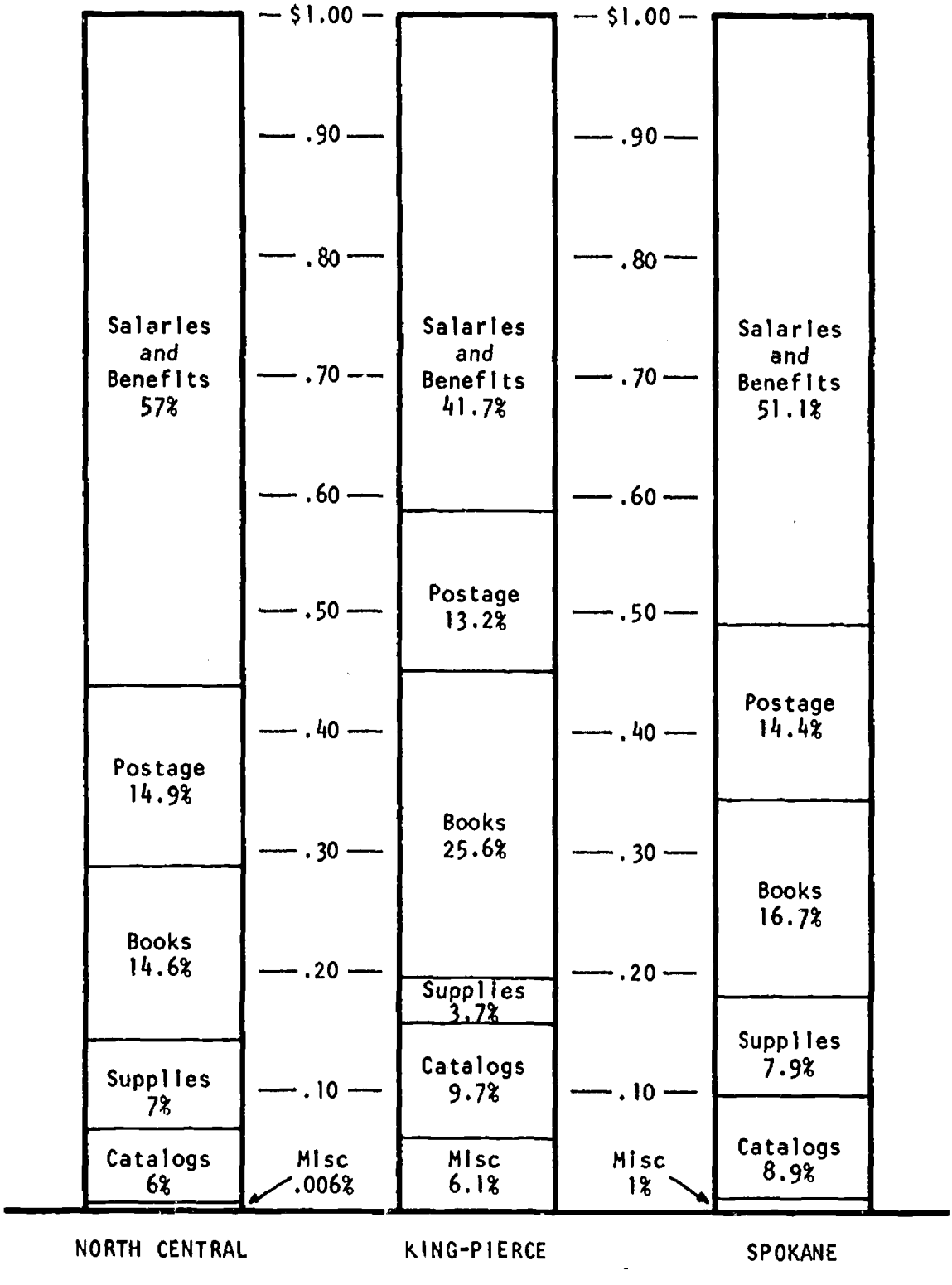
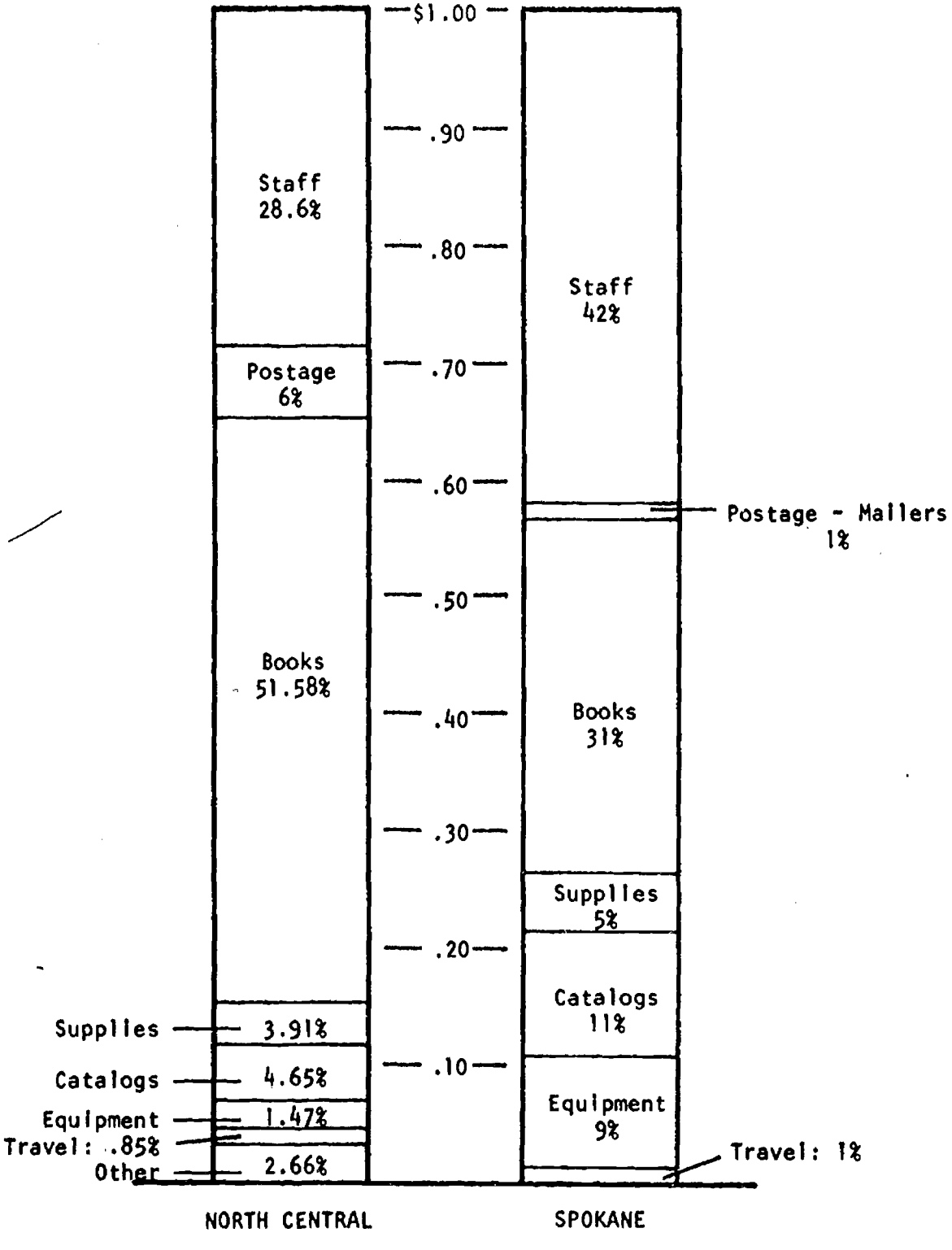


Exhibit 7a

ALLOCATIONS FOR START-UP EXPENDITURES*



*Remodeling costs not included.
King-Pierce expenditures not included because of incompatible figures.

Exhibit 8

WASHINGTON STATE MAIL ORDER CENTERS - MONTHLY CIRCULATION

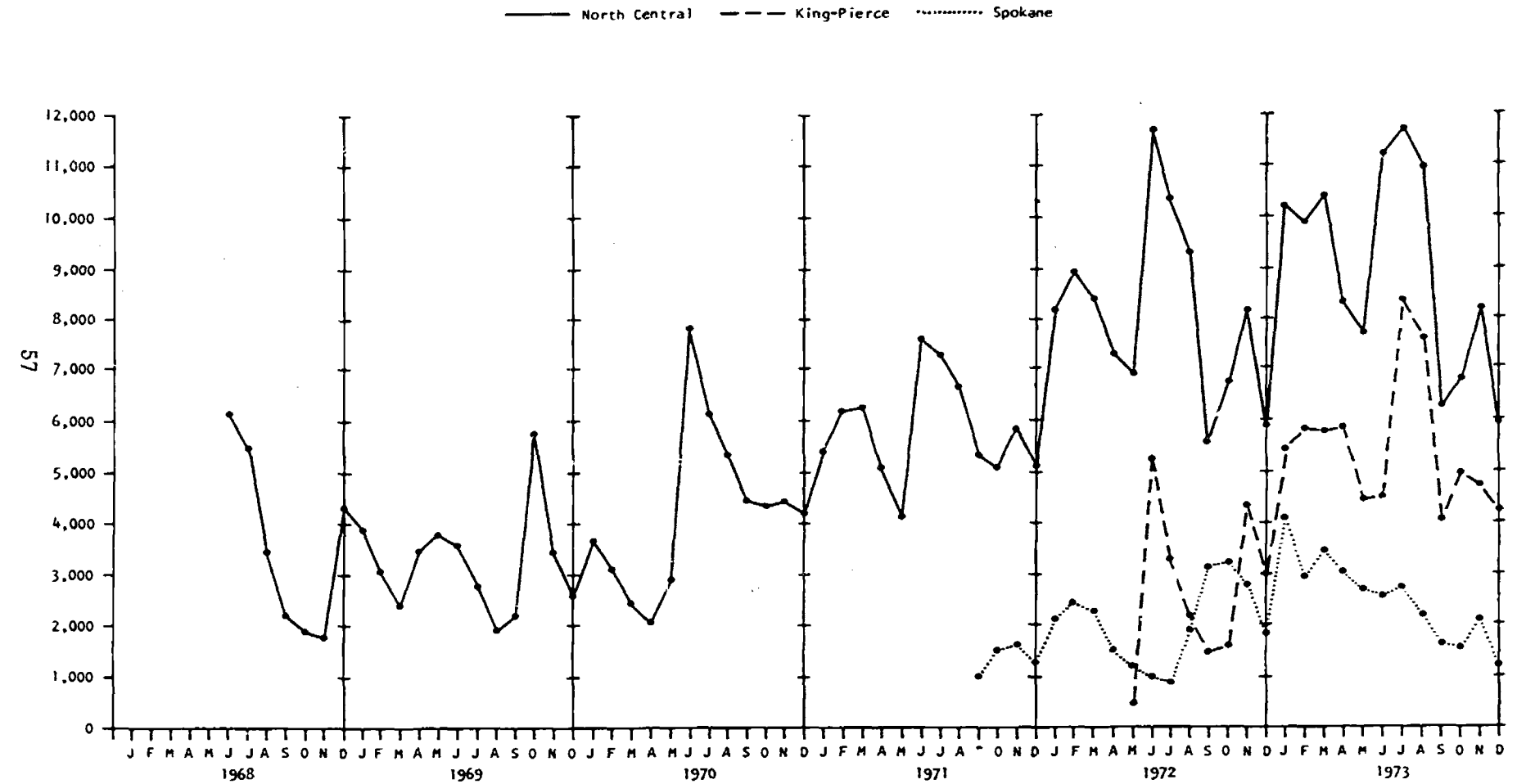
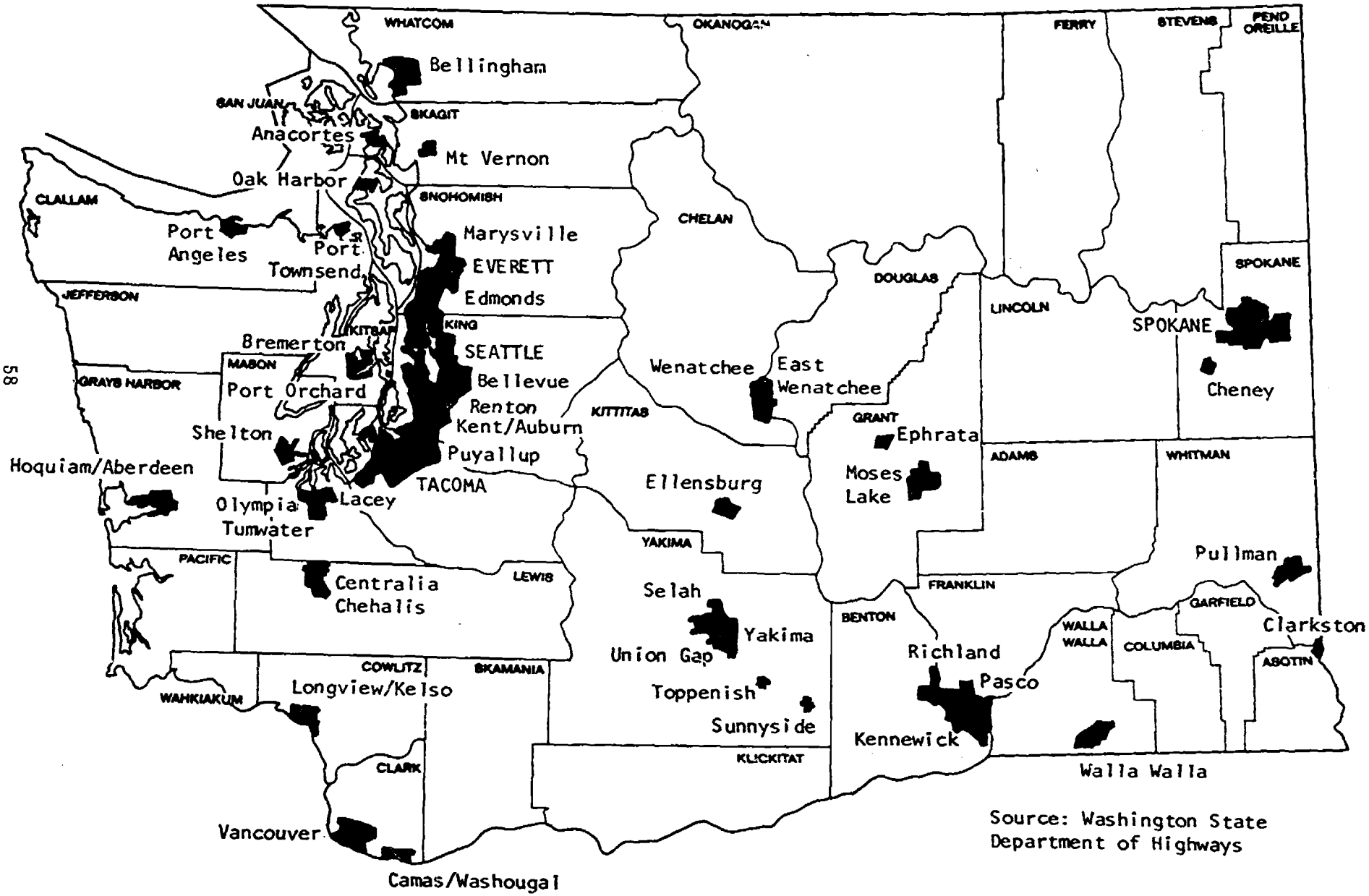


Exhibit 9

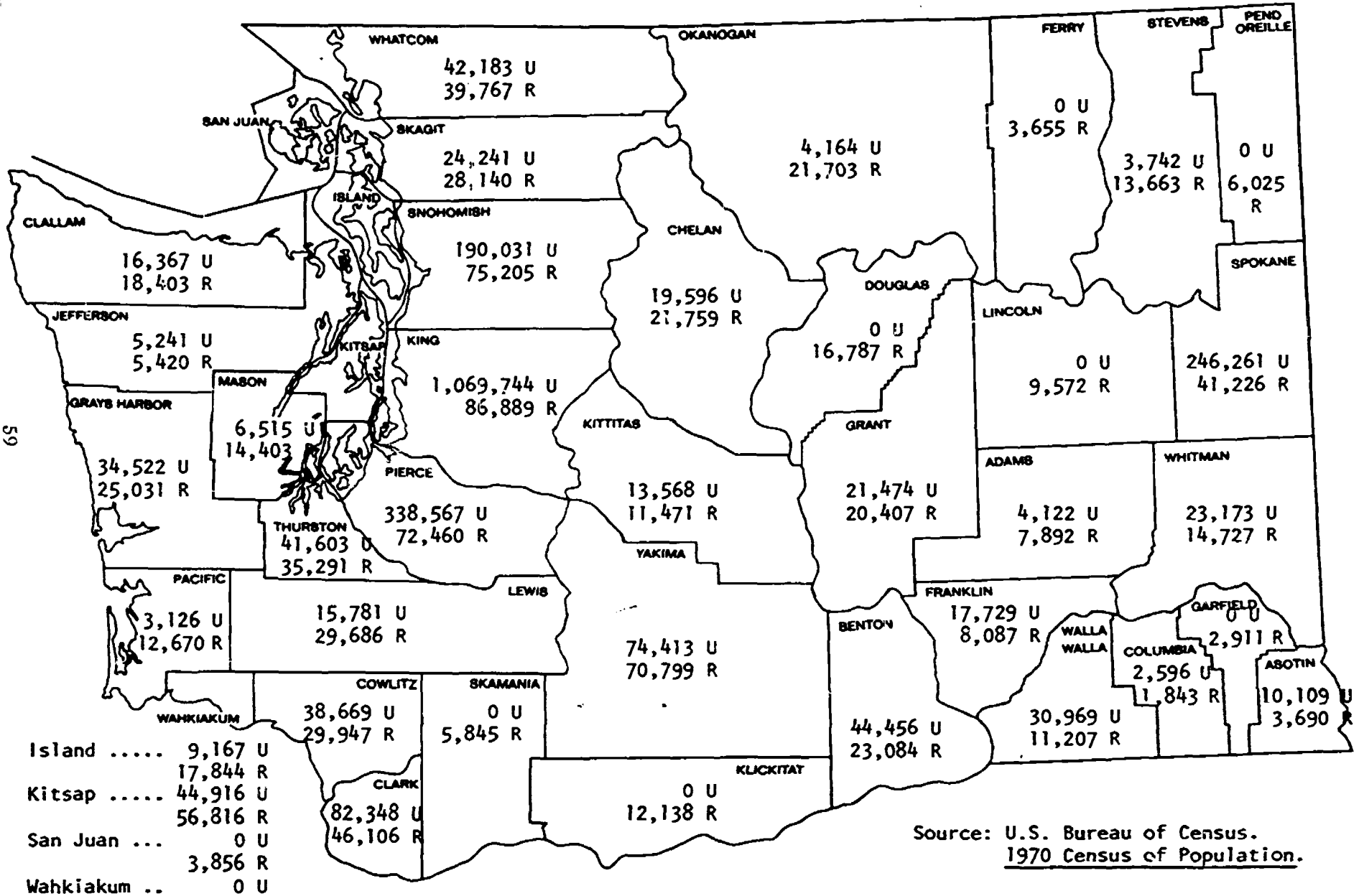
URBAN AREAS, WASHINGTON STATE



Source: Washington State Department of Highways

Exhibit 10

URBAN/RURAL POPULATION, COUNTIES OF WASHINGTON STATE

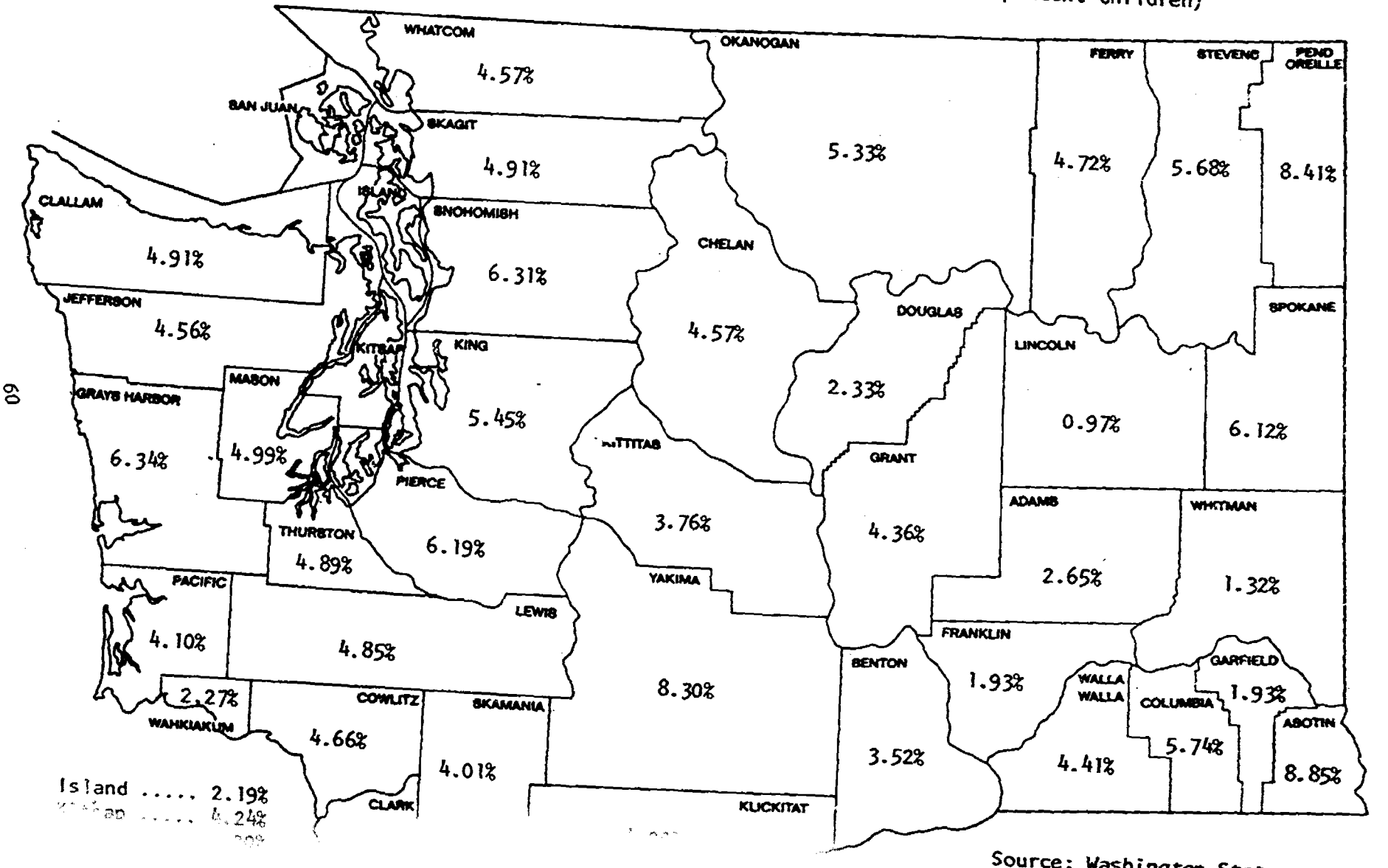


Island ..... 9,167 U
17,844 R
Kitsap ..... 44,916 U
56,816 R
San Juan ... 0 U
3,856 R
Wahkiakum .. 0 U
3,592 R

Source: U.S. Bureau of Census.
1970 Census of Population.

Exhibit 11

PERCENT OF POPULATION RECEIVING PUBLIC ASSISTANCE, 1973
(Old Age Assistance; Disability Assistance or Aid to Families with Dependent Children)



Source: Washington State Department of Social and Health Services, Public Assistance in the State of Washington. October 1973.

Exhibit 12

LIBRARY SERVICES TO WASHINGTON STATE, 1972
(Total Population 3,417,500)

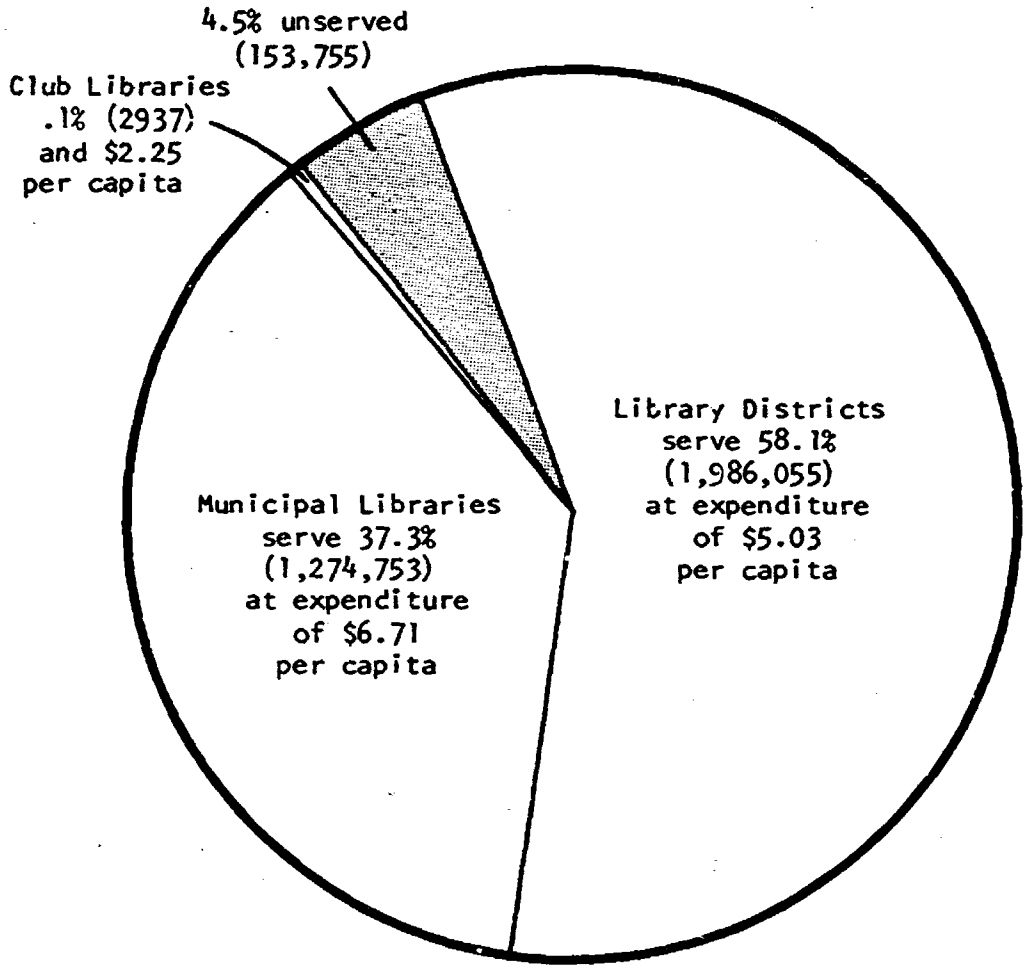


Exhibit 13

PUBLIC LIBRARY SERVICE PATTERN IN WASHINGTON

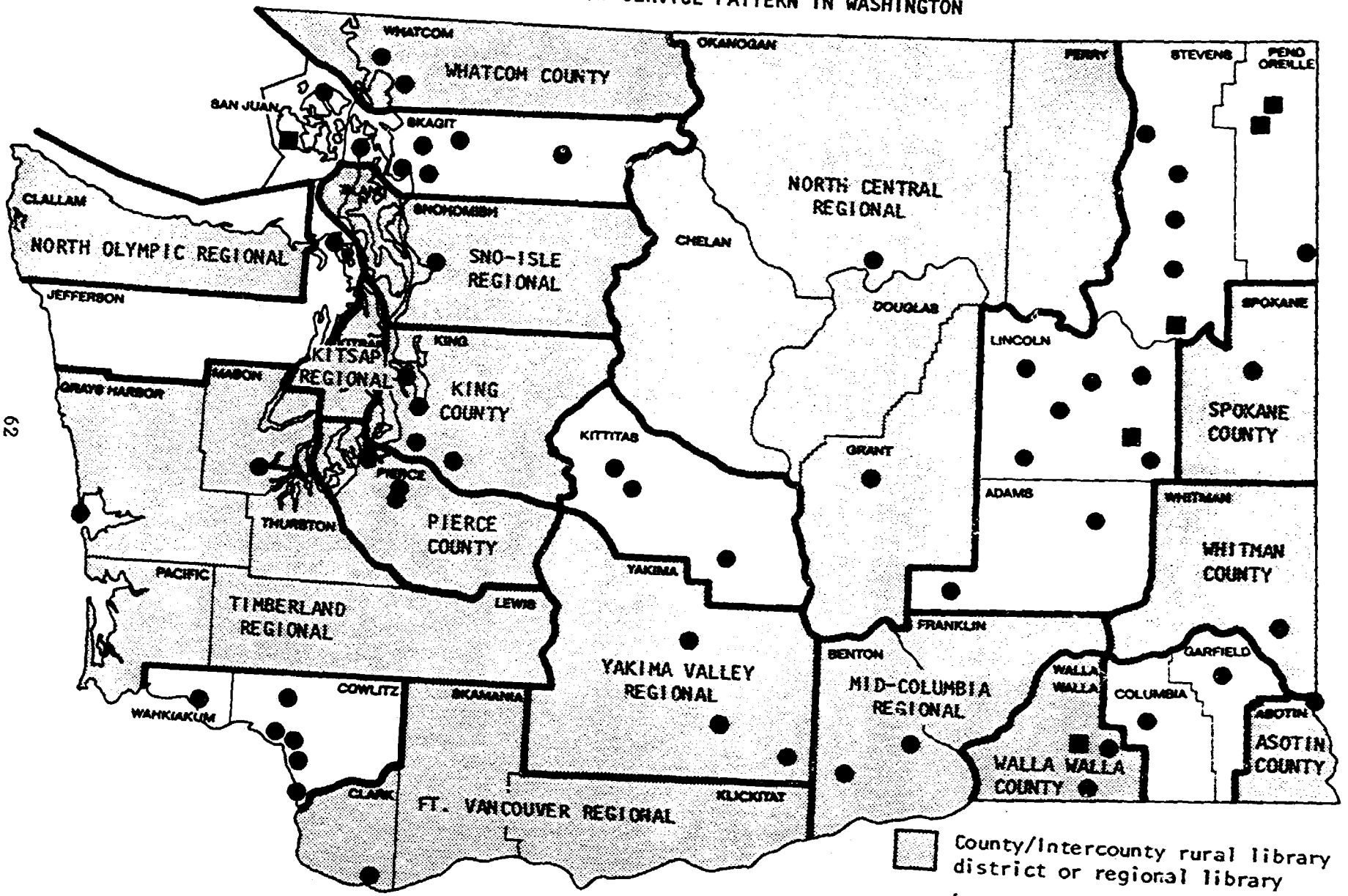
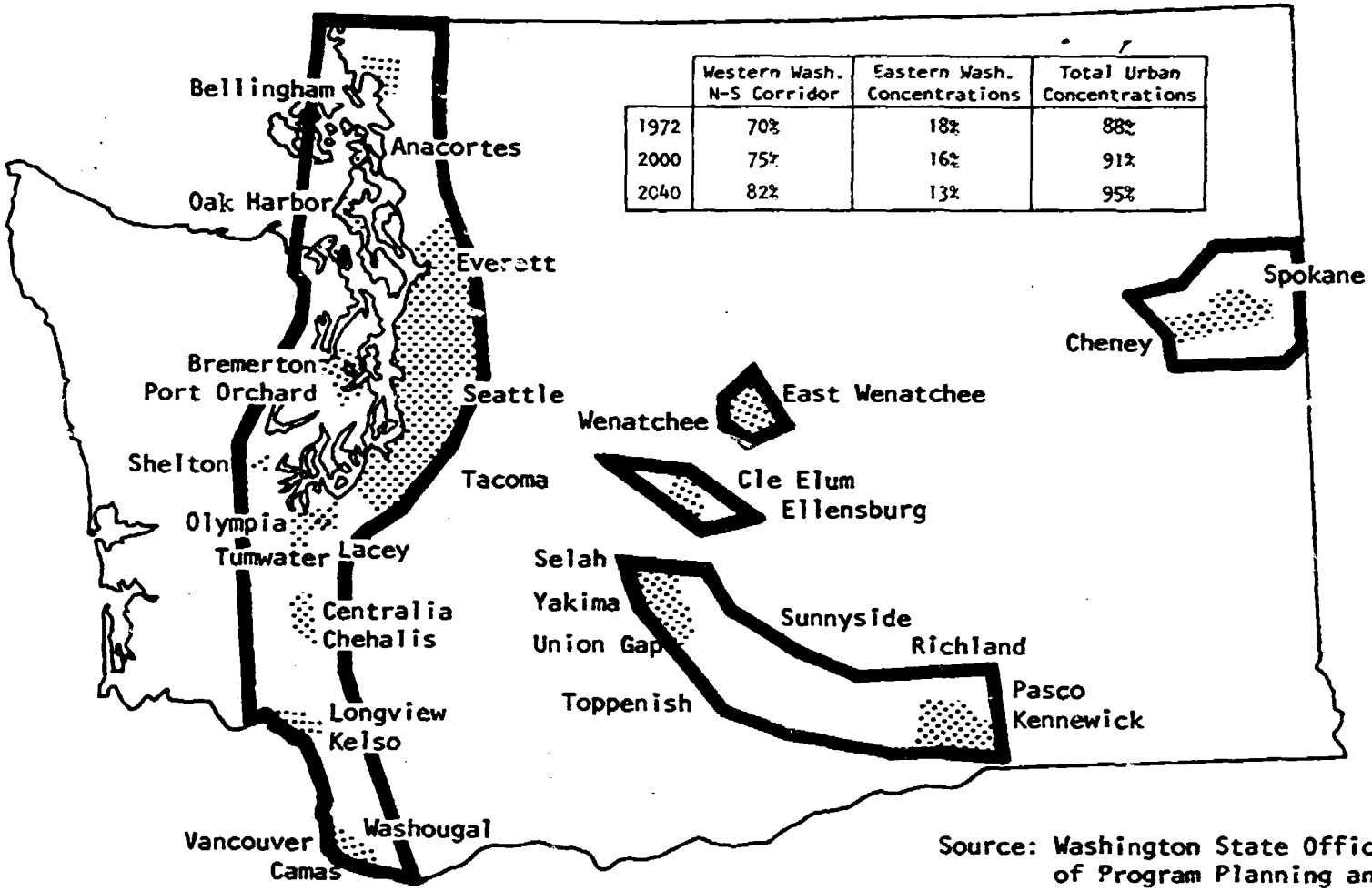


Exhibit 14

GEOGRAPHIC POPULATION DISTRIBUTION

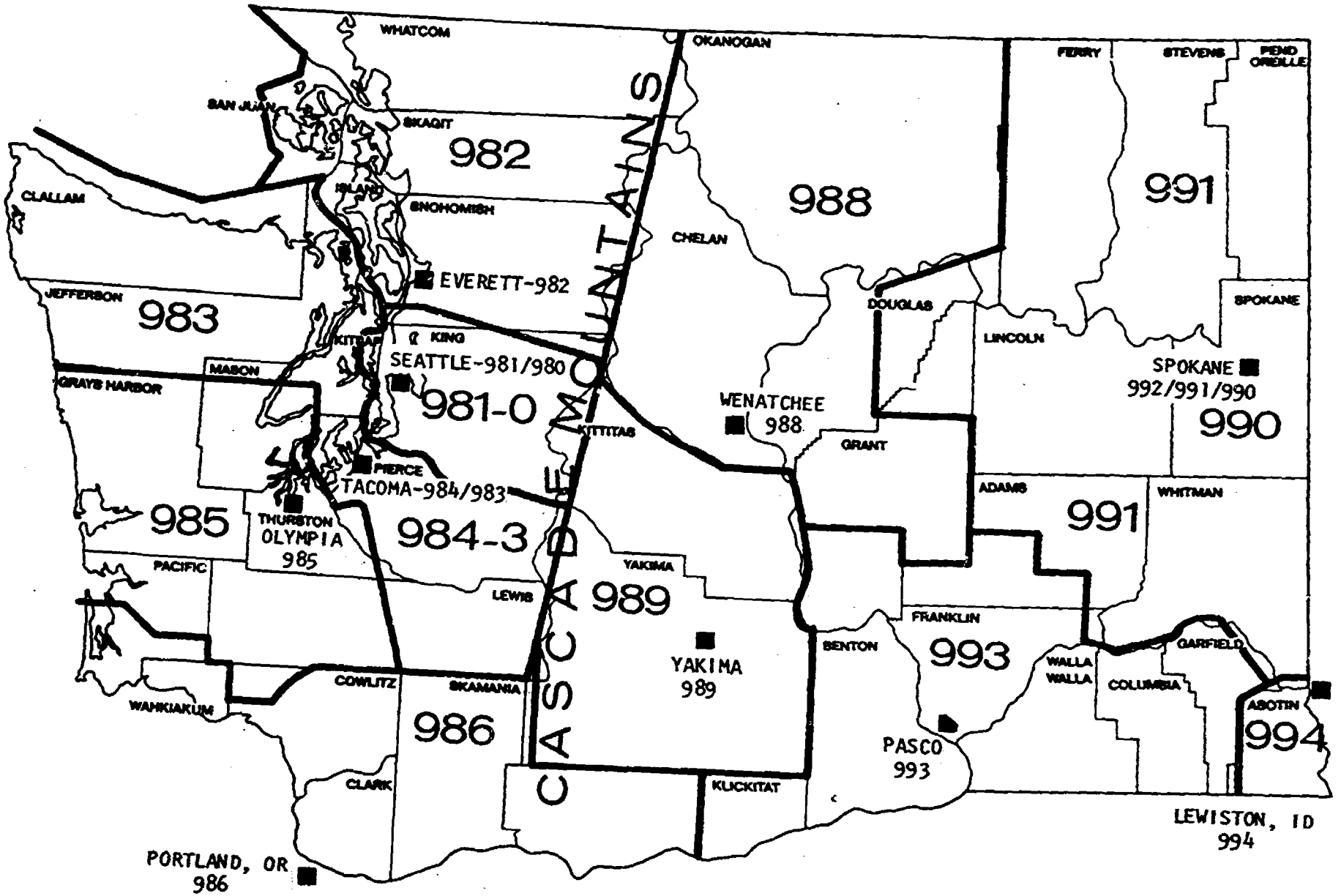


	Western Wash. N-S Corridor	Eastern Wash. Concentrations	Total Urban Concentrations
1972	70%	18%	88%
2000	75%	16%	91%
2040	82%	13%	95%

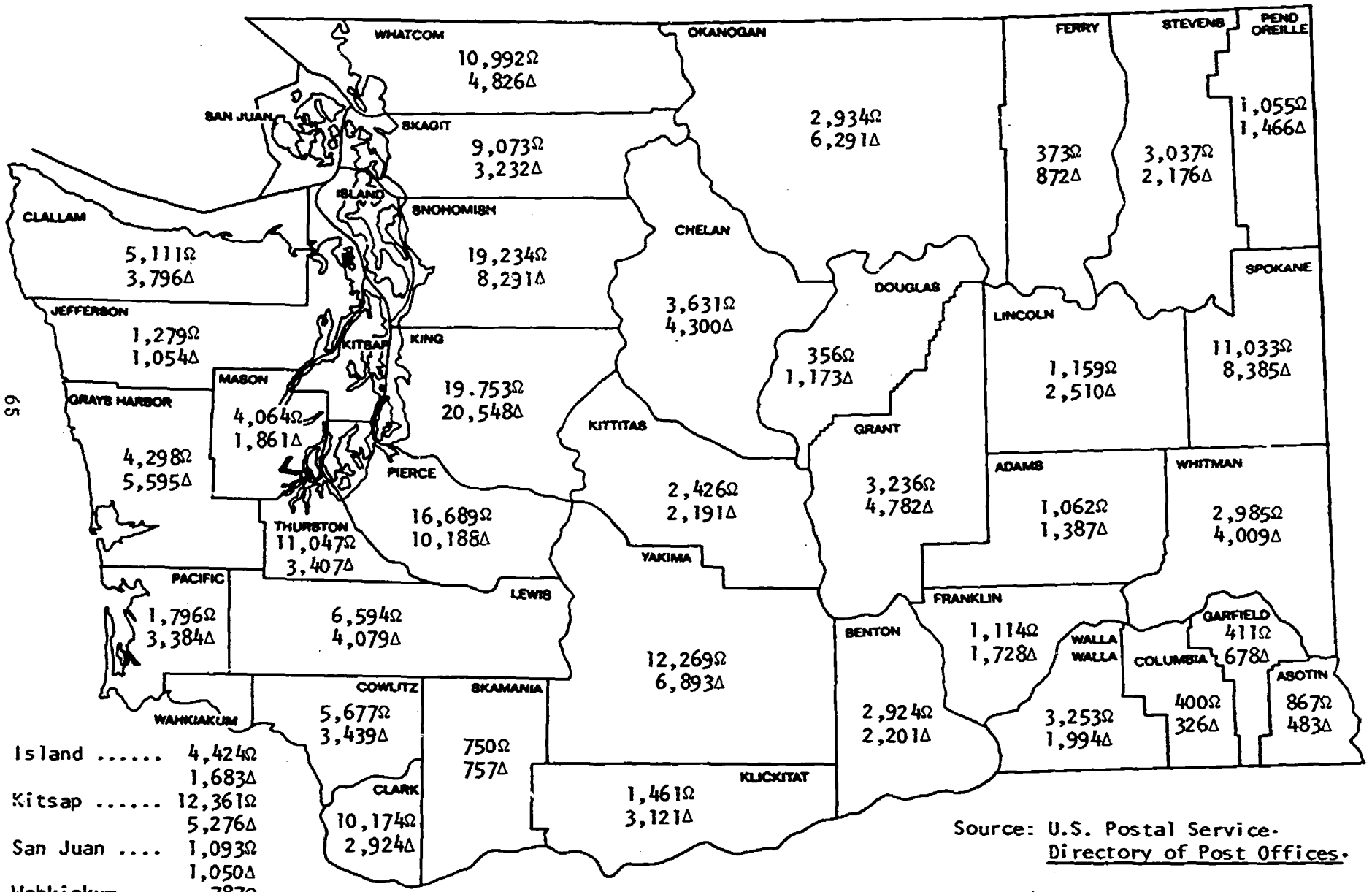
Source: Washington State Office of Program Planning and Fiscal Management, Washington State Population Studies, June 1973.

Exhibit 15

WASHINGTON STATE POSTAL ZIP CODES AND SECTIONAL CENTERS



NUMBER OF RURAL AND STAR ROUTE ADDRESSES (Ω) (STATE TOTAL: 201,182)
NUMBER OF POST OFFICE BOXES (Δ) (STATE TOTAL: 142,854)

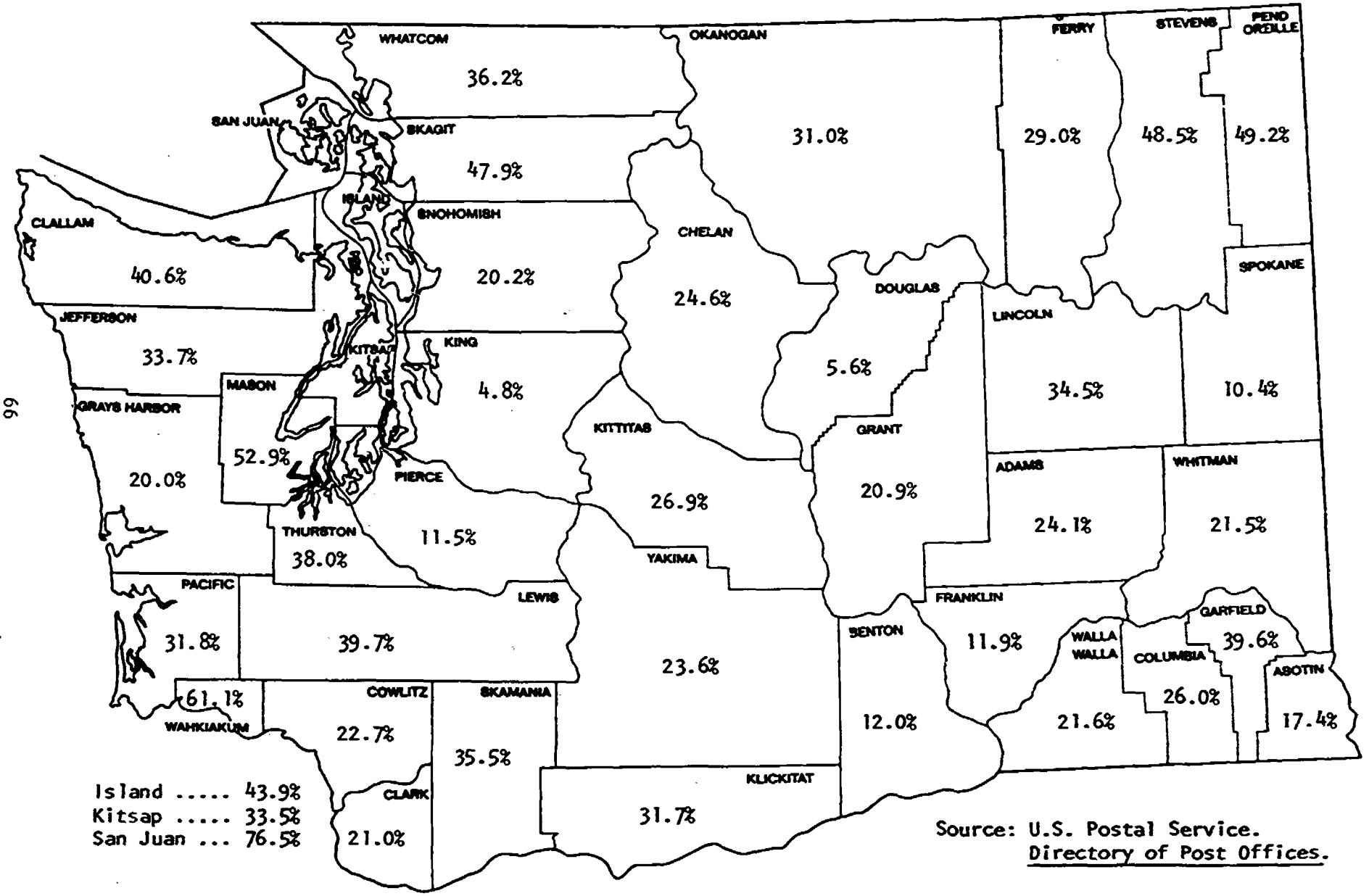


Island 4,424Ω
1,683Δ
Kitsap 12,361Ω
5,276Δ
San Juan 1,093Ω
1,050Δ
Wahkiakum ... 787Ω
498Δ

Source: U.S. Postal Service.
Directory of Post Offices.

Exhibit 17

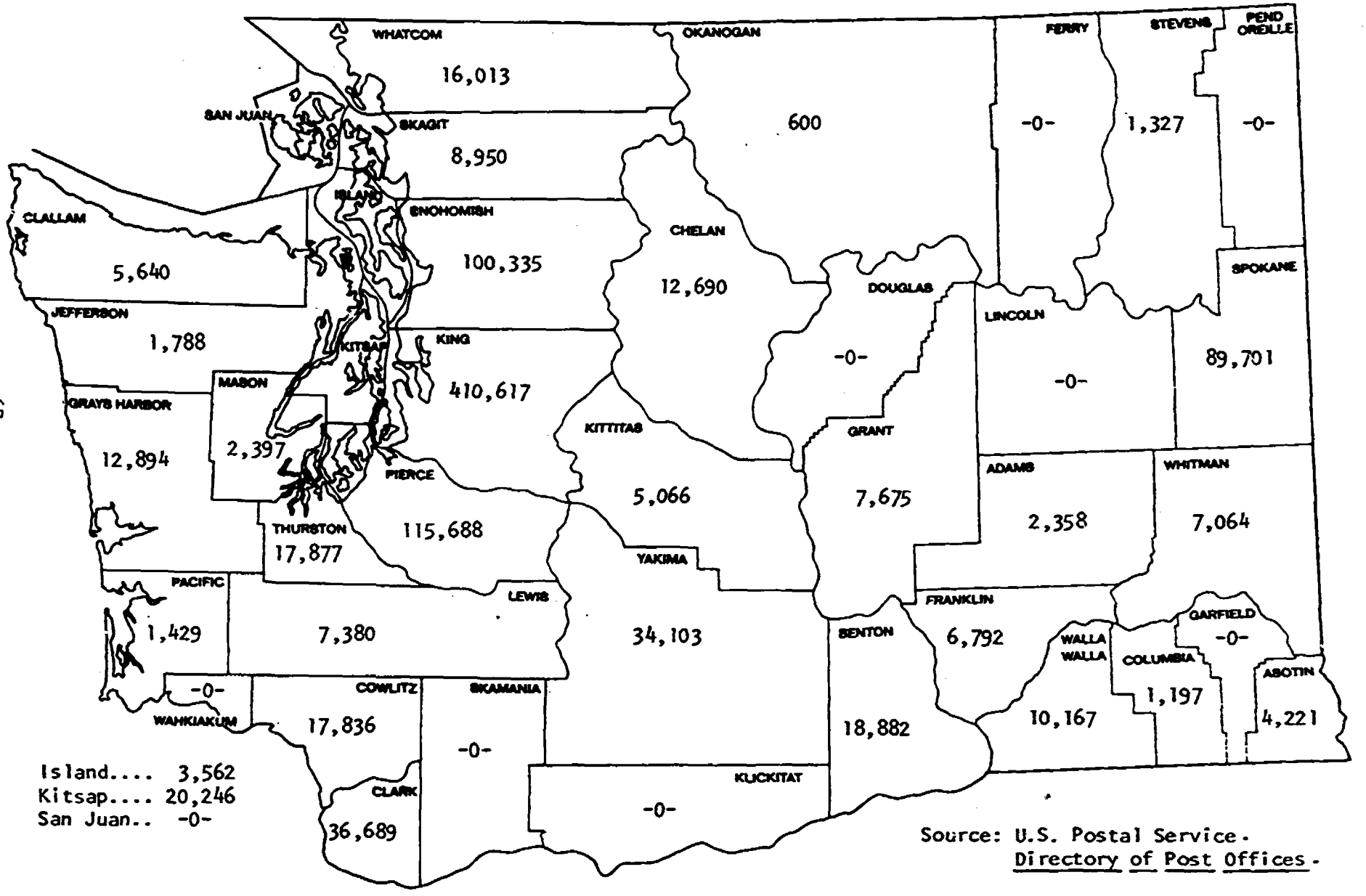
PERCENT OF POPULATION SERVED THROUGH RURAL OR STAR ROUTE DELIVERIES



Source: U.S. Postal Service.
Directory of Post Offices.

Exhibit 18

NUMBER OF CITY RESIDENTIAL ADDRESSES
(State Total: 981,094)



Island.... 3,562
Kitsap.... 20,246
San Juan.. -0-

Source: U.S. Postal Service.
Directory of Post Offices.

Exhibit 19

PROJECTED URBAN/RURAL CIRCULATION

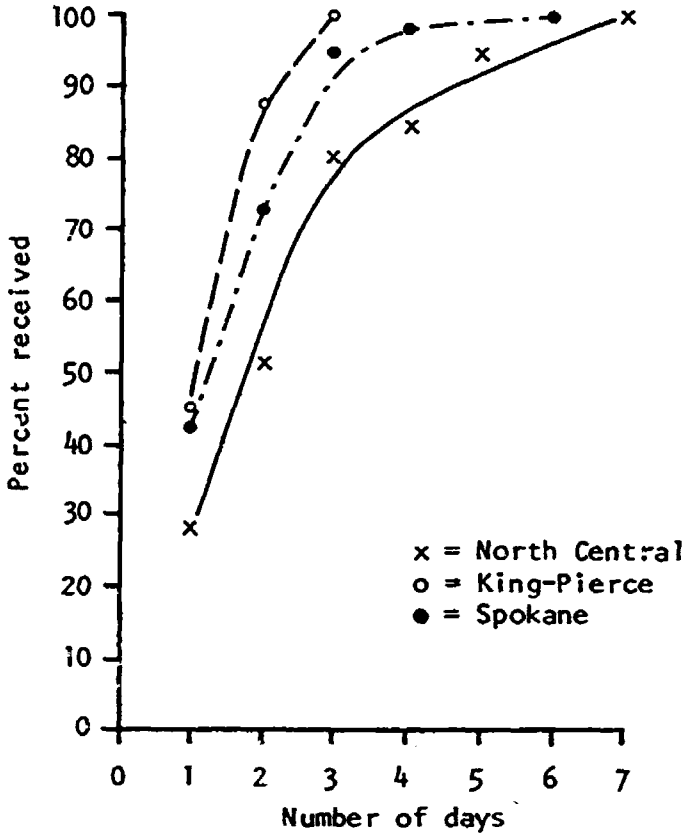
RURAL COUNTIES	NUMBER OF STAR AND RURAL ROUTE DELIVERIES	URBAN COUNTIES*	NUMBER OF STAR AND RURAL ROUTE DELIVERIES
Adams	1,062	Clark	10,174
Asotin	867	King	19,753
Benton	2,924	Kitsap	12,361
Chelan	3,631	Pierce	16,689
Clallam	5,111	Snohomish	19,234
Columbia	400	Spokane	11,033
Cowlitz	5,677	Thurston	11,047
Douglas	356	Whatcom	10,992
Ferry	373	Yakima	12,269
Franklin	1,114		
Garfield	411		
Grant	3,236	*Urban defined as "a part of, or easily accessible (geographically) to major urban centers."	
Grays Harbor	4,298		
Island	4,424		
Jefferson	1,279		
Kittitas	2,426		
Klickitat	1,461		
Lewis	6,594		
Lincoln	1,159		
Mason	4,064		
Okanogan	2,934		
Pacific	1,796		
Pend Oreille	1,055		
San Juan	1,093		
Skagit	9,073		
Skamania	750		
Stevens	3,037		
Wahkiakum	787		
Walla Walla	3,253		
Whitman	2,985		
TOTALS	77,630		123,552
CIRCULATION RATIO	7.0		3.1
PROJECTED CIRCULATION	543,410		383,011
PROJECTED TOTAL CIRCULATION		926,421	
PROJECTED CIRCULATION TO 50,841 INDIVIDUALS		75,000	
TOTAL PROJECTED CIRCULATION		1,001,421	

Exhibit 20

MAIL PATTERNS, STATEWIDE

Mailings from 3 Centers to All Patrons

	$\bar{x}$	σ
North Central	1.8	0.7
King-Pierce	1.7	0.7
Spokane	1.9	0.7



Mailings from All Patrons to 3 Centers

	$\bar{x}$	σ
North Central	2.6	1.6
King-Pierce	2.4	1.2
Spokane	2.6	1.0

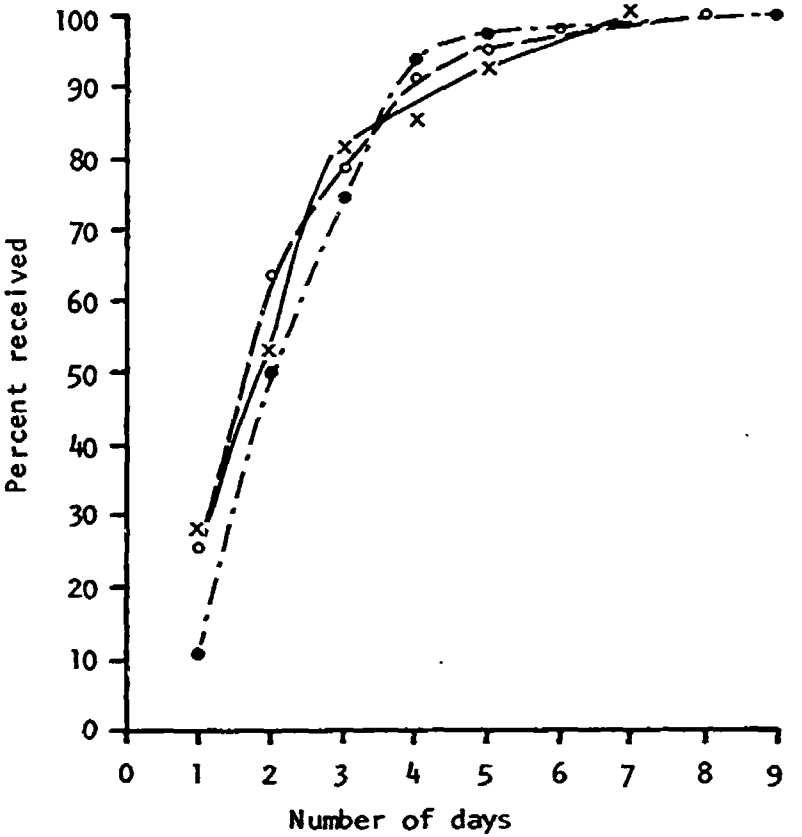
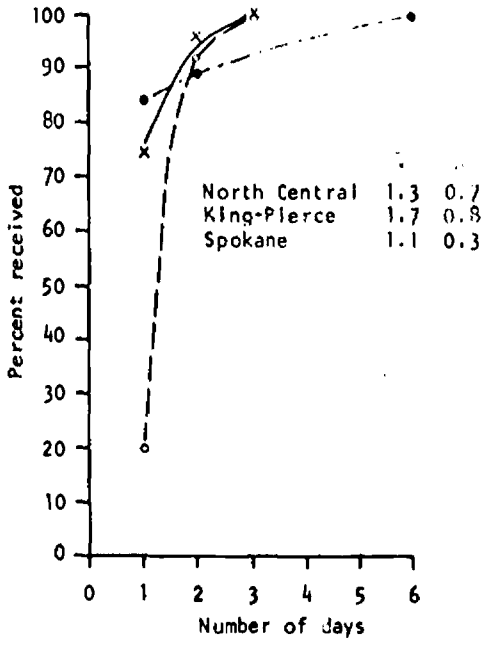


Exhibit 21

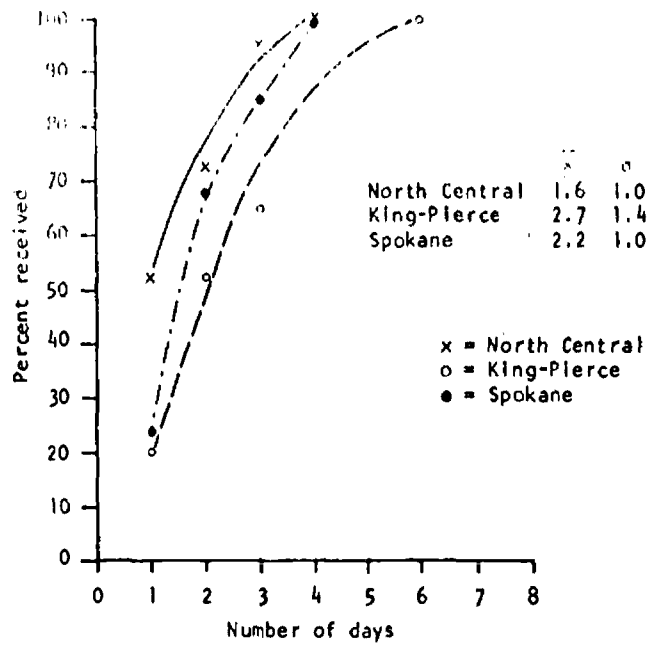
MAIL PATTERNS TO AND FROM ADDRESSES EAST OF CASCADE MOUNTAINS AND TO AND FROM ADDRESSES WEST OF CASCADE MOUNTAINS

EAST OF CASCADE MOUNTAINS

From Centers to Patrons

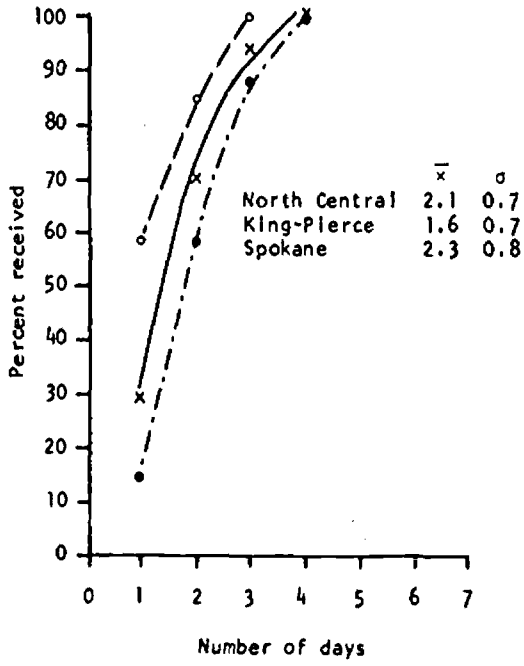


From Patron to Center



WEST OF CASCADE MOUNTAINS

From Centers to Patrons



From Patron to Center

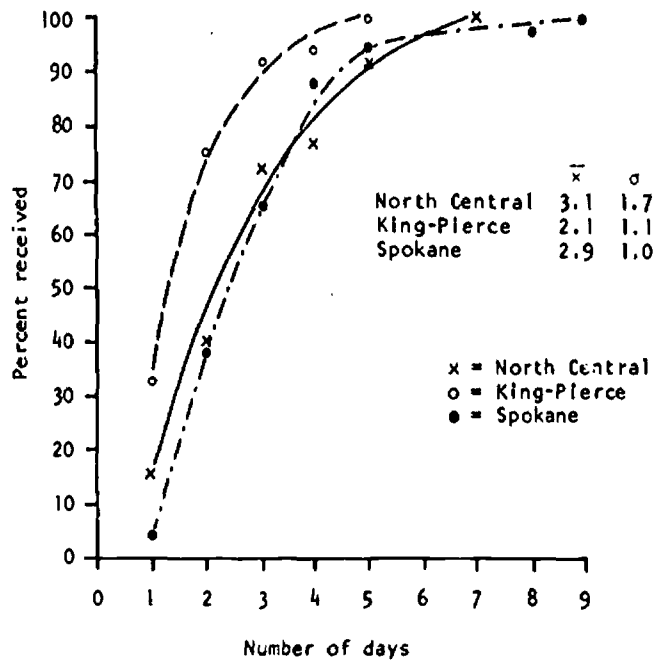


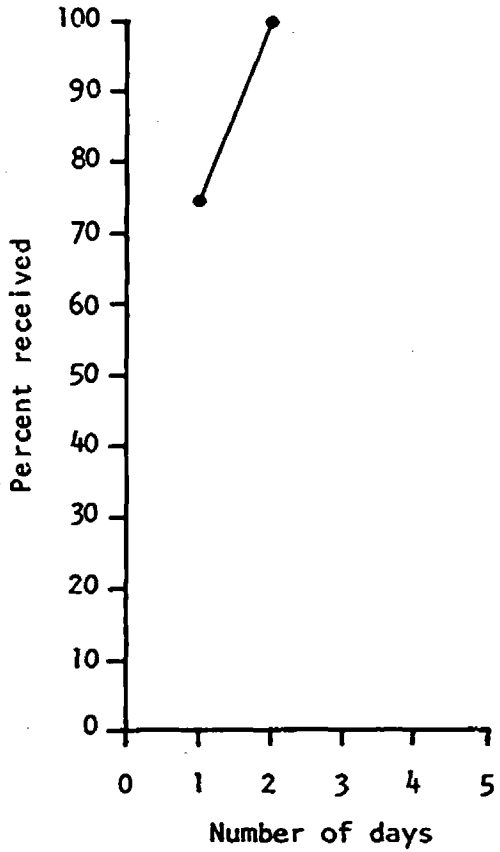
Exhibit 22

MAIL PATTERNS, COMPOSITE OF ALL MAILINGS TO AND FROM CENTERS WITHIN LOCAL REGION

From Centers to Local Patrons

$\bar{x} = 1.3$

$\sigma = 0.3$



From Local Patrons to 3 Centers

$\bar{x} = 1.7$

$\sigma = 0.8$

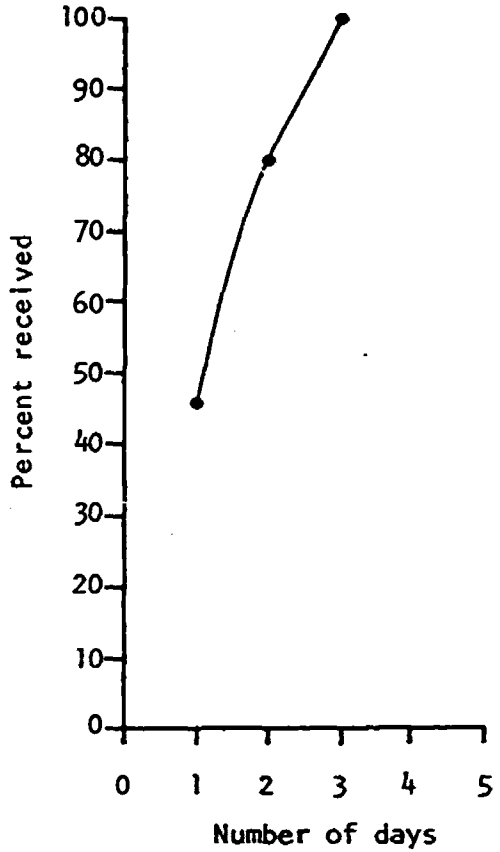


Exhibit 23

PRESENT MAIL ORDER OPERATIONS AND
PROJECTED STATEWIDE OPERATION

	North Central	King-Pierce	Spokane County	Statewide Projections
Total Annual Circulation	109,415	68,823	29,910	1,001,421
Number of Households Receiving Catalogs	15,624	28,000	8,000	201,182
Number of Individuals Receiving Catalogs	—	—	—	50,000
Total Number of Addresses Receiving Catalogs	—	—	—	251,182
Total Annual Orders	19,505	12,804	5,191	178,832[1]
Average Number of Items per Order	5.6	5.3	5.8	5.6
Total Annual Packages Mailed	34,489	23,657	6,229	312,668
Average Number of Items per Package	3.2	2.9	4.8	3.2
Full Time Equivalent Staff	6.0	4.25	1.25[2]	—[3]
Annual Items per Employee	18,236	15,294[4]	17,594	—
Area for Mail Order Operations	1846 sq ft	1950 sq ft	500 sq ft	Shelving 5000 sq ft Staff 50 sq ft each
Expenditures	$69,489	$98,162[4,5]	$14,006	—
Cost per Circulation	$ .635	$ 1.43[4,5]	$ .47[2]	—
Titles Held[6]	2,000	3,601	1,298	2,500
Volumes Held	44,389	51,679	10,308	212,500[7]

[1]Households: 165,432; Individuals: 13,400
[2]Spokane utilizes regular staff as available for mail order operations
[3]Fifty-five (55) based on North Central work flow; later reduced by simulation results to 36
[4]King - Pierce handles both films and cassettes which are more time-consuming and expensive than printed materials
[5]Includes three year amortization of remodeling costs
[6]Includes all types of materials
[7]Average of 85 copies per title

Exhibit 24

ON-GOING EXPENDITURES AND PRESENT MAIL ORDER OPERATIONS (1973)

	North Central	King-Pierce	Spokane County
Salaries and Benefits	$39,599	$40,901	$ 7,160
Books[1]	10,159	25,094	2,340
Supplies	4,861	3,613	1,104
Postage[2]	10,394	13,000	2,016
Catalogs	4,068	9,522	1,252
Physical Facility	3,599	4,704	n.a.
Miscellaneous	408	1,328	134
Totals	$69,489	$98,162	$14,006

[1]Books only
[2]See Exhibit 25 for average cost per package

Exhibit 25

WORKING RATIOS

	North Central	King-Pierce	Spokane County	Statewide Projections
$\frac{\text{Salaries}}{\text{No. Staff}}$ =	$6,600	$9,624	$5,728	$7,000
$\frac{\text{Book Expenditures}}{\text{Circulation}}$ =	.09	.36	.08	.075
$\frac{\text{Supplies}}{\text{Circulation}}$ =	.04	.05	.04	.04
$\frac{\text{Postage}}{\text{No. Packages}}$ =	.30	.55	.32	.30
Cost per Catalog	.054	.054	.128	.045
$\frac{\text{Miscellaneous Costs}}{\text{Circulation}}$ =	.004	.09	.004	.004
$\frac{\text{Facility Costs}}{\text{Circulation}}$ =	.03	.07	n.a.	.03

Exhibit 26

MAP OF SIMULATED MOD CENTERS

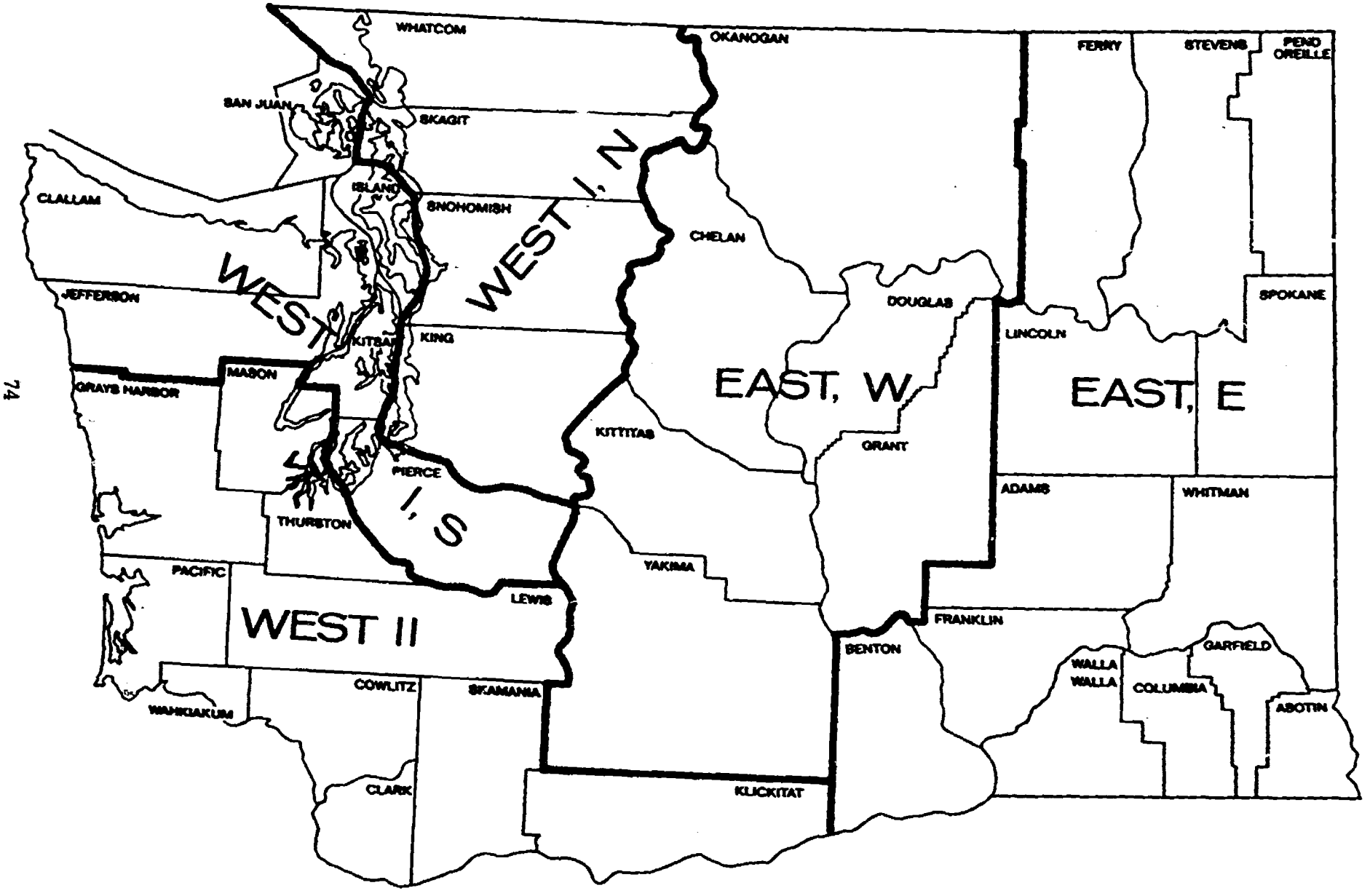


Exhibit 27

COMPARATIVE ESTIMATED STAFFING REQUIREMENTS FOR MOD SERVICE

Configuration	Man Years: Direct Service and Administration -A-	Man Years: Total Including Support Functions -B-
I. Serving all state:		
1 Center	29	36
2 Centers	30	38
East of Cascades	10	12
West of Cascades	20	26
3 Centers	31	40
East	10	12
West I	13	18
West II	8	10
4 Centers	32	41
East	10	12
West I, N	8	11
West I, S	6	8
West II	8	10
5 Centers	33	43
East, W	5	6
East, E	6	8
West I, N	8	11
West I, S	6	8
West II	8	10
14 Centers	42	63
II. Serving districts only:		
Asotin County	1/2	1
Fort Vancouver Reg.	3	4
King - Pierce*	5	7
Kitsap Regional	3	4
Mid-Columbia Regional	2	3
North Central Reg.*	3	4
North Olympic Reg.	2	3
Sno-Isle Regional	4	6
Spokane County*	2	3
Timberland Regional	5	7
Whatcom County	2	3
Whitman County	1	3
Yakima Valley Reg.	2	4
Totals	34 1/2	52

*These figures differ from actual operations, since circulation is posited on demographic figures and tasks on North Central Regional Library timings.

Exhibit 28

ESTIMATED ANNUAL COSTS FOR MOD CENTERS SERVING STATE OF WASHINGTON[1]

	Salaries and Benefits	Books	Supplies	Postage	Catalogs	Physical Facilities	Misc	Total	Cost per Circulation[2]
1 Center	$203,000	$222,800	$30,000	$94,000	$47,000	$12,900	$ 1,000	$610,700	.609
2 Centers	210,000	222,800	30,000	94,000	47,000	13,000	1,000	617,800	.616
3 Centers	217,000	222,800	30,000	94,000	47,000	13,100	1,200	625,500	.623
4 Centers	224,000	222,800	30,000	94,000	47,000	13,200	1,500	632,500	.631
5 Centers	231,000	222,800	30,000	94,000	50,000	13,300	2,000	643,100	.641
14 Centers	294,000	222,800	30,000	94,000	60,000	14,200	3,500	718,500	.717
Districts - not serving all state	245,000	253,000	22,900	71,100	61,600	22,000	7,800	683,400	.901

ESTIMATED ANNUAL COSTS FOR SERVING DISTRICT MOD CENTERS[1]

	Salaries and Benefits	Books	Supplies	Postage	Catalogs	Physical Facilities	Misc	Totals
Asotin County	$ 7,000	$ 2,100	$ 200	$ 600	$ 300	$ 200	$ 100	$ 10,500
Fort Vancouver Regional	21,000	16,700	1,500	4,700	4,500	1,600	500	50,500
King - Pierce	35,000	43,800	4,000	12,300	15,000	3,800	1,500	115,200
Kitsap Regional	21,000	14,000	1,200	3,800	4,200	1,300	400	45,900
Mid-Columbia Regional	14,000	9,800	900	2,800	1,500	800	400	30,200
North Central Regional	21,000	25,500	2,300	7,200	3,800	2,200	600	62,600
North Olympic Regional	14,000	12,200	1,000	3,400	1,700	1,100	400	33,800
Sno-Isle Regional	28,000	32,000	2,900	9,000	8,300	2,800	1,000	84,000
Spokane County	14,000	12,300	1,000	3,500	4,000	1,100	400	36,300
Timberland Regional	35,000	52,100	4,700	14,700	9,400	4,400	1,300	121,600
Whatcom County	14,000	11,700	1,000	3,300	3,500	1,100	400	35,000
Whitman County	7,000	7,100	1,000	2,000	1,000	600	300	19,000
Yakima Valley Regional	14,000	13,700	1,200	3,800	4,400	1,200	500	38,800
Totals	$245,000	$253,000	$22,900	$71,100	$61,600	$22,000	$ 7,800	$683,400

[1]Assuming central purchasing, processing, and catalog production and mailing
[2]Circulation estimates: all-state = 1,002,720; districts = 758,200

Exhibit 29

ESTIMATED ANNUAL WORKLOADS FOR SIMULATED CENTERS
TO SERVE ALL STATE

Configuration	Addresses	Circulation	Orders	Packages	Volumes Added Per Year
1 CENTER	252,000	1,002,700	179,000	313,300	222,800
2 CENTERS					
East	64,600	305,800	54,600	95,600	68,000
West	187,500	696,800	124,400	217,800	154,800
3 CENTERS					
East	64,600	305,800	54,600	95,600	68,000
West I	137,500	448,000	80,000	140,000	99,600
West II	50,000	248,800	44,400	77,700	55,300
4 CENTERS					
East	64,600	305,800	54,600	95,600	68,000
West I, N	86,700	260,000	46,400	81,200	57,800
West I, S	50,800	188,100	33,600	58,800	41,800
West II	50,000	248,800	44,400	77,700	55,300
5 CENTERS					
East, W	28,900	132,100	23,600	41,300	29,400
East, E	35,700	173,700	31,000	54,300	38,600
West I, N	86,700	260,000	46,400	81,200	57,800
West I, S	50,800	188,100	33,600	58,800	41,800
West II	50,000	248,800	44,400	77,700	55,300
14 CENTERS					
Average load	18,000	71,600	12,800	22,400	16,000

Exhibit 30

ESTIMATED ANNUAL WORKLOADS FOR MOD SERVICE
IN DISTRICT LIBRARIES

District Library	Addresses	Circulation	Orders	Packages	Volumes Added Per Year
Asotin County	1,074	6,400	1,100	2,000	2,100
Fort Vancouver Regional	14,452	50,100	9,000	15,700	16,700
King - Pierce	48,793	131,500	23,500	41,100	43,800
Kitsap Regional	13,949	40,700	7,300	12,700	14,000
Mid-Columbia Regional	4,805	29,400	5,300	9,200	9,800
North Central Regional	12,406	76,500	13,700	24,000	25,500
North Olympic Regional	5,658	36,600	6,500	11,400	12,200
Sno-Isle Regional	27,366	96,200	17,200	30,100	32,000
Spokane County	12,883	37,000	6,600	11,600	12,300
Timberland Regional	31,087	156,400	27,900	48,900	52,100
Whatcom County	11,625	35,000	6,300	10,900	11,700
Whitman County	3,232	21,300	3,800	6,700	7,100
Yakima Valley Regional	14,319	41,100	7,300	12,800	13,700
Totals	197,611	958,200	135,500	237,100	253,000

APPENDICES

APPENDIX A

REPORT OF ON-SITE VISITS TO MOD CENTERS IN WASHINGTON STATE

ACCOUNT OF VISIT TO KING-PIERCE COUNTIES' MAIL ORDER PROGRAM, TACOMA, 17 OCTOBER 1973

In 1971, funding was requested from the State Library for initiating a mail order delivery system, but not received because funds were unavailable at that time. In 1972, the Pierce County Library and King County Library System established a joint service on their own, beginning operation in May 1972. This is an effort to serve people who cannot meet bookmobile schedules and/or are housebound. Pierce County is responsible for the operation, with reimbursement from King County for the service there. Mailings of the catalog are selective, to rural route boxes and the homebound. The mail order service does not in general reach into the incorporated areas covered by the municipal libraries in Seattle and Tacoma. Pierce County serves about 15,000 households with the mail order service; King County, about the same. The mail order budget is $120,000.

The collection includes 2,500 to 3,000 paperbacks, 150 hard cover large type books, 250 films, 400 cassettes, and 15 to 20 magazine titles. The chief vendor used is a paperback jobber in Seattle; selection is based chiefly on flyers from paperback dealers. No weeding routine has yet been developed.

The catalog is printed and mailed by a local printer; annotations are written by library staff. It was not possible to use the North Central Regional Library's mail order catalog, since some of the books listed were no longer available for purchase. The order card for each catalog is color-coded, so that response can be assessed. There seemed to be some concern that

extensive demand not be encouraged, since finances limit the ability of the system to respond to requests. Ambivalence was apparent, with a strong urge also present toward building circulation.

A package answering a patron request contains books, catalog supplements, blank order cards, return address label, stamps and paper tape for reclosing the bag. Each bag serves for one to six round trips. Most requests are handled on the day received, except for interlibrary loan or in times of peak seasonal loads. Catalogs are mailed out in frequent batches rather than all at one time; this helps to even out the load of requests. A new catalog is printed about every five months, so that several will be in various stages of mailing to various segments of the service area at any one time. The operation can handle fifty requests per clerk per day, including shelving returns, maintaining card files, handling overdues, keeping statistics, etc. Staff includes three clerks, a part-time high school student, and a librarian as head of the section. The largest backlog ever encountered was about 200 requests, after a large mailing of a catalog; spreading of mailings has alleviated this problem. The day's routine starts with handling of back orders from the previous day, then opening the incoming mail, shelving books, sorting and tabulating orders, assembling books to be mailed out, packaging and turning over to post office, recording cassettes, inspecting, cleaning, and checking films. Mail arrives once a day, in the morning, and goes out once, in the afternoon.

The on-site visit offered some evidence that the staff was not pressed to keep up with the operation. Indeed there seemed to be a proliferation of files which might be the result of an overabundance of staff time. The system seemed to be smoothly run and the service is reaching people who could not otherwise be served by a library.

ACCOUNT OF VISIT TO NORTH CENTRAL REGIONAL LIBRARY, WENATCHEE, 18 OCTOBER 1973

The mail order delivery service at North Central Regional Library was a pioneering effort and has received national attention for its leadership in exploring a new avenue of library services. The operation was begun in 1968 as an attempt to equalize library access to all communities throughout the nearly 15,000 square mile region served by North Central; start-up costs were funded through a Library Services and Construction Act grant. It is viewed as an integral part of the service complex, offering supplemental service where branch library hours and location are not convenient to would-be patrons. The region had three bookmobile centers which have been phased out since establishment of the mail order system; the bookmobiles proved more expensive per circulation and users found mail order a more convenient method.

Originally offered to only one county as a pilot test, the mail order delivery has gradually been expanded to cover all five counties in the North Central region. The population in this area is almost entirely rural in composition, with patrons living up to 100 miles from a branch library which may be open only 20 hours a week. The catalogs are mailed to 15,000 rural route and post office boxholders; each receives three catalogs a year plus flyers when they receive materials. Circulation is still growing steadily and it is the opinion of the staff that this trend can be continued almost indefinitely with suitable marketing techniques. These techniques include good annotations in the catalogs, illustrations accompanying some annotations, wide distribution of catalogs, information to patrons on non-listed books being available, response to reference questions, etc. Indeed, with circulation growth in a given area, mail order service has proved to be a forerunner of new branch libraries in that it encouraged demand and interest in establishment of a local in-library service.

The staff's daily routine begins with unpacking the incoming mail and shelving returned books. Then order cards are sorted, with non-catalog-listed items referred elsewhere, books are pulled from the mail order collection shelves, back orders are filled (cued by a notice on the shelf at re-shelving time), and packaging and delivery to the post office are completed by 3:30 p.m. The operation employs no professionally-trained librarians but the head of the operation is very able and brings much energy, dedication, and extensive library experience to the job.

As observed, the operation seemed very efficiently run and looked highly professional in that it was serving well the purpose for which it has been designed.

*During the course of this study, the Walla Walla County Library Board contracted with the North Central Regional Library to provide MOD service to the rural residents of Walla Walla County.

ACCOUNT OF VISIT TO SPOKANE COUNTY LIBRARY, SPOKANE, 19 OCTOBER 1973

This mail order operation was begun in January 1971 with Library Services and Construction Act funding; catalogs were sent to nursing homes. In September 1971, 7,500 catalogs were mailed to people in the service area and in four surrounding counties who received Old Age Assistance and Disability Assistance. A later mailing included recipients of Aid to Families with Dependent Children. In November 1972, catalogs were mailed to a general group of rural route and post office boxholders; at the time of the interview, catalogs were reaching 8,000 households. The catalogs which were mailed to AFDC families resulted in increased juvenile circulation, though the titles in the collection are less than 10 percent juvenile. It was discovered that many nursing home patrons have difficulty reading the small print contained in paperbacks, and large type books were added to the mail order collection for them. A special catalog for large type books is produced quarterly and the large type collection is maintained by a standing order system. The paperback collection now has over 1,000 titles, with about twenty a month added and a few deleted. There are 400 large type titles. The paperback collection is 75 percent fiction. Extra copies of highly popular titles are acquired locally as reserve lists pile up. It was estimated that there is a six-week lag between publication of a paperback title and its being available for circulation in Spokane's system.

Mail order service is viewed as building use of libraries in general. Some MOD books are returned to branch libraries, thereby bringing new patrons into the library. It is felt by the Spokane staff that MOD has contacted a whole segment of previous non-users.

The Spokane County Library's mail order delivery service is operated highly informally, the work almost fitting into the interstices of the staff's other tasks. While this results in a seemingly low-cost operation, it also means that the traffic through the system is held at a low level, lest the staff time available be overtaxed. The people responsible for the operation are dedicated to the service, convinced that they are reaching a group of users heretofore unable to access library materials.

COMMENTS ON OBSERVED PROCEDURES

Collection

Data were gathered on collection-building and -maintenance activities. The quality of the collections was not weighed except as the materials' attractiveness to users is directly reflected in circulation figures. It is assumed that a strong effort is made to select books and other materials which will draw high use; a collection of 2,000 titles of which 1,500 are represented by at least one circulation at any given time is obviously a much more successful, much more cost-effective operation than one of 3,000 with only the same 1,500 titles in use. Since the listing of titles in the catalog is limited by printing costs, it is necessary to maintain a highly current, heavy demand collection. Experience has shown that a series of four catalogs a year, with each catalog sent in small weekly batches to different routes, will smooth out the demand so that orders arrive at a fairly even rate. And a catalog of about 500 titles seems suitable in terms of cost and in the variety of materials that can be offered to patrons. Thus, in a given year 2,000 titles might be listed, with a gradual weeding of the non-used titles and steady additions of new and popular titles as they are published. These latest additions are listed in short flyers which are tucked into outgoing orders so that active users will have prompt access to new acquisitions. Therefore, the collection at any one time might contain between 2,000 and 2,500 titles.

Staff members of the existing centers in Washington felt that book selection, annotation, and catalogs must be tailored to the clientele of each area. It appears to the investigators that the similarities among libraries, areas, and clientele are much greater than the differences; MOD centers could

be almost identical throughout the state. Book selection and catalog preparation are among the more enjoyable tasks of the MOD operation, and each center would be reluctant to give up these functions. However, if the service is to be offered to the entire state, administrative decisions on that level should be based on best cost and service factors. In fact, it may well be feasible and most economic to purchase the annotated catalogs along with the books from a responsible vendor. It has not been within the scope of this study to analyze vendors' services, but it seems highly probable that with the prospect of servicing such a large-scale annual purchase, a major vendor would set up a special staff and offer selection, processing, annotation, and catalogs at a cost below that which could be achieved in-house at a MOD center. Arrangement might also be made for the lease-purchase of materials (as McNaughton Plan from Bro-Dart) wherein after a certain time books still in good condition can be returned to the vendor and a portion of the price credited toward lease/purchase of newer materials.

The MOD catalog should strongly emphasize the availability of materials other than those titles listed in the catalog. MOD staff members state that heavy readers promptly read out a catalog, and flyers become their major resource until the next catalog arrives. Since titles in the flyers will be incorporated in the new catalog, the chief gain for the MOD operation is to have spread demand for the new titles over a pre-catalog period. These heavy readers will have read many titles from the next catalog, and will exhaust its listings even more quickly; they must be urged to request non-listed titles. This category of patrons has always been dissatisfied with bookmobile service because of the limited selection available; MOD can offer more titles but wider resources must be accessed in order to achieve satisfaction.

A report from the North Central Regional Library states:

> "During the first year or two of the program, orders for non-catalog items represented a surprisingly small percentage of the total. However, between 1969 and 1972, orders for non-catalog items increased at a rate 40 percent greater than the [percentage] increase in circulation."

The response, at first tentative, grows rapidly as users find that their requests for non-listed items are filled. Each of these requests will be more costly than a regular MOD request, since they must be referred to a regular library rather than filled by a book off the MOD shelf. But if library service is the goal, then the total resources of all libraries must be available to supplement the MOD catalog.

Staff Procedures

It is strongly recommended that manual files in any MOD operation be kept to a minimum. For example, the subject file which was being constructed in one of the centers visited is of most questionable value in this type of non-cumulative collection. Subject requests can and should be referred to a regular library where search tools are already in existence.

The routines for handling reserve books should be so simplified that minimal files are maintained. A possible procedure is to place the list of waiting patrons in the shelf space where the title will be shelved on return, so that no special files need be consulted but rather the existence of a reserve on the title will be automatically discovered at reshelving time.

Another policy which can result in considerable savings in staff time is to ignore overdues. Even where there are reserve lists for the title, the original date due slip can be sent out with the notation "Others are Waiting" so that a higher probability of a considerate response can be expected without

followup. Experience in the North Central Regional Library shows that a negligible number of books are never returned--and their value does not begin to justify the expenditure of staff time on routine overdue notices. Renewal procedures also could be greatly diminished by relaxing emphasis on due dates, though there will be some conscientious patrons who will desire renewals as the due date is passed.

Data on times for processing and quantities of requests were provided by each of the three centers. In general there seemed to be no major differences in the three operations, or the times for work.

Some gross figures could be derived by relating annual circulation figures to number of full-time-equivalent staff. This gave the following production figure per employee:

	Items per employee per year	Items per employee per day
North Central	18,326	73
King-Pierce	15,294	61
Spokane County	17,594	70

The King-Pierce rate can be at least partially accounted for by the fact that in that operation a sizeable proportion of films and cassettes are distributed.

Costs

It was hoped that a gross rule of thumb for costing could be derived from the experience of the three centers. However, while the cost-per-circulation does hover around the $ .60 to $ .70 range as shown in Exhibit 2, the rate of circulation is several orders of magnitude less than an all-state operation would be expected to carry. This cost rate should probably be considered a maximum, since costs per catalog and per title can be expected to drop in a larger operation.

Policy

Observations in the three extant MOD centers of Washington State revealed considerable ambivalence towards expanding the programs to include new categories of users or to the entire service area, due to possible workload consequences of inviting or enticing the maximum number of readers to request their offerings. Since the raison d'etre of libraries is to provide materials to readers, everyone in the centers was pleased at the reader response to their service. But it seems obvious that none of the three is pushing towards all-out expansion of service as a result of policy decisions concerning the role of Mail Order within the system, or because of staff limitations. There probably exists a sizeable number of unserved individuals and households in these supposedly MOD-served areas. Furthermore, the way to reduce cost per circulation is to increase the circulation, since a certain proportion of the costs remain relatively fixed no matter what the traffic of requests.

There is a possibility that the two MOD centers serving populations near or in major urban centers will never be able to build circulation to the point of economy of scale, since the proportion of the population which cannot go to a library is much lower than in the rural area served by North Central. It is also more expensive to reach an individual in the urban area who needs MOD service. In a rural area catalogs can be bulk mailed to "Rural Boxholder" at a much lower postal rate than individually addressed mail for the elderly and housebound in cities, which is also more expensive in staff time for addressing. Sending catalogs to all city "Occupants" seems, on the basis of present information, overcostly for the number of circulations it

is likely to produce. In any case, none of the three centers seem to be putting full effort into increasing circulation, because of the probability that circulation will grow beyond their capacity or funds to handle it.

MAILING TIME TEST

(Number of days in mail from Mail Order Catalog centers to addressee and return to centers)

ADDRESSEE	MONDAY OCTOBER 29, 1973						WEDNESDAY OCTOBER 31, 1973						FRIDAY NOVEMBER 2, 1973					
	NORTH CENTRAL		KING-PIERCE		SPOKANE		NORTH CENTRAL		KING-PIERCE		SPOKANE		NORTH CENTRAL		KING-PIERCE		SPOKANE	
	Sent	Return	Sent	Return	Sent	Return	Sent	Return	Sent	Return	Sent	Return	Sent	Return	Sent	Return	Sent	Return
BELLEVUE *(98006 - Seattle)	2	3	1	2	2	4	2	2	2	2	2	3	3	2	1	2	1	2
BELLINGHAM (98225 - Everett)	3	7	2	2	3	3	2	4	2	2	2	2	3	5	3	1	3	5
BELLINGHAM (98225 - Everett)	3	3	2	2	3	3	3	3	2	2	**	**	**	**	+	3	1	3
BREMERTON (98310 - Tacoma)	1	2	1	1	3	3	2	2	2	2	3	2	3	2	3	1	4	1
CHENEY (98004 - Spokane)	1	2	2	4	1	2	2	2	2	2	2	2	1	1	4	4	1	1
CLARKSTON (99403 - Lewiston)	1	1	2	2	1	2	1	4	2	3	1	4	1	2	3	2	6	4
COLFAX (99111 - Spokane)	2	1	2	1	1	4	2	2	2	3	1	3	3	1	3	**	1	1
EVERETT (98203 - Everett)	1	5	1	2	1	2	1	3	1	3	1	3	1	2	1	1	1	2
KENNEWICK (99336 - Pasco)	1	1	1	6	1	2	1	3	2	2	1	3	3	1	3	3	1	2
LEAVENWORTH (98826 - Wenatchee)	1	1	1	1	1	1	1	3	2	2	2	2	1	1	3	**	1	1
LIBERTY LAKE (99019 - Spokane)	1	1	2	4	1	1	1	3	2	4	1	3	1	1	3	8	1	2
MARYSVILLE (98270 - Everett)	4	5	1	1	2	3	2	2	1	3	2	2	**	3	1	1	**	**
OLYMPIA (Rural Route) (98502 - Olympia)	1	1	1	1	2	4	1	3	1	3	2	2	1	2	1	2	3	2
PORT ANGELES (98362 - Tacoma)	2	7	1	2	3	4	2	3	1	4	2	3	3	4	3	2	3	9
SEATTLE (98115 - Seattle)	2	5	2	5	3	3	2	3	3	2	3	4	4	5	4	5	4	5
TACOMA (98406 - Tacoma)	2	1	2	1	2	4	2	3	2	2	2	8	1	3	1	2	2	3
TACOMA (98406 - Tacoma)	2	1	1	1	2	2	1	3	1	3	2	2	1	1	1	1	3	2
VANCOUVER (98661 - Portland)	2	1	1	5	2	4	2	2	1	3	2	4	3	7	3	1	3	2
YAKIMA (98901 - Yakima)	1	1	1	1	1	2	1	3	2	4	1	3	1	3	3	**	1	2

*(Zip Code - Mail Distribution Center)
**Information not received
+Response invalid

washington state library
olympia, washington 98504

October 29, 1973

MEMORANDUM

TO: Heads of Mail Order Programs for Pierce-King Counties, North Central Regional, and Spokane County Libraries

FROM: Mary Jane Pobst Reed mjpr

RE: Testing of Mail Delivery Timings

This is to outline procedures for the mail order delivery test that we discussed previously.

Enclosed are:

1. 60 instruction sheets with return form--a different color is being sent to each mail order center.

   14 district plus 5 municipal libraries = 19 addresses, including your own director.

   19 x 3 mailings each = 57 mailing pieces

2. a list of home addresses for 19 directors of libraries.

Please send 3 mailings to each address, 1 on Monday, 1 on Wednesday, and 1 on Friday, in any sequence of days beginning as soon as possible.

Each mailing should consist of a bag containing a small book (to keep postage minimal), instruction sheet with return form, return label and stamps.

Fill in the date of mailing on each return form.

When you receive the return, please fill in date of receipt.

I will appreciate receiving the return forms from you as soon as possible--say a week from your third mailing. Later return forms can be sent as they arrive.

If you have any questions as to this procedure, please phone me.

Thanks so much for your assistance.

MJPR:rw
enclosures: 60 instruction sheets with return form
copy of memo to directors
stamps--2x57=114 - 6¢ stamps
list of addresses

washington state library
olympia, washington 98504

October 29, 1973

MEMORANDUM

TO: District Library Directors and Directors of Seattle, Tacoma, Spokane, Everett, and Bellingham Public Libraries

FROM: Mary Jane Pobst Reed

RE: Mail Order Book Delivery Study: Preliminary Investigation of Postal Delivery Schedules

You have received Maryan Reynolds' notification of our receipt of a grant for analyzing factors in design of a mail order delivery pattern which could serve all areas of the state.

As a start, we want to get some sample timings on postal services. The rest of this memo describes that step. Then in November I plan to talk with each of you by phone if we need local information that cannot be derived from the annual statistical issue of the Library News Bulletin and other state agency sources.

In determining whether there should be one or more centers for statewide mail delivery service, and where it or they should be located, one major factor is length of time for postal service from point to point. While this factor is somewhat variable as the seasons roll and the postal system shifts patterns, still we can ascertain some general facts.

As a first rough cut, we are proposing test mailings from the three present mail order programs to other points of the state. The present operations are chosen to minimize the extra effort, materials, and instructions which would be required for other libraries to send mailings; fortuitously, this gives us an eastern, a western, and a central location. For this first try, to keep it simple and test the technique, the addresses used will be home addresses of the library directors to whom this memo is addressed. This will avoid institutional delivery patterns, and give us figures on residential delivery times. We will not be hitting far-out rural areas this time; that can come in a later phase if the technique looks promising.

(OVER)

Each of you will be receiving a total of nine mailings--three book bags from each of the three centers--to provide a representative sampling. Enclosed in each bag will be a book, a return label, stamps, and a form for recording the day received by you, and day when you mail it back to the mail order library. Please fill in the dates, your name and address, replace the form and book in the bag, relabel and stamp the bag, and return promptly. Use of residential mailing facilities rather than your library outgoing mail will be helpful.

If you have any questions or comments, please phone me.

Your cooperation is appreciated.

copies: Linda Phillips, Head of mail order program Pierce-King County Libraries
Boyden Brooks, " " " " " North Central Regional Library
Donna Woolard, " " " " " Spokane County Library

MJPR:rw
enclosures

THIS IS A TEST MAILING RELATIVE TO THE STUDY ON
MAIL ORDER DELIVERY OF LIBRARY MATERIALS

PLEASE GO THROUGH THE FOLLOWING STEPS TO ASSIST IN OUR DATA COLLECTION:

1. Immediately on receipt, fill in the information after number 2 on the form below.

2. As soon as possible, return the bag, book, and form to the mail order center which sent it to you. Just before putting it in the mail:

   a. Fill in the information after number 3 on the form.

   b. Relabel and stamp the bag, insert form and book and close bag.

   c. If convenient, mail through a residential facility (postman, pickup at your home, corner postal collection box, or post office).

Thank you,

Mary Jane Pobst Reed

- -

TEST MAILING FOR MAIL ORDER DELIVERY STUDY

1. Mailed from SPOKANE COUNTY LIBRARY Date ____________

2. Received by ____________________ Date ____________

   P.O.: ____________________

   Zip: ____________________

3. Package mailed to Mail Order Center Date ____________

4. Received by Mail Order Center Date ____________

mjpr:rw
10/29/73

OUTPUT

This appendix shows the workflow diagram for the generalized mail order delivery operation, program listings, and samples of computer output. Two sets of output are shown here: the first is the result of the simulation of the present MOD operation at North Central Regional Library and the second is from the simulation of the operation of one MOD center serving the entire state of Washington.

The first chart shows clock time at the top (the figure of 10560 is the product of 480 minutes times 22 days) and the block counts: current contents and total number of transactions put through each step. The facility statistics give the percentage of the total time during which that facility (worker or machine) was occupied in processing transactions. (Transactions in the present model are orders, books, and packages.) It is from this set of figures that staffing needs can be derived. The queue statistics show times that transactions stayed in specified stages of the model. The five frequency tables show a tabulation of transaction times required in various operations. Table 1 gives the frequency tabulation of times required for opening packages and returning books to the shelves (one to three minutes for NCRL; one to eight minutes for all-state, indicating some time spent waiting in queue, while workers were busy with prior transactions). Table 2 gives the frequency tabulation for times required to gather items to fill an order for titles listed in the catalog (one to forty minutes in each situation). Table 3 shows the frequency distribution for processing reserve book orders, not including waiting time for books to return from another reader (one to fifty minutes for NCRL, one to seventy for all-state). Table 4 gives frequency tabulations for processing orders for titles not listed in the cata-

log; the range is one to 170 minutes for NCRL, and up to 220 minutes for the all-state center. Table 5 shows the frequency distribution of times for readying packages for mailing (one to five minutes for NCRL and for all-state, except for one errant package which required seven minutes).

FUNCTIONS

A chief difference between computer and mathematical modeling is that the mathematical approach is usually deterministic. Computer modeling permits probabilistic occurrences through the use of probability distributions which are expressed in functional relationships. These functions are activated as needed in the program, at which time the function referenced will assign an appropriate value to the argument. In some cases, the calculation of this value includes the generation of a random number and further complex computations.

Function FUN2 in the MOD simulation program represents a distribution of the number of items requested on each order card received. When in the simulation an order transaction is received, FUN2 is used to assign between one and ten items to this order.

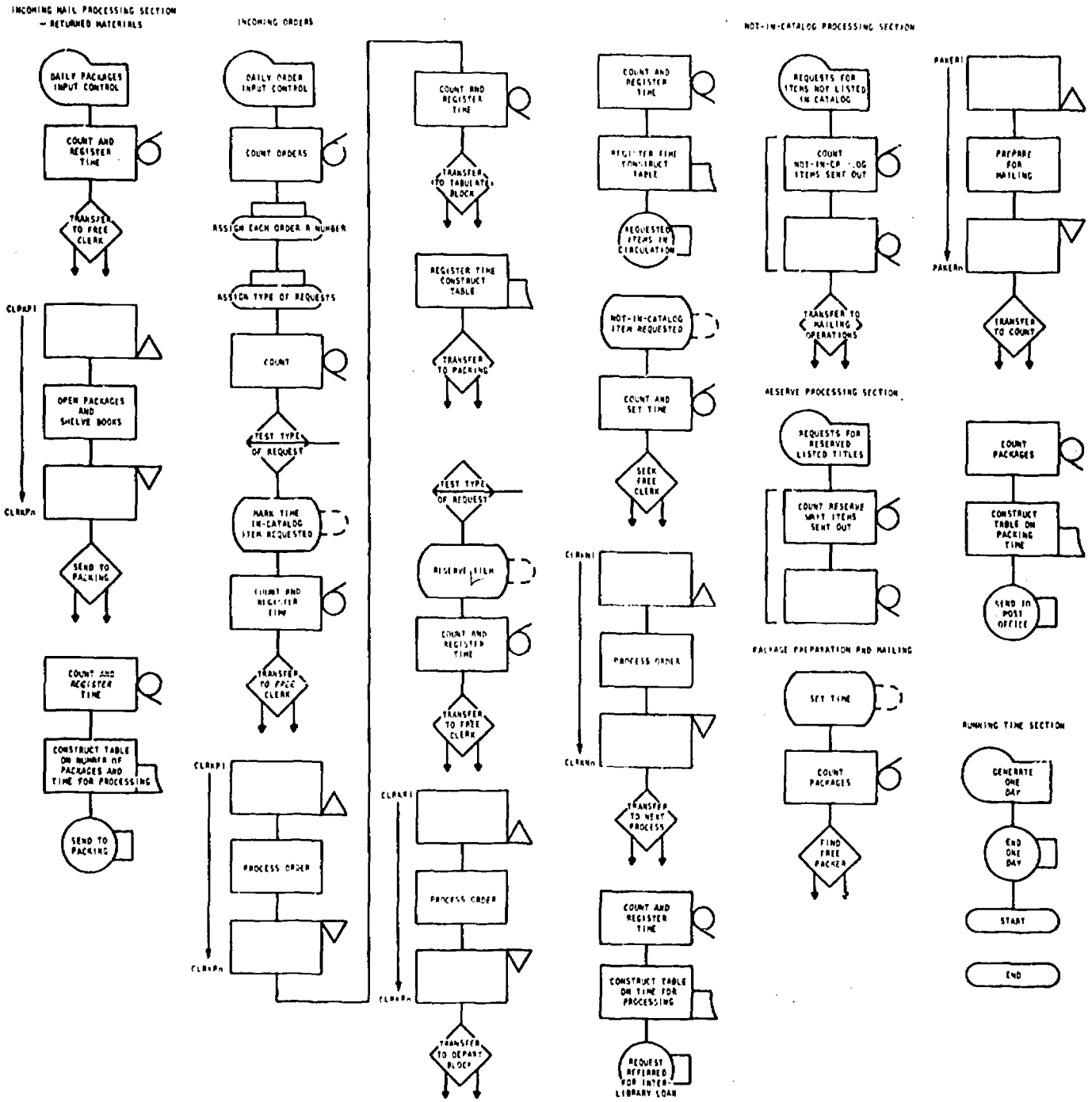
Function FUN3 establishes the nature of the items ordered: titles listed in the MOD catalog, titles not in the catalog (interlibrary loan candidates), or titles in the catalog but on which there are such demands that there are reserve waiting lists.

Functions FUN4, FUN5, and FUN7 assign times for processing each of these types of requests. FUN12 calculates the time necessary to open incoming packages and return books to their places on the shelves. FUN15 computes times for packaging books to send to patrons.

The above functions relate to internal MOD center processing; the four GEN functions relate to the external demand on the MOD system. Function GENA relates to arrival of incoming packages--that is, if a certain number of packages is to be expected per year, then a function is set to input the required number of package transactions in a given length of time from a probability distribution.

Function GENB computes the rate of incoming orders; GENC the rate of receipt of requests for not-in-catalog items; and GEND the rate of requests received for reserve items. The mathematical definitions for these functions are not reproduced in the present report, since they vary with the specific simulation.

WORK FLOW DIAGRAM FOR COMPUTER SIMULATION
LIBRARY-MAIL ORDER DELIVERY



```
                 04/29/74        SPECTRA 70 FLOW SIMULATOR INPUT        PAGE     1 (V7)

   BLOCK
  NUMBER    *LOC     NAME      A,B,C,D,E,F,G      COMMENTS                                   CARD
                     JOB       LIBRARY SIMULATION -- MAIL ORDER DELIVERY   --ORDERS--        00001
            *                                                                                00002
            *        ONE TIME UNIT = ONE MINUTE                                              00003
            *                                                                                00004
            *                                                                                00005
            * DISTRIBUTIONS * INPUTS TO SYSTEM  *                                            00006
            *                                                                                00007
            FUN2     FUNCTION                     NUMBER OF ITEMS PER ORDER CARD             00008
                                                                                             00009
            FUN3     FUNCTION                     RATIO OF TYPES OF REQUESTS                 00010
                                                                                             00011
            FUN4     FUNCTION                     PROCESSING TIME, IN-CATALOG ITEMS          00012
                                                                                             00013
            FUN5     FUNCTION                     PROCESSING TIME, RESERVE ITEMS             00014
                                                                                             00015
            FUN7     FUNCTION                     PROCESSING NOT-IN-CATALOG ITEMS            00016
                                                                                             00017
                                                                                             00018
            FUN12    FUNCTION                     TIME OPENING PKGS AND SHELVING BOOKS       00019
                                                                                             00020
            FUN15    FUNCTION                     PREPARING PACKAGES FOR MAILING             00021
                                                                                             00022
            GENA     FUNCTION                     RATE OF INCOMING PACKAGES                  00023
                                                                                             00024
            GENB     FUNCTION                     RATE OF INCOMING ORDERS                    00025
                                                                                             00026
            GENC     FUNCTION                     RATE OF NOT-IN-CATALOG ITEMS               00027
```

BLOCK NUMBER	*LOC	NAME	A,B,C,D,E,F,G	COMMENTS	CARD
					00028
	GEND	FUNCTION		RATE OF RESERVE ITEMS	00029
					00030
					00031
	*				00032
	* TRANSACTION PROCESSING MODEL				00033
	*				00034
	* INCOMING MAIL PROCESSING SECTION				00035
	*				00036
	* LIBRARY MATERIALS RETURNED BY PATRONS				00037
	*				00038
00001		GENERATE	1,FN$GENA	INCOMING PACKAGES	00039
00002	SESAME	QUEUE	RETURN	COUNT PACKAGES RETURNING	00040
00003		TRANSFER	ALL,CLRKP1,CLRKP8,4.		00041
00004	CLRKP1	SEIZE	CLRKP1		00042
00005		ADVANCE	1,FN$FUN12		00043
00006		RELEASE	CLRKP1		00044
00007		TRANSFER	,PROC1		00045
00008	CLRKP2	SEIZE	CLRKP2		00046
00009		ADVANCE	1,FN$FUN12		00047
00010		RELEASE	CLRKP2		00048
00011		TRANSFER	,PROC1		00049
00012	CLRKP3	SEIZE	CLRKP3		00050
00013		ADVANCE	1,FN$FUN12		00051
00014		RELEASE	CLRKP3		00052
00015		TRANSFER	,PROC1		00053
00016	CLRKP4	SEIZE	CLRKP4		00054

BLOCK NUMBER	*LOC	NAME	A,B,C,D,E,F,G	COMMENTS	CARD
00017		ADVANCE	1,FN$FUN12		00055
00018		RELEASE	CLRKP4		00056
00019		TRANSFER	,PROC1		00057
00020	CLRKP5	SEIZE	CLRKP5		00058
00021		ADVANCE	1,FN$FUN12		00059
00022		RELEASE	CLRKP5		00060
00023		TRANSFER	,PROC1		00061
00024	CLRKP6	SEIZE	CLRKP6		00062
00025		ADVANCE	1,FN$FUN12		00063
00026		RELEASE	CLRKP6		00064
00027		TRANSFER	,PROC1		00065
00028	CLRKP7	SEIZE	CLRKP7		00066
00029		ADVANCE	1,FN$FUN12		00067
00030		RELEASE	CLRKP7		00068
00031		TRANSFER	,PROC1		00069
00032	CLRKP8	SEIZE	CLRKP8		00070
00033		ADVANCE	1,FN$FUN12		00071
00034		RELEASE	CLRKP8		00072
00035	PROC1	DEPART	RETURN		00073
00036		TABULATE	TAB2		00074
00037	SHELF	TERMINATE			00075
	*				00076
	* INCOMING ORDERS SECTION				00077
	*				00078
00038		GENERATE	1,FN$GEN8	INCOMING ORDERS	00079
00039		QUEUE	INORDERS		00080
00040	REQ	ASSIGN	2,FN$FUN2	NUMBER OF ITEMS REQUESTED IN ORDER	00081

BLOCK NUMBER	*LOC	NAME	A,B,C,D,E,F,G	COMMENTS	CARD
00041		ASSIGN	3,FN$FUN3	TYPE OF REQUESTS	00082
00042		DEPART	INORDERS		00083
00043	TESTABC	TEST E P3,MODA,TESTBC			00084
00044	MODA	MARK	4		00085
00045		QUEUE	REQ	COUNT IN-CATALOG ORDERS	00086
00046		TRANSFER	ALL,CLRK1,CLRK13,5		00087
00047	CLRK1	SEIZE	CLRK1		00088
00048		ADVANCE	*2,FN$FUN4	TIME TO PROCESS ORDER	00089
00049		RELEASE	CLRK1		00090
00050		DEPART	REQ		00091
00051		TRANSFER	,PROCO		00092
00052	CLRK2	SEIZE	CLRK2		00093
00053		ADVANCE	*2,FN$FUN4	TIME TO PROCESS ORDER	00094
00054		RELEASE	CLRK2		00095
00055		DEPART	REQ		00096
00056		TRANSFER	,PROCO		00097
00057	CLRK3	SEIZE	CLRK3		00098
00058		ADVANCE	*2,FN$FUN4	TIME TO PROCESS ORDER	00099
00059		RELEASE	CLRK3		00100
00060		DEPART	REQ		00101
00061		TRANSFER	,PROCO		00102
00062	CLRK4	SEIZE	CLRK4		00103
00063		ADVANCE	*2,FN$FUN4	TIME TO PROCESS ORDER	00104
00064		RELEASE	CLRK4		00105
00065		DEPART	REQ		00106
00066		TRANSFER	,PROCO		00107
00067	CLRK5	SEIZE	CLRK5		00108

BLOCK NUMBER	#LOC	NAME	A,B,C,D,E,F,G	COMMENTS	CARD
00068		ADVANCE	*2,FN$FUN4	TIME TO PROCESS ORDER	00109
00069		RELEASE	CLRK3		00110
00070		DEPART	REQ		00111
00071		TRANSFER	,PROCO		00112
00072	CLRK6	SEIZE	CLRK6		00113
00073		ADVANCE	*2,FN$FUN4	TIME TO PROCESS ORDER	00114
00074		RELEASE	CLRK6		00115
00075		DEPART	REQ		00116
00076		TRANSFER	,PROCO		00117
00077	CLRK7	SEIZE	CLRK7		00118
00078		ADVANCE	*2,FN$FUN4	TIME TO PROCESS ORDER	00119
00079		RELEASE	CLRK7		00120
00080		DEPART	REQ		00121
00081		TRANSFER	,PROCO		00122
00082	CLRK8	SEIZE	CLRK8		00123
00083		ADVANCE	*2,FN$FUN4	TIME TO PROCESS ORDER	00124
00084		RELEASE	CLRK8		00125
00085		DEPART	REQ		00126
00086		TRANSFER	,PROCO		00127
00087	CLRK9	SEIZE	CLRK9		00128
00088		ADVANCE	*2,FN$FUN4	TIME TO PROCESS ORDER	00129
00089		RELEASE	CLRK9		00130
00090		DEPART	REQ		00131
00091		TRANSFER	,PROCO		00132
00092	CLRK10	SEIZE	CLRK10		00133
00093		ADVANCE	*2,FN$FUN4	TIME TO PROCESS ORDER	00134
00094		RELEASE	CLRK10		00135

BLOCK NUMBER	#LOC	NAME	A,B,C,D,E,F,G	COMMENTS	CARD
00095		DEPART	REQ		00136
00096		TRANSFER	,PROCO		00137
00097	CLRK11	SEIZE	CLRK11		00138
00098		ADVANCE	*2,FN$FUN4	TIME TO PROCESS ORDER	00139
00099		RELEASE	CLRK11		00140
00100		DEPART	REQ		00141
00101		TRANSFER	,PROCO		00142
00102	CLRK12	SEIZE	CLRK12		00143
00103		ADVANCE	*2,FN$FUN4	TIME TO PROCESS ORDER	00144
00104		RELEASE	CLRK12		00145
00105		DEPART	REQ		00146
00106		TRANSFER	,PROCO		00147
00107	CLRK13	SEIZE	CLRK13		00148
00108		ADVANCE	*2,FN$FUN4	TIME TO PROCESS ORDER	00149
00109		RELEASE	CLRK13		00150
00110		DEPART	REQ		00151
00111	PROCO	TABULATE	TAB3		00152
00112		TRANSFER	,PAK		00153
00113	TESTBC	TEST E P3,MODB,MODC			00154
00114	MODB	MARK	5		00155
00115		QUEUE	RES	COUNT RESERVE ITEMS REQUESTED	00156
00116		TRANSFER	ALL,CLRKR1,CLRKR4,4		00157
00117	CLRKR1	SEIZE	CLRKR1		00158
00118		ADVANCE	*2,FN$FUN5	RESERVE ITEM PROCESSING TIME	00159
00119		RELEASE	CLRKR1		00160
00120		TRANSFER	,PROCR		00161
00121	CLRKR2	SEIZE	CLRKR2		00162

BLOCK NUMBER	*LOC	NAME	A,B,C,D,E,F,G	COMMENTS	CARD
00122		ADVANCE	*2,FN$FUN5	RESERVE ITEM PROCESSING TIME	00163
00123		RELEASE	CLRKR2		00164
00124		TRANSFER	,PROCR		00165
00125	CLRKR3	SEIZE	CLRKR3		00166
00126		ADVANCE	*2,FN$FUN5	RESERVE ITEM PROCESSING TIME	00167
00127		RELEASE	CLRKR3		00168
00128		TRANSFER	,PROCR		00169
00129	CLRKR4	SEIZE	CLRKR4		00170
00130		ADVANCE	*2,FN$FUN5	RESERVE ITEM PROCESSING TIME	00171
00131		RELEASE	CLRKR4		00172
00132	PROCR	DEPART	RES		00173
00133		TABULATE	TAB4		00174
00134		TERMINATE		REQUESTED ITEM IS IN CIRCULATION	00175
00135	MODC	MARK	6		00176
00136		QUEUE	NIC	COUNT NOT-IN-CATALOG ITEMS REQUESTED	00177
00137		TRANSFER	ALL,CLRKN1,CLRKN7,4		00178
00138	CLRKN1	SEIZE	CLRKN1		00179
00139		ADVANCE	*2,FN$FUN7	NOT-IN-CAT ITEM PROCESSING TIME	00180
00140		RELEASE	CLRKN1		00181
00141		TRANSFER	,PROCN		00182
00142	CLRKN2	SEIZE	CLRKN2		00183
00143		ADVANCE	*2,FN$FUN7	NOT-IN-CAT ITEM PROCESSING TIME	00184
00144		RELEASE	CLRKN2		00185
00145		TRANSFER	,PROCN		00186
00146	CLRKN3	SEIZE	CLRKN3		00187
00147		ADVANCE	*2,FN$FUN7	NOT-IN-CAT ITEM PROCESSING TIME	00188
00148		RELEASE	CLRKN3		00189

BLOCK NUMBER	*LOC	NAME	A,B,C,D,E,F,G	COMMENTS	CARD
00149		TRANSFER	,PROCN		00190
00150	CLRKN4	SEIZE	CLRKN4		00191
00151		ADVANCE	*2,FN$FUN7	NOT-IN-CAT ITEM PROCESSING TIME	00192
00152		RELEASE	CLRKN4		00193
00153		TRANSFER	,PROCN		00194
00154	CLRKN5	SEIZE	CLRKN5		00195
00155		ADVANCE	*2,FN$FUN7	NOT-IN-CAT ITEM PROCESSING TIME	00196
00156		RELEASE	CLRKN5		00197
00157		TRANSFER	,PROCN		00198
00158	CLRKN6	SEIZE	CLRKN6		00199
00159		ADVANCE	*2,FN$FUN7	NOT-IN-CAT ITEM PROCESSING TIME	00200
00160		RELEASE	CLRKN6		00201
00161		TRANSFER	,PROCN		00202
00162	CLRKN7	SEIZE	CLRKN7		00203
00163		ADVANCE	*2,FN$FUN7	NOT-IN-CAT ITEM PROCESSING TIME	00204
00164		RELEASE	CLRKN7		00205
00165	PROCN	DEPART	NIC		00206
00166		TABULATE	TAB5		00207
00167		TERMINATE		REQUESTED ITEM IS NOT IN MOD CATALOG	00208
	*				00209
	* NOT-IN-CATALOG PROCESSING SECTION				00210
	*				00211
00168		GENERATE	1,FN$GENC	REQUESTS FOR ITEMS NOT LISTED IN CATALOG	00212
00169	NICO	QUEUE	NICO	COUNT NOT-IN-CATALOG ITEMS SENT OUT	00213
00170		DEPART	NICO		00214
00171		TRANSFER	,PAK	SEND OUT	00215
	*				00216

BLOCK NUMBER	*LOC	NAME	A,B,C,D,E,F,G	COMMENTS	CARD
	* ON RESERVE PROCESSING SECTION				00217
	*				00218
00172		GENERATE	1,FN$GEND	REQUESTS FOR ITEMS WITH RESERVE WAITS	00219
00173	RESO	QUEUE	RESO	COUNT RESERVE ITEMS SENT OUT	00220
00174		DEPART	RESO		00221
00175	PAK	MARK	7		00222
00176		QUEUE	PAK	COUNT OUTGOING PACKAGES	00223
00177		TRANSFER	ALL,PAKER1,PAKER5,4		00224
00178	PAKER1	SEIZE	PAKER1		00225
00179		ADVANCE	1,FN$FUN15	TIME FOR PACKAGING	00226
00180		RELEASE	PAKER1		00227
00181		TRANSFER	,PROCPAK		00228
00182	PAKER2	SEIZE	PAKER2		00229
00183		ADVANCE	1,FN$FUN15	TIME FOR PACKAGING	00230
00184		RELEASE	PAKER2		00231
00185		TRANSFER	,PROCPAK		00232
00186	PAKER3	SEIZE	PAKER3		00233
00187		ADVANCE	1,FN$FUN15	TIME FOR PACKAGING	00234
00188		RELEASE	PAKER3		00235
00189		TRANSFER	,PROCPAK		00236
00190	PAKER4	SEIZE	PAKER4		00237
00191		ADVANCE	1,FN$FUN15	TIME FOR PACKAGING	00238
00192		RELEASE	PAKER4		00239
00193		TRANSFER	,PROCPAK		00240
00194	PAKER5	SEIZE	PAKER5		00241
00195		ADVANCE	1,FN$FUN15	TIME FOR PACKAGING	00242
00196		RELEASE	PAKER5		00243

```
BLOCK
NUMBER    *LOC      NAME       A,B,C,D,E,F,G      COMMENTS                    CARD
00197     PROCPAK   DEPART     PAK                                            00244
00198               TABULATE   TAB6                                           00245
00199               TERMINATE                     PACKAGES IN MAIL           00246
                    *                                                        00247
                    TAB2       TABLE M1,1,1,10                               00248
                    TAB3       TABLE MP4,10,10,10                            00249
                    TAB4       TABLE MP5,10,10,10                            00250
                    TAB5       TABLE MP6,10,10,22                            00251
                    TAB6       TABLE MP7,1,1,10                              00252
                    *                                                        00253
                    * RUN TIMING SECTION                                     00254
                    *                                                        00255
00200               GENERATE   480,,,,2                                      00256
00201               TERMINATE  1                                             00257
                    START      22                                            00258
                    END                                                      00259
```

RELATIVE CLOCK TIME: 10560

ABSOLUTE CLOCK TIME: 10560

BLOCK COUNTS

BLOCK	CURR.	TOTAL	BLOCK	CURR.	TOTAL	BLOCK	CURR.	TOTAL	BLOCK	CURR.	TOTAL	BLOCK	CURR.	TOTAL
1	0	2901	SESAME	0	2901	3	0	2901	CLRKP1	0	2355	5	0	2355
6	0	2355	7	0	2355	CLRKP2	0	544	9	0	616	10	0	544
11	0	544	CLRKP3	0	2	13	0	2	14	0	2	15	0	2
CLRKP4	0	0	17	0	0	18	0	0	19	0	0	CLRKP5	0	0
21	0	0	22	0	0	23	0	0	CLRKP6	0	0	25	0	0
26	0	0	27	0	0	CLRKP7	0	0	29	0	0	30	0	0
31	0	0	CLRKP8	0	0	33	0	0	34	0	0	PROC1	0	2901
36	0	2901	SHELF	0	2901	38	0	1597	39	0	1597	REC	0	1597
41	0	1597	42	0	1597	TESTABC	0	1597	MODA	0	1362	45	0	1362
46	0	1362	CLRK1	0	854	48	1	853	49	0	3460	50	0	853
51	0	853	CLRK2	0	412	53	1	411	54	0	411	55	0	411
56	0	411	CLRK3	0	68	58	0	68	59	0	68	60	0	68
61	0	68	CLRK4	0	8	63	0	8	64	0	8	65	0	8
66	0	8	CLRK5	0	0	68	0	0	69	0	0	70	0	0
71	0	0	CLRK6	0	0	73	0	0	74	0	0	75	0	0
76	0	0	CLRK7	0	0	78	0	0	79	0	0	80	0	0
81	0	0	CLRK8	0	0	83	0	0	84	0	0	85	0	0
86	0	0	CLRK9	0	0	88	0	0	89	0	0	90	0	0
91	0	0	CLRK10	0	0	93	0	0	94	0	0	95	0	0
96	0	0	CLRK11	0	0	98	0	0	99	0	0	100	0	0
101	0	0	CLRK12	0	0	103	0	0	104	0	0	105	0	0
106	0	0	CLRK13	0	0	108	0	0	109	0	0	110	0	0
PROC0	0	1360	112	0	1360	TESTBC	0	235	MOD8	0	163	115	0	163
116	0	163	CLRKR1	0	145	118	0	145	119	0	145	120	0	145
CLRKR2	0	18	122	0	18	123	0	18	124	0	18	CLRKR3	0	0
126	0	0	127	0	0	128	0	0	CLRKR4	0	0	130	0	0
131	0	0	PROCR	0	163	133	0	163	134	0	163	MODC	0	72

136	0	72	137	72	0	CLRKN1	0	57	139	1	56	140	0	56
141	0	56	CLRKN2	0	14	143	0	14	144	0	14	145	0	14
CLRKN3	0	1	147	0	1	148	0	1	149	0	1	CLRKN4	0	0
151	0	0	152	0	0	153	0	0	CLRKN5	0	0	155	0	0
156	0	0	157	0	0	CLRKN6	0	0	159	0	0	160	0	0
161	0	0	CLRKN7	0	0	163	0	0	164	0	0	PROCN	0	71
166	0	71	167	0	71	168	0	331	NICO	0	331	170	0	331
171	0	331	172	0	916	RESO	0	916	174	0	916	PAK	0	2607
176	0	2607	177	2607	0	PAKER1	0	2126	179	0	2126	180	0	2126
181	0	2126	PAKER2	0	439	183	0	439	184	0	439	185	0	439
PAKER3	0	39	187	0	39	188	0	39	189	0	39	PAKER4	0	2
191	0	2	192	0	2	193	0	2	PAKER5	0	1	195	0	1
196	0	1	PROCPAK	0	2607	198	0	2607	199	0	2607	200	0	22
201	0	22												

RANGE	FACILITY ID	AVERAGE UTILIZATION	NUMBER ENTRIES	AVERAGE TIME/TRANS	SEIZING TRNSACTION	PREEMPTING TRNSACTION	RANGE
1	CLRKP1	0.447	2355	2.006	0	0	1
2	CLRKP2	0.104	544	2.026	0	0	2
3	CLRKP3	0.000	2	2.000	0	0	3
9	CLRK1	0.549	854	6.790	300	0	9
10	CLRK2	0.254	412	6.517	294	0	10
11	CLRK3	0.056	88	6.670	0	0	11
12	CLRK4	0.004	8	4.875	0	0	12
22	CLRKR1	0.162	145	11.766	0	0	22
23	CLRKR2	0.023	18	13.444	0	0	23
26	CLRKN1	0.351	57	64.965	273	0	26
27	CLRKN2	0.084	14	63.286	0	0	27
28	CLRKN3	0.006	1	67.000	0	0	28
33	PAKER1	0.130	2126	0.648	0	0	33
34	PAKER2	0.029	439	0.695	0	0	34
35	PAKER3	0.002	39	0.487	0	0	35
36	PAKER4	0.000	2	0.500	0	0	36
37	PAKER5		1	0.000	0	0	37

RANGE	QUEUE ID	MAXIMUM CONTENTS	AVERAGE CONTENTS	TOTAL ENTRIES	ZERO ENTRIES	%-ZERO ENTRIES	AVERAGE TIME/TRANS	NZ-AVERAGE TIME/TRANS	TABLE NUMBER	CURRENT CONTENTS	RANGE
1	RETURN	3	[illegible]	2901	0	.00	2.009	2.009	0	0	1
2	INORDERS	1	0.000	1597	1597	100.00	0.000	0.000	0	0	2
3	REQ	4	0.863	1362	251	18.42	6.692	8.204	0	2	3
4	RES	2	0.184	163	0	.00	11.951	11.951	0	0	4
5	NIC	3	0.441	72	0	.00	64.667	64.667	0	1	5
6	NICQ	1	0.000	331	331	100.00	0.000	0.000	0	0	6
7	RESQ	1	0.000	916	916	100.00	0.000	0.000	0	0	7
8	PAK	5	0.161	2607	1751	67.16	2.653	1.988	0	0	8

TABLE NUMBER 1

ENTRIES IN TABLE	MEAN ARGUMENT	STANDARD DEVIATION	SUM OF ARGUMENTS
2901	2.009	0.541	5829.002 NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	411	14.17	14.17	85.83	0.498	1.865-
2	2052	70.73	84.90	15.10	0.995	.017-
3	438	15.10	100.00	.00	1.493	1.831
4	0	.00	100.00	.00	1.991	3.679
5	0	.00	100.00	.00	2.488	5.528
6	0	.00	100.00	.00	2.986	7.376
7	0	.00	100.00	.00	3.484	9.225
8	0	.00	100.00	.00	3.981	11.073
9	0	.00	100.00	.00	4.479	12.921
10	0	.00	100.00	.00	4.977	14.770

REMAINING FREQUENCIES ARE ALL ZERO

TABLE NUMBER Z

ENTRIES IN TABLE	MEAN ARGUMENT	STANDARD DEVIATION	SUM OF ARGUMENTS
1360	6.699	5.748	9110.001 NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
10	1121	82.43	82.43	17.57	1.493	0.574
20	179	13.16	95.59	4.41	2.986	2.313
30	57	4.19	99.78	.22	4.479	4.053
40	3	.22	100.00	.00	5.971	5.793
50	0	.00	100.00	.00	7.464	7.532
60	0	.00	100.00	.00	8.957	9.272
70	0	.00	100.00	.00	10.450	11.012
80	0	.00	100.00	.00	11.943	12.751
90	0	.00	100.00	.00	13.436	14.491
100	0	.00	100.00	.00	14.929	16.230

REMAINING FREQUENCIES ARE ALL ZERO

TABLE NUMBER 3

ENTRIES IN TABLE	MEAN ARGUMENT	STANDARD DEVIATION	SUM OF ARGUMENTS
163	11.951	9.604	1948.000 NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
10	101	61.96	61.96	38.04	0.837	.198-
20	34	20.86	82.82	17.18	1.674	0.820
30	16	9.82	92.64	7.36	2.510	1.840
40	11	6.75	99.38	.62	3.347	2.860
50	1	.61	100.00	.00	4.184	3.880
60	0	.00	100.00	.00	5.021	4.900
70	0	.00	100.00	.00	5.857	5.920
80	0	.00	100.00	.00	6.694	6.940
90	0	.00	100.00	.00	7.531	7.960
100	0	.00	100.00	.00	8.368	8.980

REMAINING FREQUENCIES ARE ALL ZERO

TABLE NUMBER 4

ENTRIES IN TABLE	MEAN ARGUMENT	STANDARD DEVIATION	SUM OF ARGUMENTS
71	65.577	38.256	4656.003 NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
10	5	7.04	7.04	92.96	0.152	1.452-
20	4	5.63	12.68	87.33	0.305	1.191-
30	1	1.41	14.08	85.92	0.457	.929-
40	10	14.08	28.17	71.83	0.610	.668-
50	4	5.63	33.80	66.20	0.762	.407-
60	12	16.90	50.70	49.30	0.915	.145-
70	9	12.68	63.38	36.62	1.067	0.115
80	7	9.86	73.24	26.76	1.220	0.377
90	4	5.63	78.87	21.13	1.372	0.638
100	2	2.82	81.69	18.32	1.525	0.899
110	2	2.82	84.50	15.50	1.677	1.161
120	4	5.63	90.13	9.87	1.830	1.422
130	2	2.82	92.95	7.05	1.982	1.683
140	1	1.41	94.36	5.64	2.135	1.945
150	2	2.82	97.17	2.83	2.287	2.206
160	1	1.41	98.58	1.42	2.440	2.468
170	1	1.41	99.99	.01	2.592	2.729
180	0	.00	99.99	.01	2.745	2.990
190	0	.00	99.99	.01	2.897	3.252
200	0	.00	99.99	.01	3.050	3.513
210	0	.00	99.99	.01	3.202	3.775
220	0	.00	99.99	.01	3.355	4.036

REMAINING FREQUENCIES ARE ALL ZERO

TABLE NUMBER 5

ENTRIES IN TABLE	MEAN ARGUMENT	STANDARD DEVIATION	SUM OF ARGUMENTS
2607	0.653	1.129	1702.000 NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	2128	81.63	81.63	18.37	1.532	0.307
2	235	9.01	90.64	9.36	3.063	1.193
3	151	5.79	96.43	3.57	4.595	2.078
4	63	2.42	98.85	1.15	6.127	3.964
5	30	1.15	100.00	.00	7.659	5.849
6	0	.00	100.00	.00	9.190	4.735
7	0	.00	100.00	.00	10.722	5.620
8	0	.00	100.00	.00	12.254	6.506
9	0	.00	100.00	.00	13.786	7.392
10	0	.00	100.00	.00	15.317	8.277

REMAINING FREQUENCIES ARE ALL ZERO

RELATIVE CLOCK TIME: 10560

ABSOLUTE CLOCK TIME: 10560

BLOCK COUNTS

BLOCK	CURR.	TOTAL	BLOCK	CURR.	TOTAL	BLOCK	CURR.	TOTAL	BLOCK	CURR.	TOTAL	BLOCK	CURR.	TOTAL
1	0	25537	SESAME	0	25537	3	0	25537	CLRKP1	0	4062	5	0	4062
6	0	4062	7	0	4062	CLRKP2	0	3686	9	0	3636	10	0	3141
11	0	3686	CLRKP3	0	3250	13	0	3250	14	0	3250	15	0	3250
CLRKP4	0	2850	17	0	2850	18	0	2850	19	0	2850	CLRKP5	0	2490
21	0	2490	22	0	2490	23	0	2490	CLRKP6	0	2147	25	0	2147
26	0	2147	27	0	2147	CLRKP7	0	1847	29	0	1847	30	0	1847
31	0	1847	CLRKP8	0	1594	33	0	1594	34	0	1594	35	0	1594
CLRKP9	0	1381	37	0	1381	38	0	1381	39	0	1840	CLRKP10	0	1212
41	0	1212	42	0	1212	43	0	1212	CLRKP11	0	1018	45	0	1018
46	0	1018	PROC1	0	25537	48	0	25537	SHELF	0	25537	50	0	14770
51	0	14770	REQ	0	14770	53	0	14770	54	0	14770	TESTABC	0	14770
MODA	0	12836	57	0	12836	58	0	12836	CLRK1	0	1412	60	1	1411
61	0	1411	62	0	1411	63	0	1411	CLRK2	0	1298	65	1	1297
66	0	1297	67	0	1297	68	0	1297	CLRK3	0	1270	70	0	1270
71	0	1270	72	0	1270	73	0	1270	CLRK4	0	1218	75	1	1217
76	0	1217	77	0	1217	78	0	1217	CLRK5	0	24964	80	1	1189
81	0	1189	82	0	1189	83	0	1189	CLRK6	0	1055	85	1	1054
86	0	1054	87	0	1054	88	0	1054	CLRK7	0	958	90	1	957
91	0	957	92	0	957	93	0	957	CLRK8	0	883	95	1	862
96	0	882	97	0	882	98	0	882	CLRK9	0	790	100	0	790
101	0	790	102	0	790	103	0	790	CLRK10	0	683	105	0	683
106	0	683	107	0	683	108	0	683	CLRK11	0	563	110	0	563
111	0	563	112	0	563	113	0	563	CLRK12	0	519	115	0	519
116	0	519	117	0	519	118	0	519	CLRK13	0	391	120	0	391
121	0	391	122	0	391	123	0	391	CLRK14	0	327	125	0	327
126	0	327	127	0	327	128	0	327	CLRK15	0	299	130	0	299
131	0	299	132	0	299	PROCO	0	12849	134	0	12849	TESTBC	0	1914

MODB	0	1455	137	0	1455	138	1455	0	CLRKR1	0	560	140	1	559	
141	0	559	142	0	559	CLRKR2	0	403	144	0	403	145	0	403	
146	0	403	CLRKR3	0	271	148	0	271	149	0	271	150	0	271	
CLRKR4	0	133	152	0	133	153	0	133	154	0	133	CLRKR5	0	59	
156	1	58	157	0	58	158	0	58	CLRKR6	0	29	160	0	29	
161	0	29	PROCR	0	1453	163	0	1453	164	0	1453	MODC	0	459	
166	0	459	167	459	0	CLRKN1	0	124	169	0	124	170	0	124	
171	0	124	CLRKN2	0	111	173	1	110	174	0	110	175	0	110	
CLRKN3	0	84	177	0	84	178	0	84	179	0	84	CLRKN4	0	65	
181	0	65	182	0	65	183	0	55	CLRKN5	0	37	185	0	37	
186	0	37	187	0	37	CLRKN6	0	25	189	0	25	190	0	25	
191	0	25	CLRKN7	0	13	193	0	13	194	0	13	PROCN	0	458	
196	0	458	197	0	458	198	0	2516	NICO	0	2516	200	0	2516	
201	0	2516	202	0	8409	RESO	0	8409	204	0	8409	PAK	0	23774	
206	0	23774	207	23774	0	PAKER1	0	7736	209	1	7735	210	0	7735	
211	0	7735	PAKER2	0	6357	213	1	6356	214	0	6356	215	0	6356	
PAKER3	0	4869	217	0	4869	218	0	4869	219	0	4869	PAKER4	0	3097	
221	1	3096	222	0	3096	223	0	3096	PAKER5	0	1715	225	0	1715	
226	0	1715	PROCPAK	0	23771	228	0	23771	229	0	23771	230	0	22	
231	0	22													

RANGE	FACILITY	AVERAGE IO UTLIZATION	NUMBER ENTRIES	AVERAGE TIME/TRANS	SEIZING TRNSACTION	PREEMPTING TRNSACTION	RANGE
1	CLRKP1	0.769	4042	1.998	0	0	1
2	CLRKP2	0.699	3686	2.004	0	0	2
3	CLRKP3	0.617	3250	2.003	0	0	3
4	CLRKP4	0.538	2850	1.994	0	0	4
5	CLRKP5	0.471	2490	1.999	0	0	5
6	CLRKP6	0.410	2147	2.016	0	0	6
7	CLRKP7	0.349	1847	1.996	0	0	7
8	CLRKP8	0.302	1594	1.999	0	0	8
9	CLRKP9	0.262	1381	2.002	0	0	9
10	CLRKP10	0.232	1212	2.025	0	0	10
11	CLRKP11	0.195	1018	2.020	0	0	11
12	CLRK1	0.883	1412	6.605	753	0	12
13	CLRK2	0.852	1298	6.929	620	0	13
14	CLRK3	0.828	1270	6.887	0	0	14
15	CLRK4	0.773	1218	6.696	824	0	15
16	CLRK5	0.728	1190	6.402	724	0	16
17	CLRK6	0.700	1055	7.010	955	0	17
18	CLRK7	0.637	958	7.022	955	0	18
19	CLRK8	0.572	883	6.843	853	0	19
20	CLRK9	0.501	790	6.691	0	0	20
21	CLRK10	0.434	683	6.716	0	0	21
22	CLRK11	0.368	563	6.906	0	0	22
23	CLRK12	0.322	519	6.551	0	0	23
24	CLRK13	0.237	391	6.414	0	0	24
25	CLRK14	0.213	327	6.890	0	0	25
26	CLRK15	0.175	299	6.197	0	0	26
27	CLRKR1	0.603	560	11.368	916	0	27
28	CLRKR2	0.448	403	11.749	0	0	28
29	CLRKR3	0.275	271	10.708	0	0	29

RANGE	FACILITY ID	AVERAGE UTILIZATION	NUMBER ENTRIES	AVERAGE TIME/TRANS.	SEIZING TRNSACTION	PREEMPTING TRNSACTION	RANGE
30	CLRKR4	0.138	133	10.992	0	0	30
31	CLRKR5	0.064	59	11.390	474	0	31
32	CLRKR6	0.033	29	12.000	0	0	32
33	CLRKN1	0.710	124	60.435	0	0	33
34	CLRKN2	0.609	111	57.955	947	0	34
35	CLRKN3	0.486	84	61.131	0	0	35
36	CLRKN4	0.387	65	62.800	0	0	36
37	CLRKN5	0.227	37	64.703	0	0	37
38	CLRKN6	0.148	25	62.720	0	0	38
39	CLRKN7	0.098	13	79.846	0	0	39
40	PAKER1	0.484	7736	0.661	703	0	40
41	PAKER2	0.408	6357	0.678	476	0	41
42	PAKER3	0.296	4869	0.643	0	0	42
43	PAKER4	0.198	3097	0.675	630	0	43
44	PAKER5	0.117	1715	0.720	0	0	44

RANGE	QUEUE ID	MAXIMUM CONTENTS	AVERAGE CONTENTS	TOTAL ENTRIES	ZERO ENTRIES	%-ZERO ENTRIES	AVERAGE TIME/TRANS	NZ-AVERAGE TIME/TRANS	TABLE NUMBER	CURRENT CONTENTS	RANGE
1	RETURN	37	5.468	25537	0	.00	2.261	2.261	0	0	1
2	INORDERS	1	0.000	14770	14770	100.00	0.000	0.000	0	0	2
3	REQ	36	8.477	12856	2090	16.25	6.963	8.315	0	7	3
4	RES	8	1.569	1455	0	.00	11.388	11.388	0	2	4
5	NIC	12	2.705	459	0	.00	62.233	62.233	0	1	5
6	NICQ	1	0.000	2516	2516	100.00	0.000	0.000	0	0	6
7	RESQ	1	0.000	8409	8409	100.00	0.000	0.000	0	0	7
8	PAK	16	1.525	23774	15830	66.58	0.678	2.028	0	3	8

TABLE NUMBER 1

ENTRIES IN TABLE	MEAN ARGUMENT	STANDARD DEVIATION	SUM OF ARGUMENTS
25337	2.281	0.848	57748.002 NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	3148	12.33	12.33	87.67	0.442	1.486-
2	15210	59.56	71.89	28.11	0.884	.308-
3	5254	20.57	92.46	7.54	1.327	0.870
4	1375	5.38	97.85	2.16	1.769	2.049
5	427	1.67	99.52	.48	2.211	3.227
6	83	.33	99.84	.16	2.653	4.406
7	35	.14	99.98	.02	3.095	5.584
8	5	.02	100.00	.00	3.538	6.763
9	0	.00	100.00	.00	3.980	7.942
10	0	.00	100.00	.00	4.422	9.120

REMAINING FREQUENCIES ARE ALL ZERO

TABLE NUMBER 2

ENTRIES IN TABLE	MEAN ARGUMENT	STANDARD DEVIATION	SUM OF ARGUMENTS
12849	6.966	5.709	89510.019 NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
10	10433	81.20	81.20	18.80	1.435	0.531
20	1931	15.02	96.22	3.78	2.871	2.285
30	464	3.61	99.83	.17	4.306	4.038
40	22	.17	100.00	.00	5.742	5.792
50	0	.00	100.00	.00	7.177	7.545
60	0	.00	100.00	.00	8.613	9.299
70	0	.00	100.00	.00	10.048	11.052
80	0	.00	100.00	.00	11.484	12.805
90	0	.00	100.00	.00	12.919	14.559
100	0	.00	100.00	.00	14.355	16.312

REMAINING FREQUENCIES ARE ALL ZERO

TABLE NUMBER 3

ENTRIES IN TABLE	MEAN ARGUMENT	STANDARD DEVIATION	SUM OF ARGUMENTS
1453	11.388	8.871	16547.001 NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
10	921	63.39	63.39	36.61	0.878	-.156
20	346	23.81	87.20	12.80	1.756	0.970
30	126	8.67	95.87	4.13	2.634	2.097
40	41	2.82	98.69	1.31	3.512	3.225
50	14	.96	99.65	.35	4.391	4.352
60	2	.14	99.79	.21	5.269	5.479
70	3	.21	100.00	.00	6.147	6.606
80	0	.00	100.00	.00	7.025	7.733
90	0	.00	100.00	.00	7.903	8.861
100	0	.00	100.00	.00	8.781	9.988

REMAINING FREQUENCIES ARE ALL ZERO

TABLE NUMBER 4

ENTRIES IN TABLE	MEAN ARGUMENT	STANDARD DEVIATION	SUM OF ARGUMENTS
458	62.343	36.702	28553.003 NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
10	12	2.62	2.62	97.38	0.160	1.420-
20	29	6.33	8.95	91.05	0.321	1.153-
30	44	9.61	18.56	81.44	0.481	.891-
40	63	13.76	32.31	67.69	0.642	.668-
50	53	11.57	43.88	56.12	0.802	.336-
60	59	12.88	56.77	43.23	0.962	.063-
70	46	10.04	66.81	33.19	1.123	0.208
80	31	6.77	73.58	26.42	1.283	0.431
90	30	6.55	80.13	19.87	1.444	0.733
100	21	4.59	84.71	15.29	1.604	1.026
110	17	3.71	88.42	11.58	1.764	1.298
120	13	2.84	91.26	8.74	1.925	1.570
130	13	2.84	94.10	5.90	2.085	1.843
140	12	2.62	96.72	3.28	2.246	2.115
150	6	1.31	98.03	1.97	2.406	2.388
160	3	.66	98.68	1.32	2.566	2.660
170	3	.66	99.34	.66	2.727	2.933
180	1	.22	99.56	.44	2.887	3.205
190	0	.00	99.56	.44	3.048	3.478
200	0	.00	99.56	.44	3.208	3.750
210	0	.00	99.56	.44	3.368	4.023
220	2	.44	99.99	.01	3.529	4.295

REMAINING FREQUENCIES ARE ALL ZERO

TABLE NUMBER 5

ENTRIES IN TABLE	MEAN ARGUMENT	STANDARD DEVIATION	SUM OF ARGUMENTS
23771	0.676	1.157	16107.003 NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	19241	80.94	80.94	19.06	1.476	0.278
2	2143	9.02	89.97	10.03	2.952	1.143
3	1330	5.61	95.57	4.43	4.427	2.007
4	761	3.20	98.97	1.03	5.903	2.872
5	243	1.02	99.99	.01	7.379	3.737
6	0	.00	99.99	.01	8.855	4.601
7	1	.00	100.00	.00	10.331	5.466
8	0	.00	100.00	.00	11.807	6.331
9	0	.00	100.00	.00	13.282	7.195
10	0	.00	100.00	.00	14.758	8.060

REMAINING FREQUENCIES ARE ALL ZERO