NATIONAL BUREAU OF STANDARDS REPORT

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A STATISTICAL CHAIN RATIO METHOD FOR DETERMINING THE DISTRIBUTION OF MAIL BY DESTINATION

By

Norman C. Severo
Arthur E. Newman

Report to
Post Office Department
Office of Research and Engineering

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

THE NATIONAL BUREAU OF STANDARDS

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To

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PREFACE

The National Bureau of Standards is developing equipments and systems for improved letter sorting by automation. Therefore it is necessary to determine the nature and distribution of mail in post offices.

Since the volume of mail is much too large for complete piece counts to be feasible, sampling methods of known and adequate accuracy must be used. The present paper is the first step in the effort to develop such methods as applied to mail distribution.

ISRAEL ROTKIN
Coordinator, Post Office Project

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A work of this magnitude could not have been carried out without the splendid cooperation of many other people. The authors particularly wish to express their deepest appreciation to Dr. Marvin Zelen, N.B.S., for his enthusiastic encouragement and many helpful suggestions throughout the course of this study; to Mrs. Jeanne Auber, N.B.S., for her untiring assistance and perserverance in performing almost all of the arduous computations and tabulations; to Mrs. Lola S. Deming, N.B.S., for a detailed statistical review of the original manuscript; to Inspector John Falconer, Post Office Department, and Messrs. Martin Stark and John Lloyd, both of N.B.S., for their assistance in supervising the collection of data involved in the sampling procedures. Finally, gratitude is expressed to the Postmasters and staffs of the San Francisco, Los Angeles, and Baltimore Post Offices for their cordial cooperation.

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This report outlines the methods, techniques and procedure of a statistical sampling plan designed to determine, for any post office, the percentages of mail destined for all final separations. This method was applied to outgoing first class letter-mail at the San Francisco, Los Angeles and Baltimore Post Offices. The results for each of these post offices are included here. Some of the principal conclusions of this study are:

San Francisco:

1. The largest 200 Destinations received 80% of the Total Volume.
2. Seventy-six percent of the Total Volume remained in the state of California (not including Air-mail and Go-backs).
3. Thirty-nine percent of the Total Volume remained in San Francisco.
4. Only seven Destinations received more than 1% of the Total Volume, respectively.

Los Angeles:

1. The largest 200 Destinations received 81% of the Total Volume.
2. Seventy-eight percent of the Total Volume remained in the state of California (not including Air-mail and Go-backs).

Los Angeles (Continued):

3. Forty-two percent of the Total Volume remained in Los Angeles.
4. Only six Destinations received more than 1% of the Total Volume, respectively.

Baltimore:

1. The largest 200 Destinations received 78% of the Total Volume.
2. Sixty-six percent of the Total Volume remained in the state of Maryland (not including Air-mail and Go-backs).
3. Fifty-one percent of the Total Volume remained in Baltimore.
4. Only four cities received more than 1% of the Total Volume, respectively.

In General:

1. The sampling methods presented here are relatively simple to apply.
2. The final percentages given in the Tables 4, 8, and 13 may be used to determine the expected number of letters per Destination on a daily or weekly basis. This may be done by multiplying the percentage, expressed in decimals, corresponding to the Destination by the average daily or weekly Total Volume of letters.

Formulae for determining the reliability of the estimates given in this report will follow in a supplement.

When additional data of this type are needed for other post offices it is strongly recommended that a statistical sampling plan similar to that described in this report be used. The use of such a plan will result in:

a. accurate results,

b. no delay in moving the mail through the post office,

c. relatively small cost.

In the past such data have been gathered by complete enumeration. It is our recommendation that such methods be discarded for the more scientific statistical sampling procedures.

2. Introduction.

This report discusses the methods, techniques, and analyses of a sampling procedure designed to estimate the distribution of mail by destination (i.e., the proportion of mail going to each Destination). In the course of this study the method has often been referred to as the "Chain ratio" method because the nature of the formulae involved in the analyses resembles a chain of ratios. The method is applied to outgoing first class letter-mail at the San Francisco, Los Angeles and Baltimore Post Offices.

It was intended, initially, to study five cities: Baltimore, Washington, Philadelphia, Chicago and Los Angeles. Philadelphia, Baltimore, and Washington were chosen because they would tend to give a pattern of postal operations on the East Coast. Chicago was chosen to show Mid-west influence, and Los Angeles was selected to show the West Coast influence. San Francisco was added to the list in an effort to find out whether or not Los Angeles was atypical, because, Los Angeles services an unusually large area, as compared with other Post Offices.

The Post Office Department made special studies in Philadelphia, Chicago and New York, where in each case a complete count was made of the Total Volume of mail to each destination for either a 24 or 48 hour period of time. The NBS also made a modified version of the complete count on November 5th, 1956, in Baltimore. In this count, only the total volume entering the system between 4:00 P.M. and 7:00 P.M. was included.

However, any complete count of large volumes of mail, even for short periods of time such as three hours, involves a considerable number of man hours and invariably tends to delay the normal function of sorting mail. Furthermore, any such complete counts are open to criticisms that may be leveled against complete enumeration methods. (The literature contains many examples [1], [2], [3], [4][1] comparing complete

[1] Figures in brackets refer to the list of references given at the end of the report.

enumeration methods with statistically designed sampling procedures, and shows the desirability, from the economics and reliability point of view, of the sampling techniques). A complete count of mail, properly done, say, for 24 hours, gives a good indication of what happens during a particular 1/365 part of a year. If one wishes to enlarge this fraction then additional complete counts can be made. Thus to represent a particular 5/365 part of a year one might take five consecutive days - e.g., Monday through Friday or Thursday through Monday depending upon whether or not the weekend is to be included. This is expensive and time consuming. Furthermore tremendous effort is needed on the part of all concerned to keep tract of all the mail to each Destination. Thus errors are bound to occur. Finally, the mail itself will tend to be delayed during such exhausting counts. A sampling study, however, enables one to check the behavior of mail from time to time during any interval of time and with far less effort than needed in a complete enumeration. Thus, for example, to obtain information about mail for some given week, samples may be taken several times each day throughout the week. (Actually in the applications discussed here, two samples a day were taken during five-day periods excluding the weekends). Or if one wanted to check

the behavior of mail for any other given time period, say some particular month or during the Christmas rush, then samples could be taken from time to time during that particular time period.

Section 3 gives the definitions and notations as used in this report and the model of the flow of mail that is studied. Section 4 discusses in detail the sampling procedures, analysis and necessary volume counts of the statistical chain ratio method. Section 5 defines precisely the types of mail that were studied at San Francisco, Los Angeles and Baltimore. Sections 6, 7 and 8 present the details of the San Francisco, Los Angeles and Baltimore studies, respectively.

3. Definitions, The Model and Notations

3.1 Definitions. A list of definitions of terms, as used in this report, is given here for reference.[1/] These definitions are given in order to avoid misinterpretation and ambiguity because of postal language differences between post offices.

1. Separation. - A Separation is a classification characterized by a labeled pigeon-hole on a sorting case.

1/ Terms not defined in this section are used as given in the "Glossary of Postal Terms in Common Use".

2. Destination. - A Destination for a given post office is a final Separation made at that post office. All directs and residues are included in this classification. [1]

3. Direct. - A Direct is a Destination to a single given post office.

4. Distribution. - A Distribution is the function of physically sorting letters into their respective separation boxes.

5. Primary. - The term Primary, (often referred to as Mailing Primary), is the first stage of Distribution of outgoing mail.

6. Secondary. - The term Secondary (often referred to as State Primary), is the second stage of Distribution of outgoing mail. Secondary mail can not be distributed to final Destination on the Primary.

7. Tertiary. - The term Tertiary, (often referred to as State Secondary), is the third stage of Distribution of outgoing mail. Tertiary mail can not be distributed to final Destination on the Secondary.

8. By-pass mail. - The term By-pass mail refers to mail which receives its first Distribution in the Secondary or Tertiary cases. Also the term refers to mail which goes directly to the city section.

9. Residue. - The term Residue refers to mail destined for post offices for which no direct Separation is provided in case or rack.

10. Total Volume. - The term Total Volume refers to the defined classes of mail studied. (Total Volume is defined more explicitly as used in this study in Section 5).

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[1] Nixies, Go-backs, Misfiles, Air Mail and Foreign off Primary are also considered Destinations in this study.

3.2 The Model. The model for the operation of outgoing mail that is discussed in this report consists of a three stage sorting scheme which can be represented by a flow chart as given in Figure 1. The Total Volume in the top box consists of those types of mail indicated in Section 5. This volume then divides into two parts, that which goes into the Primary and that which by-passes the Primary. The By-pass mail is sent either to the city section or into the Secondary. Mail leaving the Primary may go either to its Destinations or into the Secondary. Mail leaving the Secondary goes either to its Destinations or into the Tertiary. Mail leaving the Tertiary goes directly to its Destinations.

3.3 Notations. The list of notations used in this report are summarized here. Ratios without parentheses indicate that those ratios are obtained from sample figures. Ratios in parentheses ( ) indicate that those ratios are obtained from volume counts. Ratios in starred parentheses ( )* indicate that those ratios are obtained from the appropriate formulae of Section 4.3.

$\left(\frac{T_P}{T}\right)$ = Ratio of Primary mail to the Total Volume.

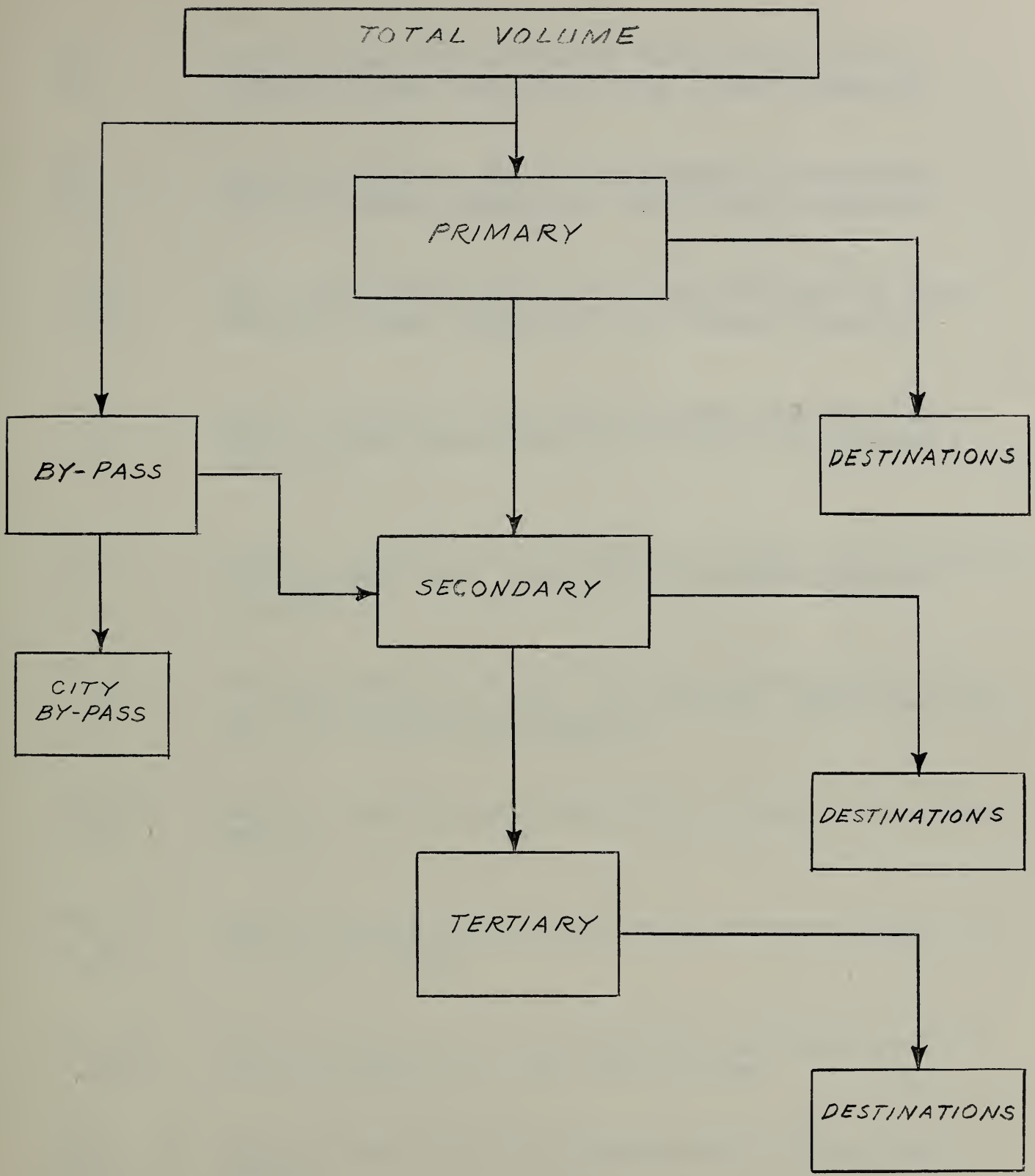

Figure 1

Flow Chart Model for the Distribution of Outgoing Mail

$\frac{D_P}{T_P}$ = Ratio of mail to a Primary Destination to the Primary Volume (Obtained from Primary samples)

$\frac{S_i}{T_P}$ = Ratio of mail to an i-th Secondary to the Total Primary Volume (Obtained from Primary Samples)

$\sum \frac{S_i}{T_P}$ = Sum of Ratios of mail to all Secondaries to Total Primary Volume (Obtained from Primary Samples)

$\frac{D_{S_i}}{S_i}$ = Ratio of mail to an i-th Secondary Destination to the i-th Secondary (Obtained from i-th Secondary samples)

$\frac{t_{ij}}{S_i}$ = Ratio of mail to a j-th Tertiary (off i-th Secondary) to i-th Secondary (Obtained from i-th Secondary Samples)

$\frac{D_{t_{ij}}}{t_{ij}}$ = Ratio of mail to a j-th Tertiary Destination (off i-th Secondary) to the j-th Tertiary (Obtained from the i,j-th Tertiary Samples)

$\left(\frac{D_P}{T}\right)^*$ = Ratio of mail to a Primary Destination to the Total Volume

$\left(\frac{D_{S_i}}{T}\right)^*$ = Ratio of mail to an i-th Secondary Destination to the Total Volume

$\left(\frac{D_{t_{ij}}}{T}\right)^*$ = Ratio of mail to a j-th Tertiary Destination (off i-th Secondary) to the Total Volume

$\left(\frac{S_i}{T}\right)$ = Ratio of mail to an i-th Secondary to the Total Volume

$\left(\frac{B_S}{T}\right)$ = Ratio of By-pass mail entering at the Secondary to the Total Volume

$\left(\frac{B_C}{T}\right)$ = Ratio of City By-pass mail to the Total Volume

$\left(\frac{\Sigma D_P}{T}\right)$ = Sum of ratios of mail to all Destinations off the Primary to the Total Volume

$\frac{D_P}{\Sigma D_P}$ = Ratio of mail to a Destination off the Primary to the sum of all Destinations off the Primary (Obtained from the Primary samples)

4. Fundamental Sampling Procedures and Related Formulae

4.1 Volume Count Data. Certain ratios must be established in order to relate the pieces of mail counted in each separation of the sample to the Total Volume of mail. It is therefore necessary to acquire from volume counts in the post office the following data:

Daily volume information expressed in footage for:

a. All mail into the Primary.

b. All mail by-passing the Primary and entering the Secondary.

c. All By-pass mail to the city.

d. All mail into each individual type Secondary case. (This count may not be necessary, see Section 6.1).

From the data listed above it is possible to determine the ratio of each class and type processed to the Total Volume of mail. Several of these ratios are then utilized in the formulae of Section 4.3 to estimate the percentage of the

Total Volume going to each Destination. It is advisable to obtain these volume figures at least one day prior to drawing the sample so that decisions regarding the type of analysis that will be used can be made early. Very often the analysis will not make use of certain volume ratios, such as those of d above, and therefore the particular volume counts may be discontinued. (See Sections 6.1, 7.1 and 8.1 for examples).

4.2 Sampling Procedures.

4.2.1 Primary. Two feet of mail is selected as it flows into the Primary cases from the canceling machines. It is placed on the ledge of the "test" case and distributed by a clerk. Special care is taken to see to it that no mail is added to or subtracted from the sample. After Distribution has been made, the contents of each separation box are counted by the distributor and recorded by the supervising clerk. (e.g., see Figure 4 on page 24).

Special care must be given to the choice of the sample. The randomness of the selection of the two foot tray was assured by choosing the first two feet flowing into the Primary from the cancelling machine at the predetermined time for drawing the sample. The mail accumulating in the stackers of the cancellation machines is fed from a moving conveyor belt that passes seven or eight persons, each of whom faces and places on

the belt letters selected from those within his reach. Thus the letters undergo a fairly thorough mixing as they are being stacked so that the letters in any tray of mail sampled at this point would tend to have the property of randomness which is necessary in sampling studies. This method of sampling was selected in order to help eliminate the possibility of personal bias, conscious or unconscious, or personal responsibility for actual allocations. Metered mail and Patron Segregated Stamped mail which do not "run" are sampled in the same way described for Machine Cancellation mail.

However, Metered mail and Patron Segregated mail which do tend to "run" must be sampled differently. Any "bite" or "bunch" of this kind of mail may be addressed to the same Destination and therefore would not have the required property of randomness. In this case successive letters are selected every few inches apart from each tier of mail until the required two feet is obtained. The distance between successive letters should be predetermined and constant.

Two samples, each of which consists of about 580 letters, may be drawn during the morning peak period and two during the evening peak period. It is recommended that samples be taken for five successive days, exclusive of Saturday and Sunday, in order to obtain a fairly representative picture of the mail throughout the week.

4.2.2 Secondary. Mail flowing into the Secondary comes either from the Primary or from By-pass mail. Secondary cases do not simultaneously generate enough mail to be sampled at any given moment. Each sample is drawn when enough mail has generated. In each case the sample used in the study is the first two feet of mail (regardless of type) that accumulates after a case has been selected for sampling. After Distribution has been made, the contents of each separation box is counted by the distributor and recorded by the supervising clerk. One sample may be taken in the morning peak and one in the evening peak periods throughout the week.

4.2.3 Tertiary. Mail flowing into the Tertiary cases usually comes from the Secondary. Therefore, it is possible to make counts on these cases only when enough mail is generated.

However, in cases where the required two feet does not generate, then smaller samples (i.e., whatever is available) may be counted. Here again, after Distribution has been made the contents of each separation box is counted by the distributor and recorded by the supervising clerk. Samples may be taken once in the morning and once in the evening at peak periods throughout the week.

Care must be taken to record any mail dispatched during the sample period prior to the final count of each Destination on Primary, Secondary, and Tertiary cases.

4.3 Related Formulae. Three essentially different sets of formulae may be used. [1/] These depend upon the percentage of By-pass mail that enters the system at the Secondary. In all cases the aim is to estimate the ratio of mail going to a given Destination to the sum of Primary and all By-pass mail.

4.3.1. The case where there is no By-pass mail that enters the system at the Secondary.

a. For a Destination off the Primary:

$$\left(\frac{D_P}{T}\right)^* = \frac{D_P}{T_P} \times \left(\frac{T_P}{T}\right)$$

b. For a Destination off the Secondary:

$$\left(\frac{D_{S_i}}{T}\right)^* = \frac{D_{S_i}}{S_i} \times \frac{S_i}{T_P} \times \left(\frac{T_P}{T}\right)$$

c. For a Destination off the Tertiary:

$$\left(\frac{D_{t_{ij}}}{T}\right)^* = \frac{D_{t_{ij}}}{t_{ij}} \times \frac{t_{ij}}{S_i} \times \frac{S_i}{T_P} \times \left(\frac{T_p}{T}\right)$$

1/ No proofs are given in this report. A forthcoming report by the first author will discuss the derivations and statistical properties of these estimates.

4.3.2. The case where the percentage of By-pass mail that enters the system at the Secondary is small, say, less than 2%.

a. For a Destination off the Primary:

$$\left(\frac{D_P}{T}\right)^* = \frac{D_P}{T_P} \times \left(\frac{T_P}{T}\right)$$

b. For a Destination off the Secondary:

$$\left(\frac{D_{S_i}}{T}\right)^* = \frac{D_{S_i}}{S_i} \times \frac{S_i}{T_P} \times \left(\frac{T_P}{T}\right) \times \frac{\left(\frac{T_P}{T}\right)\sum \frac{S_i}{T_P} + \left(\frac{B_S}{T}\right)}{\left(\frac{T_P}{T}\right)\sum \frac{S_i}{T_P}}$$

c. For a Destination off the Tertiary:

$$\left(\frac{D_{t_{ij}}}{T}\right)^* = \frac{D_{t_{ij}}}{t_{ij}} \times \frac{t_{ij}}{S_i} \times \frac{S_i}{T_P} \times \left(\frac{T_P}{T}\right) \times \frac{\left(\frac{T_P}{T}\right)\sum \frac{S_i}{T_P} + \left(\frac{B_S}{T}\right)}{\left(\frac{T_P}{T}\right)\sum \frac{S_i}{T_P}}$$

Implicit in the use of these formulae is the assumption that either:

a. the ratio of the i-th Secondary mail including By-pass mail to the i-th Secondary mail excluding By-pass mail is the same for all i (in which case the formulae always hold regardless of the amount of By-pass mail into the Secondary),

b. the volume of By-pass mail that flows into the Secondary is small relative to the total Secondary mail (in which case the formulae are approximations to optimum formulae).

4.3.3. The case where the percentage of By-pass mail that enters the system at the Secondary is large, say, greater than 2%.

a. For a Destination off the Primary:

$$\left(\frac{D_P}{T}\right)^* = \frac{D_P}{\Sigma D_P} \times \left(\frac{\Sigma D_P}{T}\right)$$

b. For a Destination off the Secondary:

$$\left(\frac{D_{S_i}}{T}\right)^* = \frac{D_{S_i}}{S_i} \times \left(\frac{S_i}{T}\right)$$

c. For a Destination off the Tertiary:

$$\left(\frac{D_{t_{ij}}}{T}\right)^* = \frac{D_{t_{ij}}}{t_{ij}} \times \frac{t_{ij}}{S_i} \times \left(\frac{S_i}{T}\right)$$

It is to be noted that formulae b and c of this section depend upon special volume count data that give $\left(\frac{S_i}{T}\right)$.

For examples worked out in detail see the San Francisco study, Section 6.

5. Type of Mail Studied at San Francisco, Los Angeles, and Baltimore.

The Total Volume of mail studied in the San Francisco, Los Angeles, and Baltimore Post Offices may be classified as outgoing first class letter mail of the following types:

1. Cancellation Mail (Machine and Hand)
   a. Stamped Mail into Mailing Primary
   b. Air Mail to Mailing Primary

c. Specials to Mailing Primary
d. Stamped Mail into Secondary by-passing Primary
e. Stamped By-pass mail to city.

2. Non-Cancellation Mail

a. Metered into Primary
b. Metered into Secondary by-passing Primary
c. Air Mail into Mailing Primary
d. Specials into Mailing Primary
e. Permit into Primary
f. Permit into Secondary By-passing Primary
g. Penalty to Primary
h. Metered and Permit By-Pass to City

3. Dis Mail

a. Transit and Red line[1/] into Secondary
b. Transit and Red line into Tertiary
c. Transit and Red line to city

Not included in this study is any type of incoming letter mail nor outgoing first class letter mail of the following types:

1. All mail to Air Mail and Special Delivery Sections by-passing mailing Primary
2. Dis mail to dispatch without separation
3. Large special mailings which would tend to bias the sample

6. San Francisco Study

6.1 Volume Count Data. Special volume counts were made in San Francisco to determine what percentage of the Total Volume flowed into the Primary, how much by-passed the Primary

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1/ Regular first class mail carried by air.

and flowed either into the City section for local distribution or into the Secondary. These counts were made on six days, June 21, 24, 25, 26, 27, and 28, 1957, between the hours of 10:00 A.M. and 10:00 P.M. These control figures were begun one day prior to drawing samples, so that decisions regarding sample size and optimum sampling periods and areas could be made. Volume control counts of mail flowing into the Secondary that by-passed the Primary were less than 1%. Thus San Francisco is analyzed according to Section 4.3.2. Therefore, it was established early that a footage count of mail flowing into the Secondary could be discontinued.

The Total volume figures and the corresponding percentages are summarized in Table 1. Figure 2 shows the consistency of these percentage figures during the entire sample period, based on a day by day comparison. The flow chart given in Figure 3 contains the basic proportion figures which are then applied in the appropriate formula, as well as certain other summary figures that are a result of the sampling study.

6.2 Sampling Procedure. The sampling procedure adopted for San Francisco is the same as that described in Sections 4.2 with the added modification that, wherever possible, the samples are made to consist of equal parts of the following: stamped long, stamped short, metered long, and metered short letters. This was done because San Francisco makes a

TABLE 1

San Francisco Volume Count Data
10:00 AM Through 10:00 PM
(in feet)

Mail to:	6-21-57	6-24-57	6-25-57	6-26-57	6-27-57	6-28-57	Grand Total
Primary							
Stamp	2007' 6"	1870' 7"	1924' 8"	2136' 7"	1984' 9"	1959' 10"	11,883.92'
Meter	2473' 0	2102' 9"	2403' 9"	1861' 8"	2270' 7"	2307' 6"	13,419.25'
Penalty	179' 7"	626'10"	195' 3"	193'10"	195' 0	433' 6"	1,824.00'
City Go Backs	2' 0	0	19' 0	5' 6"	3' 6"	14' 6"	44.50'
Post Cards 1/	2' 6"	2' 0	23' 3"	5' 9"	12' 0	13' 11"	59.42'
Total	4664.58'	4602.17'	4565.92'	4203.33'	4465.83'	4729.25'	27,231.08'
Percent	84.13	89.44	89.57	85.66	85.55	86.34	86.74
City By-Pass							
Stamp	460'12"	83' 4"	148'17"	143' 5"	171' 5"	139' 4"	1,147.92'
Meter	418'13"	452' 0	345' 0	545' 0	561' 9"	548' 18"	2,872.33'
Dis	0	7"	13'11"	0	0	45' 4"	59.83'
Total	880.08'	535.92'	508.33'	688.42'	733.17'	734.16'	4,080.08'
Percent	15.87	10.42	9.97	14.03	14.04	13.40	13.00
Secondary							
Stamp		1' 3"	5' 3"	9' 3"	6' 0	1' 3"	23.00'
Meter		6' 0	18' 0	6' 0	10 0	6' 0	46.00'
Dis		0	0	0	5' 5"	6' 10"	12.25'
Total	0	7.25'	23.25'	15.25'	21.42'	14.08'	81.25'
Percent	0	.14	.46	.31	.41	.26	.26
Grand Total	5544.66'	5145.34'	5097.50'	4907.00'	5220.42'	5477.49'	31,392.41'

1/ If the proper weighting factor is used for post cards (1200 let./ft. as compared to 290 let./ft. or 4 to 1), then the proportion of primary mail to total is 86.80%.

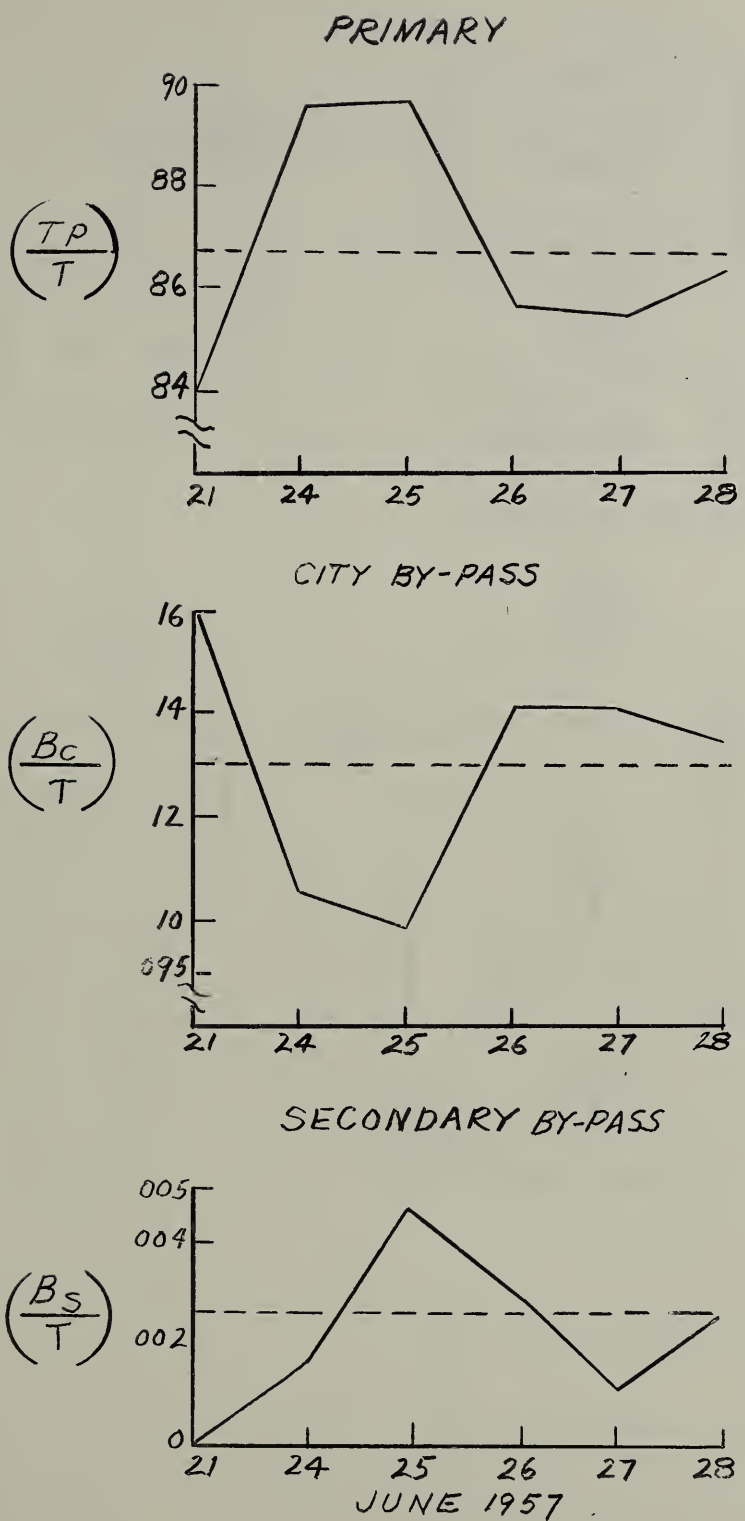


Figure 2

Graphs of Daily Volume Ratios for San Francisco

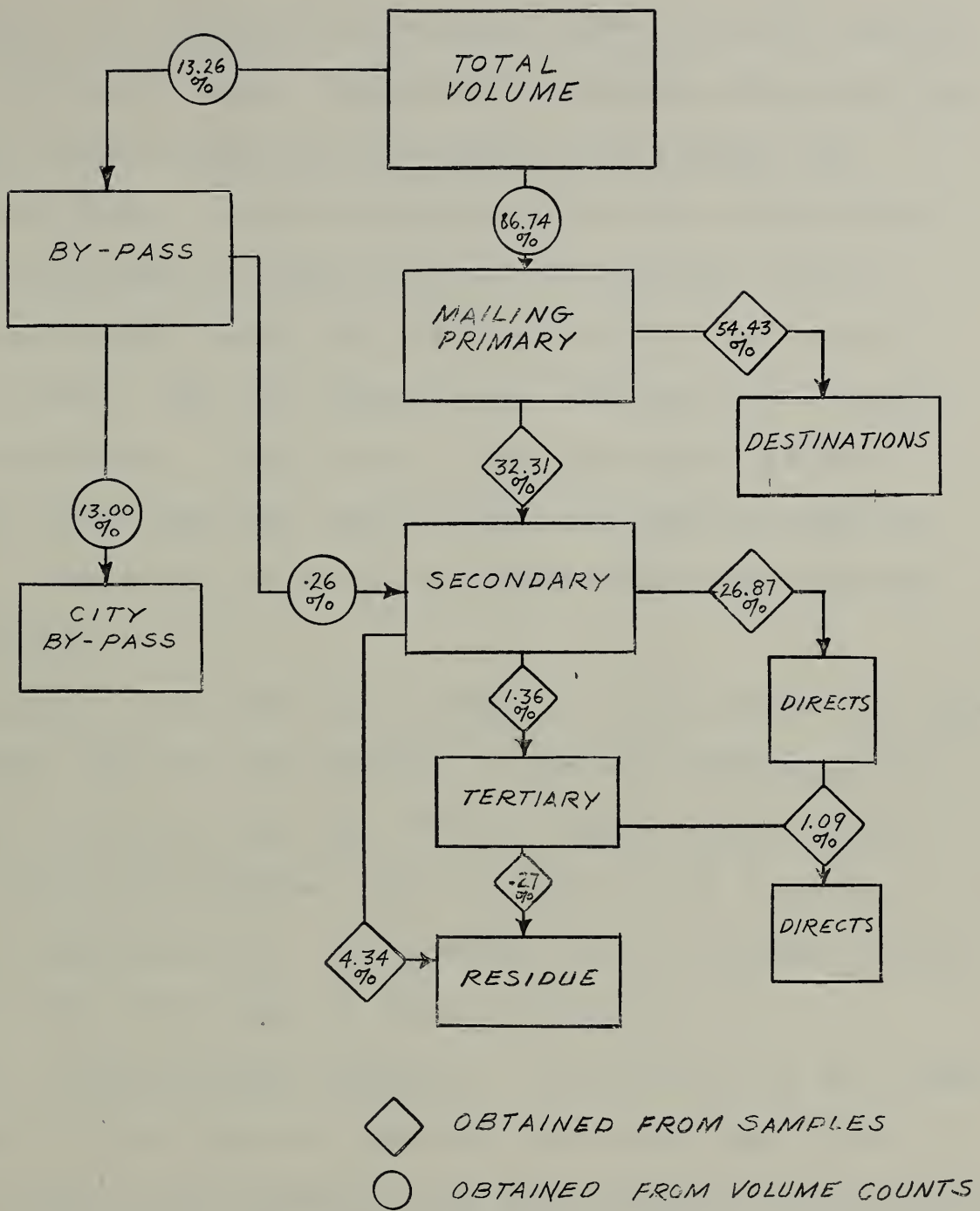
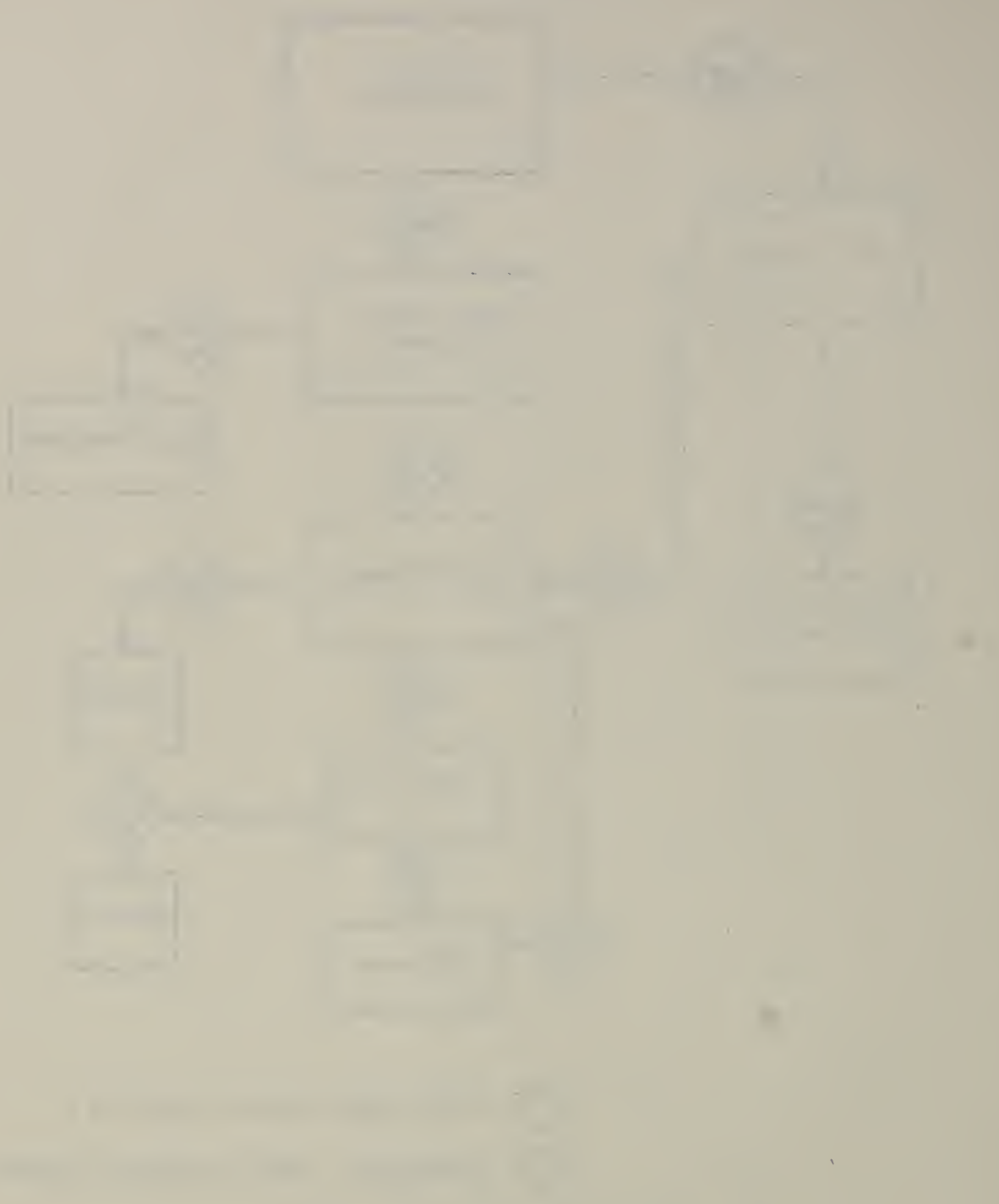


Figure 3

San Francisco Flow Chart



separation between long and short letters which is maintained throughout the Primary and Secondary cases but not, however, in the Tertiary cases. Furthermore, metered and non-metered mail are worked separately throughout the Primary and Secondary cases. Special samples were taken on the San Francisco Primary in order to determine whether or not differences exist among the distributions of the various types of mail. (See the Appendix for the data and a preliminary analysis). The volume of mail generated in the Tertiary cases was very small during the morning sampling period. Therefore, no Tertiary samples were taken during this period.

Figures 4, 5, and 6 are copies of field sheets that show the sample data for the Primary, a typical Secondary, and a typical Tertiary at the San Francisco post office. Each column represents samples taken on each of the five consecutive sampling days. Application of the formulae to an example from each stage is shown in Section 6.4.

6.3 Computational formulae. In this Section the computational formulae used to estimate the percentage of the Total Volume of mail going to any given Destination are given. As indicated above the formulae of Section 4.3.2 are appropriate to the San Francisco study.

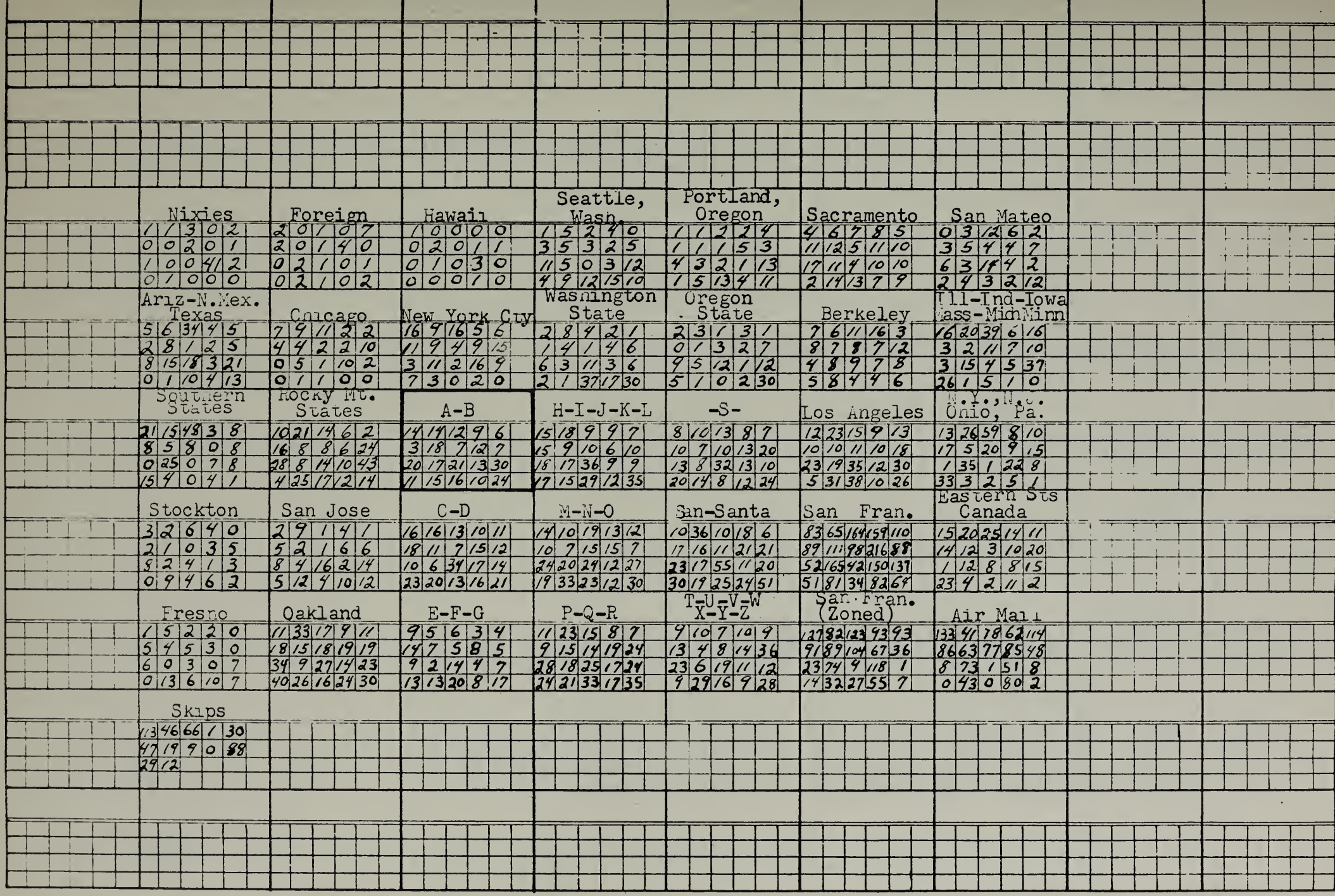


Figure 4 - Sample Data for San Francisco Primary (Worksheet)
(11,196 Letters)

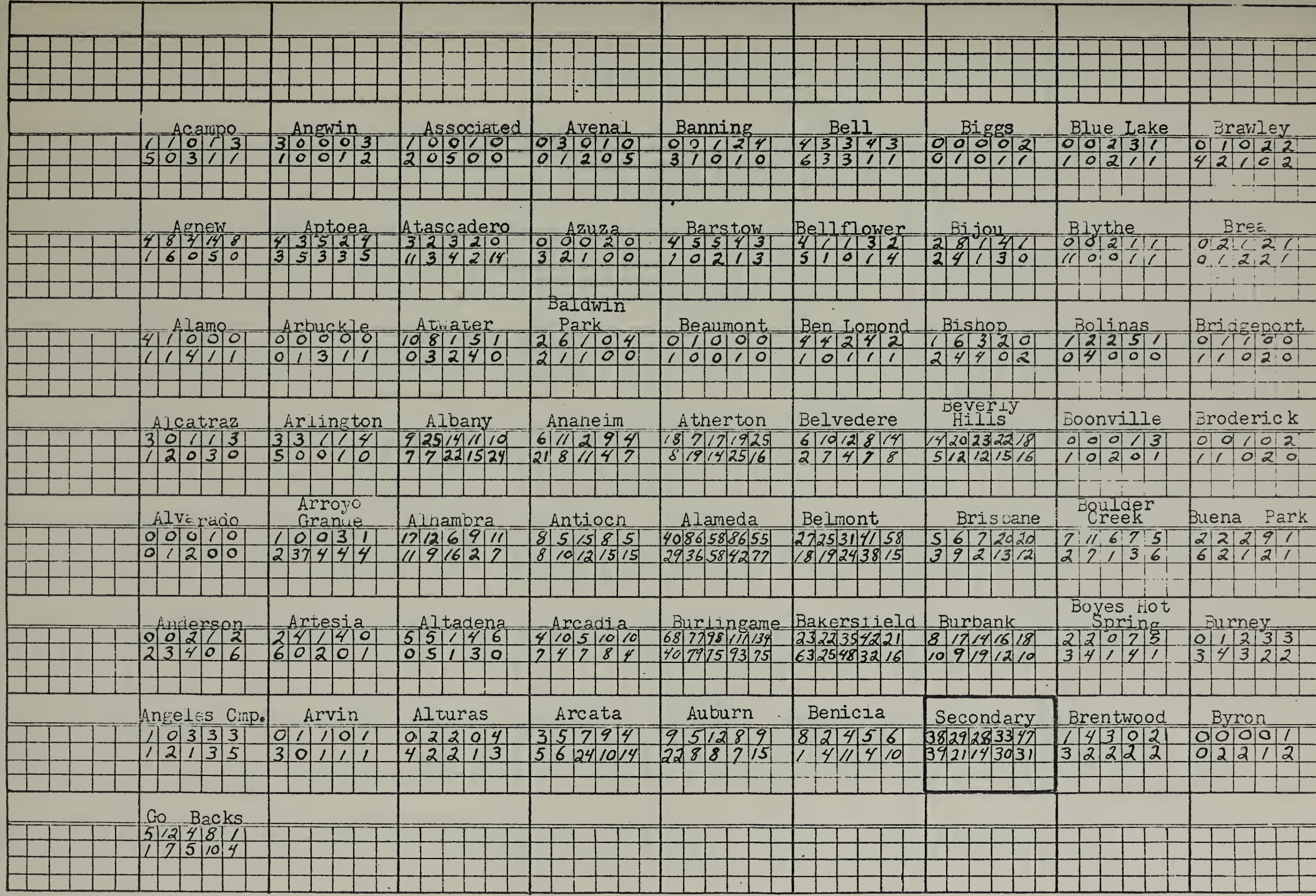


Figure 5 - Sample Data for California A-B Secondary for San Francisco (Worksheet)
(4,678 Letters)

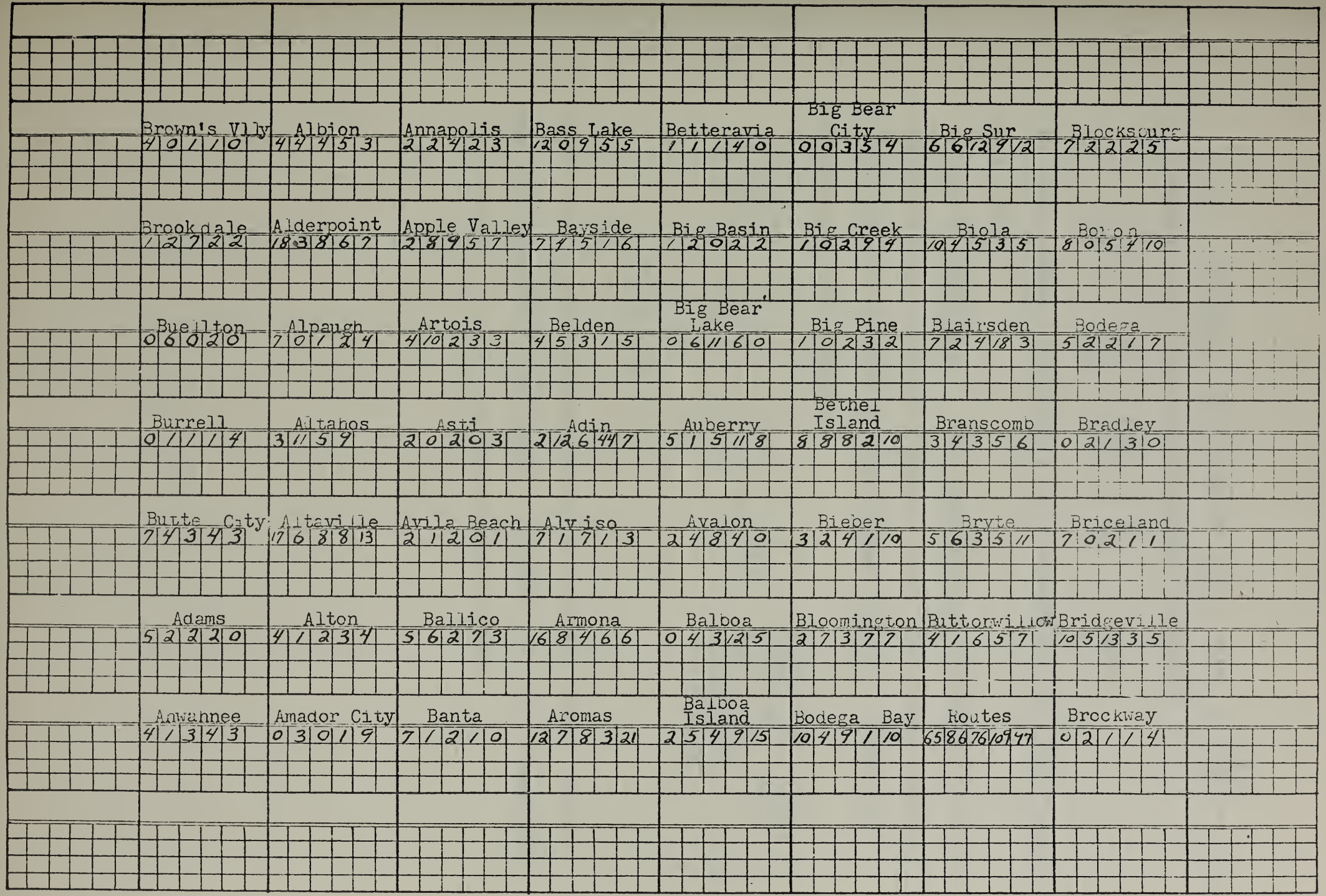


Figure 6 - Sample Data for California A-B Tertiary for San Francisco (Worksheet)
(1,665 Letters)

6.3.1 Primary. From Figure 3 the value of $\left(\frac{T_P}{T}\right) = .8674$ and therefore the appropriate formula becomes:

$$\left(\frac{D_P}{T}\right)^* = \frac{D_P}{T_P} \times \left(\frac{T_P}{T}\right) = \frac{D_P}{T_P} \times .8674$$

(The total number of letters in the samples off the Primary was 11,196).

6.3.2 Secondary. The computational formula for Destinations off the Secondary depends upon the ratios obtained at the Primary as well as the volume counts. Using such ratios gives the formula:

$$\left(\frac{D_{S_i}}{T}\right)^* = \frac{D_{S_i}}{S_i} \times \left\{ \frac{S_i}{T_P} \times \left(\frac{T_P}{T}\right) \times \frac{\left(\frac{T_P}{T}\right)\sum \frac{S_i}{T_P} + \left(\frac{B_S}{T}\right)}{\left(\frac{T_P}{T}\right)\sum \frac{S_i}{T_P}} \right\}$$

$$= \frac{D_{S_i}}{S_i} \times c_i ,$$

where the c_i are the quantities in brackets which depend upon the particular Secondary. Values of c_i corresponding to particular Secondaries are listed in Table 2.

TABLE 2

Number of Pieces in Sample and
Constants used in Computational Formula for Destinations
off the Secondaries for San Francisco

i	S_i	No. Pcs.	c_i
1	Ariz.-New Mexico-Texas	5,519	.01290
2	Ill.-Ind.-Iowa-Mass.-Mich.-Minn.	5,739	.01774
3	Southern States	5,865	.01468
4	Rocky Mountain States	5,252	.02266
5	N.Y.-N.J.-Ohio-Penn.	6,286	.02289
6	Canada-Eastern	5,535	.01797
7	California A-B	4,676	.02180
8	California C-D	4,945	.02367
9	California E-G	4,499	.01351
10	California H-L	4,989	.02383
11	California M-O	4,994	.02702
12	California P-R	5,049	.03024
13	California S	4,759	.02031
14	California San Santa	4,893	.03446
15	California T-Z	4,596	.02203
	Total	77,596	.32571

These constants actually represent the ratio, as estimated by using volume and Primary sample counts, of a Secondary volume of mail to the Total Volume.

6.3.3 Tertiary. The computational formula for Destinations off the Tertiary depends upon ratios obtained at the Primary and Secondary, as well as the volume counts. Using such ratios gives the formula:

$$\left(\frac{D_{t_{ij}}}{T}\right)^{*} = \frac{D_{t_{ij}}}{t_{ij}} \times \left\{ \frac{t_{ij}}{S_i} \times \frac{S_i}{T_P} \times \left(\frac{T_P}{T}\right) \times \frac{\left(\frac{T_P}{T}\right)\sum \frac{S_i}{T_P} + \left(\frac{B_S}{T}\right)}{\left(\frac{T_P}{T}\right)\sum \frac{S_i}{T_P}} \right\}$$

$$= \frac{D_{t_{ij}}}{t_{ij}} \times k_{ij} ,$$

where the k_{ij} are the quantities in brackets which depend upon the particular Tertiary. Values of k_{ij} corresponding to particular Tertiaries are listed in Table 3.

TABLE 3

Number of Pieces in Sample and Constants used in Computational Formula for Destinations off the Tertiaries for San Francisco

i,j	t_{ij}	No. Pcs.	k_{ij}
7,1	California A-B	1,665	.00145
8,1	California C-D	2,507	.00277
9,1	California E-G	1,727	.00081
10,1	California H-L	2,648	.00229
11,1	California M-O	2,086	.00185
12,1	California P-R	2,262	.00135
13+14,1	California S	1,118	.00107
15,1	California T-Z	2,152	.00202
	Total	16,165	.01361

These constants actually represent the ratio, as estimated by using volume and Primary and Secondary sample counts, of a Tertiary volume of mail to the Total Volume.

6.4 Examples. Applications of the formulae for each stage are given here:

Primary: (Seattle, Washington)

D_P = 111 pieces - Seattle, Washington

T_P = 11,196 pieces - Total Primary

where the numbers are taken from Figure 4.

Thus,

$$\left(\frac{D_P}{T}\right)^* = \frac{D_P}{T_P} \times .8674 = \frac{111}{11,196} \times .8674 = .0085996$$

Secondary: (Bell, California)

D_{S_7} = 31 pieces - Bell, California

S_7 = 4,676 pieces - Total Calif. A-B Secondary

where the numbers are taken from Figure 5.

Thus,

$$\left(\frac{D_{S_7}}{T}\right)^* = \frac{D_{S_7}}{S_7} \times c_7 = \frac{31}{4676} \times .02180 = .0001445$$

where the constant c_7 is taken from Table 2.

Tertiary: (Albion, California)

$D_{t_{7,1}}$ = 20 pieces - Albion, California

$t_{7,1}$ = 1665 pieces - Total Calif. A-B Tertiary

where the numbers are taken from Figure 6.

Thus,

$$\left(\frac{D_{t_{7,1}}}{T}\right)^* = \frac{D_{t_{7,1}}}{t_{7,1}} \times k_{7,1} = \frac{20}{1665} \times .00145 = .0000174$$

where $k_{7,1}$ is taken from Table 3.

6.5 Tabulation of Estimated Distribution and Observations.

The tabulation of the estimated proportions of the Total Volume mail going to each Destination is given in Table 4. These are listed in order of descending value. The largest 200 are listed by name and the remainder grouped by percentages. Figure 7 graphically portrays the largest 200 Destinations by percentage. Several observations, based on the tabulation, are given here:

1. The largest 200 Destinations received 80% of the Total Volume

2. Seventy-six percent of the Total Volume remained in the State of California (Not including Air Mail and Go backs)

3. Thirty-nine percent of the Total Volume remained in San Francisco.

4. Seven Destinations: San Francisco, Oakland, Los Angeles, Washington State, Berkeley, New York City, and Sacramento were the only Destinations to receive more than one percent of the Total Volume.

5. Eighty percent of the Total Volume remained on the West Coast (Not including Air Mail and Go backs)

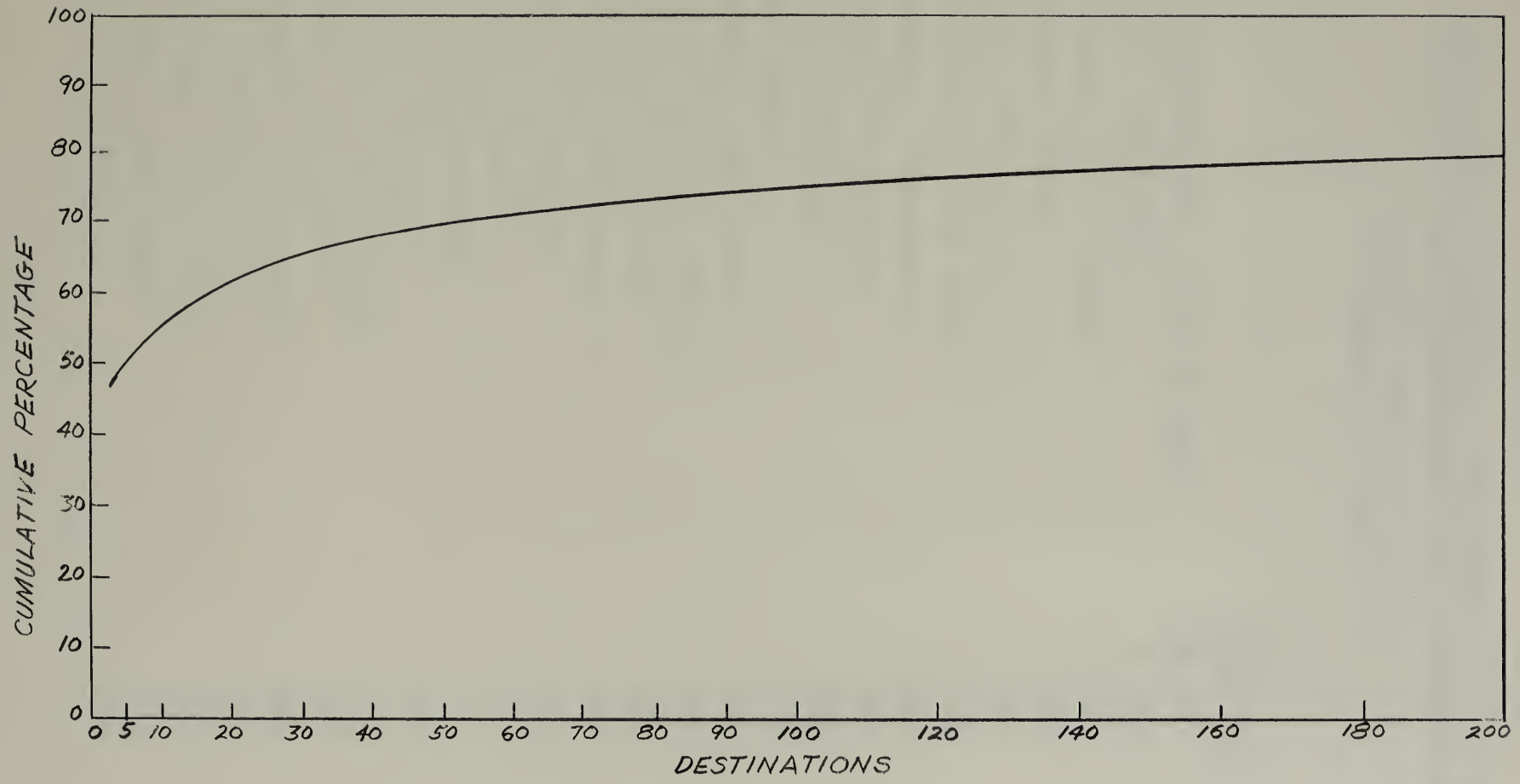


Figure 7

Graph of Largest 200 Destinations for San Francisco

TABLE 4

TABULATION OF ESTIMATED PERCENTAGES OF THE TOTAL VOLUME TO EACH DESTINATION FOR SAN FRANCISCO

Largest 200 Destinations
Listed by Name

		Percent	Cumulative Percent
1.	San Francisco Inc. City By Pass	38.501	38.501
2.	Oakland, California	8.158	46.659
3.	Los Angeles, California	2.789	49.448
4.	Washington State	1.155	50.603
5.	Berkeley, California	1.147	51.750
6.	New York City, New York	1.116	52.866
7.	Sacramento, California	1.364	54.230
8.	San Jose, California	.961	55.191
9.	Seattle, Washington	.860	56.051
10.	Oregon State	.775	56.826
11.	San Mateo, California	.759	57.585
12.	Redwood City, California	.679	58.264
13.	Daly City, California	.670	58.934
14.	Palo Alto, California	.654	59.588
15.	Fresno, California	.612	60.200
16.	Portland, Oregon	.605	60.805
17.	South San Francisco	.574	61.379
18.	Chicago, Illinois	.566	61.945
19.	San Rafael, California	.521	62.466
20.	Stockton, California	.504	62.970
21.	Burlingame, California	.396	63.366
22.	Menlo Park,California	.394	63.760
23.	Santa Rosa, California	.352	64.112
24.	San Diego, California	.349	64.461
25.	Vallejo, California	.295	64.756

		Percent	Cumulative Percent
26.	Reno, Nevada	.292	65.048
27.	Hayward, California	.287	65.335
28.	Richmond, California	.281	65.616
29.	San Leandro, California	.277	65.893
30.	Long Beach, California	.272	66.165
31.	Alameda, California	.264	66.429
32.	San Bruno, California	.261	66.690
33.	Mill-Valley, California	.252	66.942
34.	San Carlos, California	.244	67.186
35.	Walnut Creek, California	.234	67.420
36.	Washington, D. C. (off. and unoff.)	.232	67.652
37.	Salt Lake City, Utah	.229	67.881
38.	Santa Cruz, California	.210	68.091
39.	Sunnyvale, California	.207	68.298
40.	Denver, Colorado	.205	68.503
41.	Watsonville, California	.195	68.698
42.	Los Altos, California	.192	68.890
43.	Salinas, California	.189	69.079
44.	Vet. Adm., (Denver, Colo.)	.187	69.266
45.	Concord, California	.185	69.451
46.	Phoenix, Arizona	.183	69.634
47.	Mountain View, California	.167	69.801
48.	San Anselmo, California	.167	69.968
49.	Millbrae, California	.164	70.132
50.	Santa Clara, California	.164	70.296
51.	Napa, California	.162	70.458
52.	Modesta, California	.159	70.617
53.	Los Gatos, California	.158	70.775
54.	Bakersfield, California	.152	70.927
55.	Belmont, California	.138	71.065

		Percent	Cumulative Percent
56.	Eureka, California	.135	71.200
57.	Sausalito, California	.134	71.334
58.	Santa Barbara, California	.129	71.463
59.	Monterey, California	.127	71.590
60.	Philadelphia, Pennsylvania	.121	71.711
61.	La Fayette, California	.116	71.827
62.	Ukiah, California	.114	71.941
63.	Minneapolis, Minnesota	.112	72.053
64.	Emeryville, California	.110	72.163
65.	Pasadena, California	.110	72.273
66.	Petaluma, California	.108	72.381
67.	Chico, California	.107	72.488
68.	St. Louis, Missouri	.106	72.594
69.	Brooklyn, New York	.106	72.700
70.	Redding, California	.104	72.804
71.	Sharp Park, California	.100	72.904
72.	San Lorenzo, California	.098	73.002
73.	Long Isl. Cities, New York	.097	73.099
74.	Elcerrito, California	.095	73.194
75.	Detroit, Michigan	.094	73.288
76.	Garden City, New York	.094	73.382
77.	Merced, California	.094	73.476
78.	Dallas, Texas	.093	73.569
79.	Carmel, California	.093	73.662
80.	Castro Valley, California	.092	73.754
81.	Las Vegas, Nevada	.088	73.842
82.	San Pedro, California	.087	73.929
83.	Sonoma, California	.086	74.015
84.	Houston, Texas	.085	74.100
85.	Boston, Massachusetts	.085	74.185

		Percent	Cumulative Percent
86.	Tuscon, Arizona	.083	74.268
87.	Glendale, California	.082	74.350
88.	Cleveland, Ohio	.080	74.430
89.	Sebastapol, California	.079	74.509
90.	Lodi, California	.079	74.588
91.	Atherton, California	.078	74.666
92.	Hawaii	.077	74.743
93.	Cincinnati, Ohio	.076	74.819
94.	San Antonio, Texas	.075	74.894
95.	Beverly Hills, California	.073	74.967
96.	Martinez, California	.072	75.039
97.	Visalia, California	.071	75.110
98.	Whittier, California	.069	75.179
99.	Pittsburg, California	.069	75.248
100.	North Hollywood, California	.068	75.316
101.	Riverside, California	.068	75.384
102.	Novato, California	.068	75.452
103.	Turlack, California	.068	75.520
104.	Paso Robles, California	.068	75.588
105.	Van Nuys, California	.067	75.655
106.	Kansas City, Missouri	.067	75.722
107.	Saratoga, California	.067	75.789
108.	Baltimore, Maryland	.067	75.856
109.	Albany, California	.067	75.923
110.	Kentfield, California	.067	75.990
111.	Boise, Idaho	.066	76.056
112.	Cupertino, California	.066	76.122
113.	New Orleans, Louisiana	.065	76.187
114.	Orinda, California	.063	76.250
115.	Woodland, California	.063	76.313

		Percent	Cumulative Percent
116.	Burbank, California	.062	76.375
117.	Santa Monica, California	.061	76.436
118.	Santa Ana, California	.061	76.497
119.	Inglewood, California	.061	76.558
120.	San Bernadino, California	.060	76.618
121.	Stanford, California	.060	76.678
122.	Milwaukee, Wisconsin	.060	76.738
123.	Healdsburg,California	.060	76.798
124.	Campbell, California	.059	76.857
125.	Sonora, California	.058	76.915
126.	Fairfax, California	.057	76.972
127.	San Luis Obispo, California	.056	77.028
128.	Marysville, California	.055	77.083
129.	Corte Madera, California	.055	77.138
130.	Oroville, California	.055	77.193
131.	St. Paul, Minnesota	.055	77.248
132.	Ogden, Utah	.055	77.303
133.	Ontario, Canada	.054	77.357
134.	San Fernando, California	.054	77.411
135.	Pittsburg, Pennsylvania	.053	77.464
136.	Gilroy, California	.052	77.516
137.	Woodside, California	.052	77.568
138.	Fort Ord, California	.051	77.619
139.	Livermore, California	.050	77.669
140.	Terre Haute, Indiana	.049	77.718
141.	Ross, California	.049	77.767
142.	Monterey Park, California	.048	77.815
143.	San Pablo, California	.048	77.863
144.	Auburn, California	.048	77.911
145.	Alhambra, California	.047	77.958

		Percent	Cumulative Percent
146.	Tracy, California	.047	78.005
147.	Yuba City, California	.047	78.052
148.	Larkspur, California	.047	78.099
149.	Antioch, California	.047	78.146
150.	El Paso, Texas	.046	78.192
151.	Hanford, California	.046	78.238
152.	Ventura, California	.045	78.283
153.	Vancouver, B.C.	.045	78.328
154.	Brisbane, California	.045	78.373
155.	Pacific Grove, California	.044	78.417
156.	Omaha, Nebraska	.044	78.461
157.	Indianapolis, Indiana	.043	78.504
158.	Dayton, Ohio	.043	78.547
159.	Hollister, California	.043	78.590
160.	Madera, California	.041	78.631
161.	Fort Bragg, California	.041	78.672
162.	Guernerville, California	.041	78.713
163.	Montreal, Quebec	.041	78.754
164.	Calistoga, California	.041	78.795
165.	Arcata, California	.041	78.836
166.	Albuquerque, New Mexico	.040	78.876
167.	Santa Maria, California	.040	78.916
168.	Ft. Worth, Texas	.040	78.956
169.	Toronto, Ontario	.040	78.996
170.	Grass Valley, California	.039	79.035
171.	Anaheim, California	.039	79.074
172.	St. Helena, California	.038	79.112
173.	South Gate, California	.038	79.150
174.	Pleasantville, New York	.037	79.187
175.	Seaside, California	.037	79.224

		Percent	Cumulative Percent
176.	Belvedere, California	.036	79.260
177.	Torrance, California	.035	79.295
178.	Newark, New Jersey	.035	79.330
179.	Vacaville, California	.034	79.364
180.	Tulare, California	.033	79.397
181.	Louisville, Kentucky	.033	79.430
182.	Atlanta, Georgia	.033	79.463
183.	San Gabriel, California	.033	79.496
184.	Oklahoma City, Oklahoma	.032	79.528
185.	Paradise, California	.032	79.560
186.	Pomona, California	.032	79.592
187.	Roseville, California	.032	79.624
188.	Fullerton, California	.032	79.656
189.	Miami, Florida	.032	79.688
190.	Buffalo, New York	.032	79.720
191.	Des Moines, Iowa	.032	79.752
192.	Arcadia, California	.032	79.784
193.	Fairfield, California	.031	79.815
194.	Danville, California	.031	79.846
195.	Pleasant Hill, California	.031	79.877
196.	Wilmington, California	.030	79.907
197.	Lakeport, California	.030	79.937
198.	Willits, California	.029	79.966
199.	Porterville, California	.029	79.995
200.	Placerville, California	.029	80.024

Rank	No. in Group	Individual Percent	Group Percent	Cumulative Percent
201-204	4	.029	.116	80.140
205-207	3	.028	.084	80.224
208-214	7	.027	.189	80.413
215-220	6	.026	.156	80.569
221-225	5	.025	.125	80.694
226-231	6	.024	.144	80.838
232-239	8	.023	.184	81.022
240-249	10	.022	.220	81.242
250-256	7	.021	.147	81.389
257-264	8	.020	.160	81.549
265-281	17	.019	.323	81.872
282-292	11	.018	.198	82.070
293-304	12	.017	.204	82.274
305-321	17	.016	.272	82.546
322-335	14	.015	.210	82.756
336-360	25	.014	.350	83.106
361-380	20	.013	.260	83.366
381-401	21	.012	.252	83.618
402-429	28	.011	.308	83.926
430-467	38	.010	.380	84.306
468-505	38	.009	.342	84.648
506-550	45	.008	.360	85.008
551-604	54	.007	.378	85.386
605-667	63	.006	.378	85.764
668-729	62	.005	.310	86.074
730-798	69	.004	.276	86.350
799-919	121	.003	.363	86.713
920-1087	168	.002	.336	87.049
1088-1271	184	.001	.184	87.233
1272-1296	25	<.001	.006	87.239

Go Backs	.753	87.992
Skips	3.564	91.556
Air Mail	3.200	94.756
Nixies	.426	95.182
Foreign	.201	95.383
Residues	4.617	100.000

Breakdown on Residue

Illinois	.253	Colorado	.121
Indiana	.108	Nevada	.060
Iowa	.103	Utah	.114
Massachusetts	.194	Wyoming	.041
Michigan	.162	South Dakota	.030
Wisconsin	.103	North Dakota	.035
Maryland	.076	Arizona	.058
Delaware	.007	New Mexico	.037
Nebraska	.051	Mississippi	.046
Kansas	.106	Alabama	.034
Maine	.029	Florida	.102
Vermont	.014	Kentucky	.057
New Hampshire	.020	Tennessee	.050
Connecticut	.074	North Carolina	.084
Missouri	.106	Virginia	.073
Texas	.252	Arkansas	.066
Minnesota	.101	Georgia	.070
New Jersey	.249	Louisiana	.082
New York	.257	Oklahoma	.078
Ohio	.189	South Carolina	.019
Pennsylvania	.373	West Virginia	.034
Montana	.074	California	.307
Idaho	.101	All other Canadas	.017
		TOTAL	4.617

7. Los Angeles Study

7.1 Volume Count Data. Special volume counts were made in Los Angeles to determine what percentage of the Total Volume flowed into the Primary, how much by-passed the Primary and flowed either into the City section for local Distribution or into the Secondary. These counts were made on six days, June 11, 12, 13, 14, 17, and 18, 1957, between the hours of 10:00 A.M. and 10:00 P.M. These control figures were begun one day prior to drawing samples, so that decisions regarding sample size and optimum sampling periods and areas could be made. Volume control counts of mail flowing into the Secondary that by-passed the Primary were less than 1%. Thus, Los Angeles is analyzed according to Section 4.3.2. Therefore, it was established early that a footage count of mail flowing into the Secondary could be discontinued.

The Total Volume figures and the corresponding percentages are summarized in Table 5. Figure 8 shows the consistency of these percentage figures during the entire sample period, based on a day by day comparison. The flow chart given in Figure 9, contains the basic percentage figures which are then applied in the appropriate formula, as well as certain other summary figures that are a result of the sampling study. It is to be noticed that the Primary mail

TABLE 5

Los Angeles Volume Count Data
10:00 AM Through 10:00 PM
(in feet)

Mail to:	6-11-57	6-12-57	6-13-57	6-14-57	6-17-57	6-18-57	Grand Total
Primary							
Meter-36 Hole	2486' 3"	1695' 3"	1371' 6"	3661' 3"	3107' 3"	3273' 3"	15,594.75'
Meter-36 Hole	1053' 9"	1606' 3"	2130' 6"	0	0	0	4,790.50'
Post Cards	20' 3"	29' 3"	13' 5"	31' 3"	22' 3"	28' 0	144.42'
49-Hole	378' 0	445' 0	524' 0	481' 0	576' 9	584' 6"	2,989.25'
Post Cards	0	3' 0	0	0	0	0	3.00'
63-Hole	1640' 9"	1209' 9"	1375' 3"	1391' 9"	1475' 6"	1455' 8"	8,548.67'
Post Cards	1' 9"	0	0	0	0	0	1.75'
Stamp-36 Hole	6981' 0	7477' 6"	6789' 6"	7322' 0"	6535' 6"	6230' 3"	41,335.75'
Post Cards	103' 0	104' 1"	64' 0	121' 3"	160' 9"	142' 6"	695.58'
Dis	267' 3"	243' 3"	357' 9"	311' 3"	401' 6"	248' 3"	1,829.25'
Dis Post Cards	0	2' 0	8' 0	0	8' 9"	8' 6"	27.25'
Total (Let.)	12807.00'	12677.00'	12548.50'	13167.25'	12096.50'	11791.92'	75,088.17'
Total (P.C.)	125.00'	138.33'	85.42'	152.50'	191.75'	179.00'	872.00'
P.C. x 4.138	517.25'	572.41'	353.47'	631.05'	793.46'	740.70'	3,608.34'
Total	13324.25'	13249.41'	12901.97'	13798.30'	12889.96'	12532.62'	78,696.51'
Percent	94.53	94.02	94.83	95.57	94.66	94.85	94.75
City By-pass							
Metered	296' 6"	343' 3"	301' 5"	491' 3"	521' 3"	479' 0	2,432.67'
Metered	178' 3"	217' 0	267' 0	0	0	0	662.25'
Stamp	22' 6"	83' 8"	32' 6"	36' 9"	99' 0	27' 3"	301.67'
Post Cards 1/	3' 6"	21' 0	4' 9"	4'10"	11' 6"	0	45.58'
P.C. x 4.138	14.48'	86.90'	19.66'	19.99'	47.59'	0	188.62'
Total (Let.)	497.25'	643.92'	600.92'	528.00'	620.25'	506.25'	3,396.59'
Total	511.73'	730.82'	620.58'	547.99'	667.84'	506.25'	3,585.21'
Percent	3.63	5.19	4.56	3.80	4.90	3.83	4.32

1/ Appropriate conversion factor is used.

TABLE 5 (Continued)

Mail to:	6-11-57	6-12-57	6-13-57	6-14-57	6-17-57	6-18-57	Grand Total
Secondary By-pass							
Metered	4' 0"	36' 0	12' 0	37' 6"	11' 9"	45' 0	146.25'
Metered	34' 6"	0	0	0	0	0	34.50'
Stamp	151' 1"	27' 6"	9' 3"	36' 0	0	115' 9"	339.58'
Dis	17' 3"	13' 0	12' 3"	18' 0	17' 6"	14' 0	92.00'
Post Cards 1/	12' 9"	8' 3"	11' 9"	0	7' 3"	0	40.00'
P.C. x 4.138	52.76'	34.14'	48.62'	0	30.00'	0	165.52'
Total (Let.)	206.83'	76.50'	33.50'	91.50'	29.25'	174.75'	612.33'
Total	259.59'	110.64'	82.12'	91.50'	59.25'	174.75'	777.85'
Percent	1.84	.79	.61	.63	.44	1.32	.93
Grand Total	14095.74'	14090.87'	13604.67'	14437.79'	13618.09'	13213.62'	83060.78'

1/ Appropriate conversion factor is used.

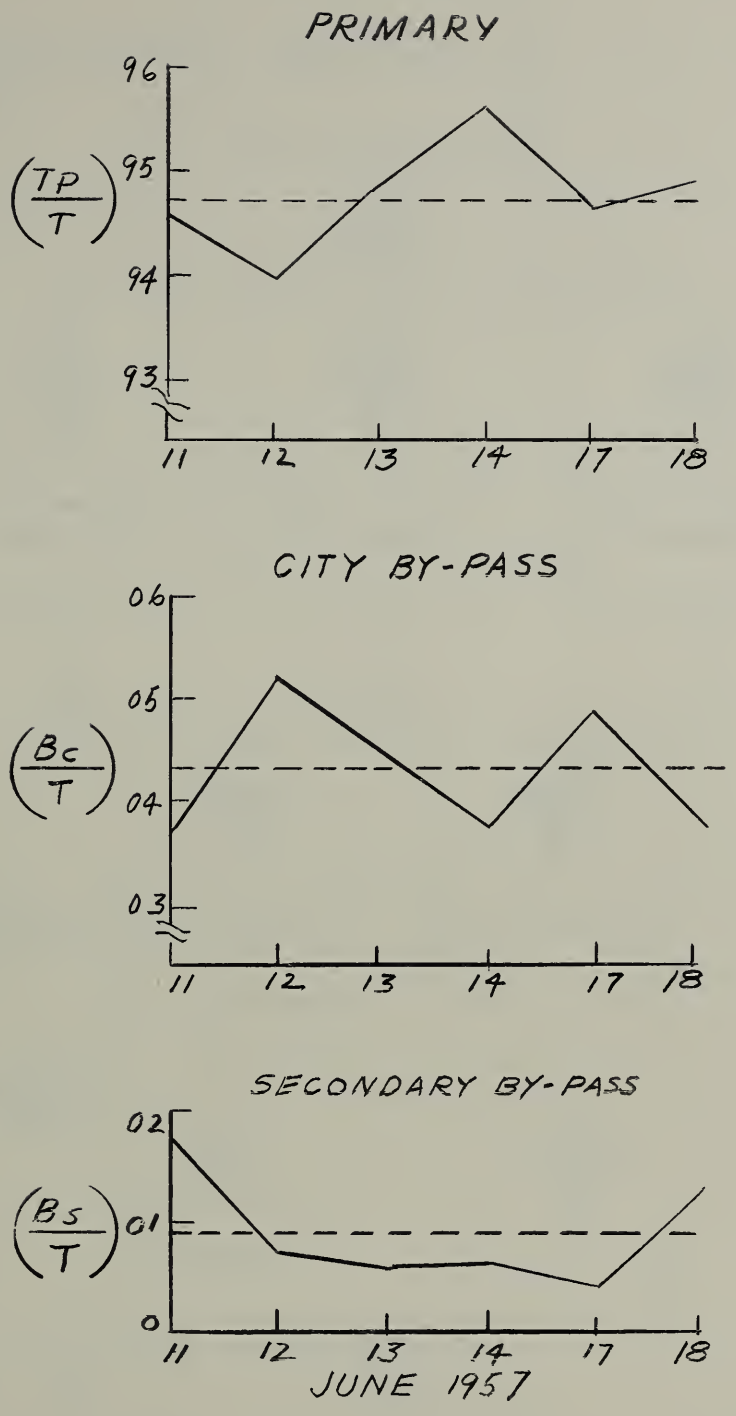


Figure 8

Graphs of Daily Volume Ratios for Los Angeles

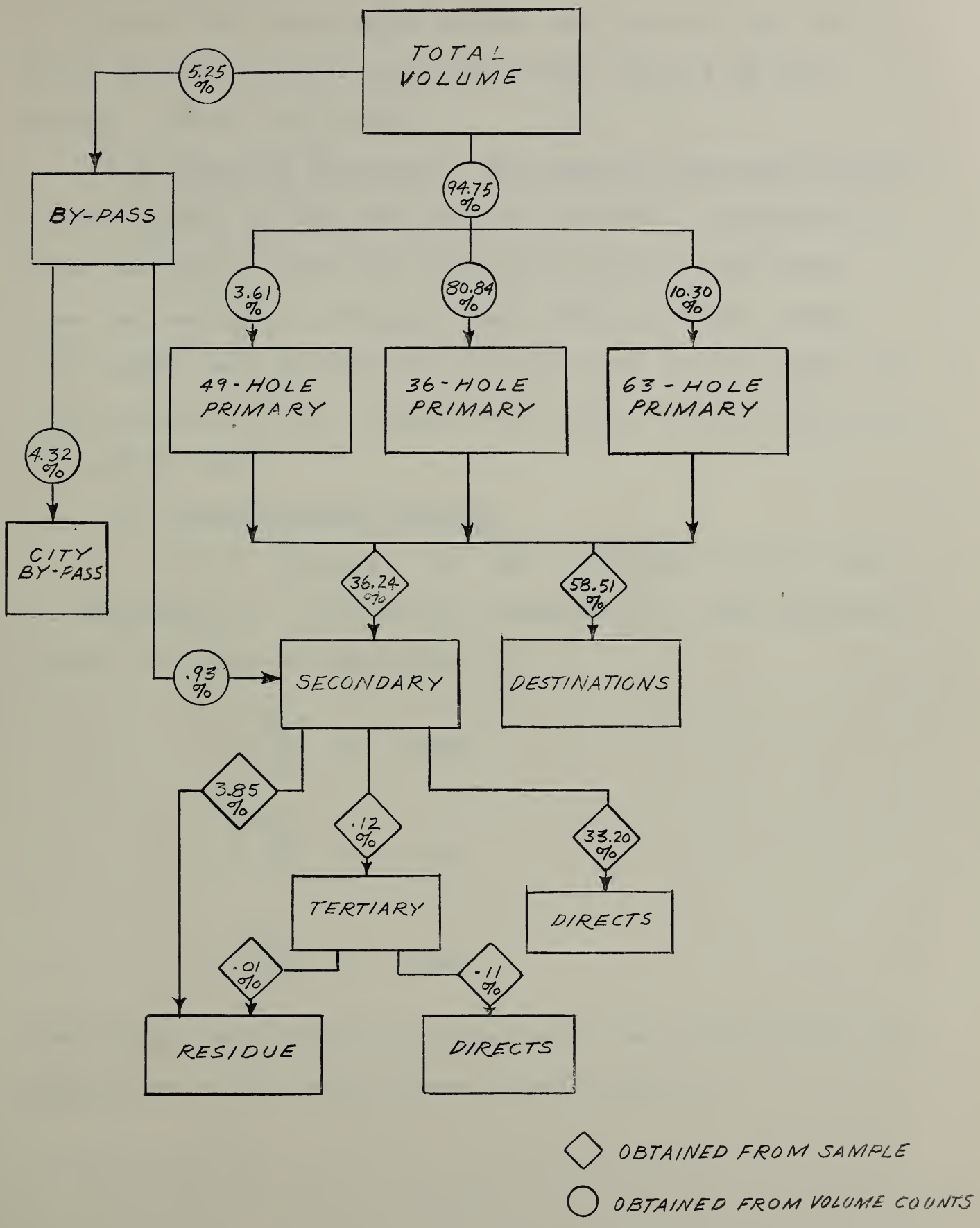


Figure 9

Los Angeles Flow Chart

is divided into three parts because Los Angeles made use of three Primary cases of different sizes, notably 36 hole, 49 hole, and 63 hole cases.

7.2 Sampling Procedure. The sampling procedure adopted in Los Angeles is the same as that described in Section 4.2 with the modification that additional samples were taken from the two special Primary cases (49 and 63 hole cases) that handle only metered mail and are used solely during the evening peak periods. Samples were taken on June 12, 13, 14, 17, and 18, 1957.

7.3 Computational Formulae.

7.3.1 Primary. Let the 36, 49, and 63 hole cases be designated by P_1, P_2, and P_3 respectively. The following ratios are obtained from Figure 9:

$$\left(\frac{T_{P_1}}{T}\right) = .8084$$

$$\left(\frac{T_{P_2}}{T}\right) = .0361$$

$$\left(\frac{T_{P_3}}{T}\right) = .1030$$

Therefore, the following formulae were used to determine the proportion of the Total Volume of mail going to:

a. Destination on the 36 hole Primary:

$$\left(\frac{D_{P_1}}{T}\right)^* = \frac{D_{P_1}}{T_{P_1}} \times \left(\frac{T_{P_1}}{T}\right) = \frac{D_{P_1}}{T_{P_1}} \times .8084,$$

(The total number of letters in the samples off the 36 hole Primary was 12,162).

b. Destination on the 49 hole Primary:

$$\left(\frac{D_{P_2}}{T}\right)^* = \frac{D_{P_2}}{T_{P_2}} \times \left(\frac{T_{P_2}}{T}\right) = \frac{D_{P_2}}{T_{P_2}} \times .0361,$$

(The total number of letters in the samples off the 49 hole Primary was 2,162).

c. Destination on the 63 hole Primary:

$$\left(\frac{D_{P_3}}{T}\right)^* = \frac{D_{P_3}}{T_{P_3}} \times \left(\frac{T_{P_3}}{T}\right) = \frac{D_{P_3}}{T_{P_3}} \times .1030,$$

(The total number of letters in the samples off the 63 hole Primary was 2,783).

7.3.2 Secondary. The formula for Destinations off the Secondary depends upon the ratios obtained at the Primary and Secondary, as well as the volume counts. Using such ratios gives the formula:

$$\left(\frac{D_{S_i}}{T}\right)^* = \frac{D_{S_i}}{S_i} \times \left\{ \frac{S_i}{T_P} \times \left(\frac{T_P}{T}\right) \times \frac{\left(\frac{T_P}{T}\right)\sum_i \frac{S_i}{T_P} + \left(\frac{B_S}{T}\right)}{\left(\frac{T_P}{T}\right)\sum \frac{S_i}{T_P}} \right\}$$

$$= \frac{D_{S_i}}{S_i} \times c_i ,$$

where the c_i are the quantities in brackets which depend upon the particular Secondary. Values of c_i corresponding to the particular Secondaries are listed in Table 6.

TABLE 6

Number of Pieces in Sample and Constants used in Computational Formula for Destinations off the Secondaries for Los Angeles

i	S_i	No. Pcs.	c_i
1	Ariz.-Colo.-New Mexico	3,847	.01364
2	Ind.-Mass.-Pennsylvania	6,377	.01556
3	Illinois-Ohio	5,847	.01414
4	Central States	5,403	.00972
5	North States	5,811	.01258
6	Northwest States	4,780	.00775
7	South States	5,699	.00815
8	New Jersey-New York	7,302	.01492
9	Oklahoma	4,446	.00233
10	East States	5,844	.01104
11	Texas	4,809	.01014
12	California A-B	5,303	.02445
13	California C	5,296	.02178
14	California D-G	5,014	.02392
15	California H-L	4,951	.03462
16	California M-N	5,120	.01905
17	California O-P-Q-Nevada	5,310	.02461
18	California R-San	5,575	.02932
19	California S-Santa	5,320	.04248
20	California T-Z	5,578	.03146
	Total	107,632	.37166

7.3.3 Tertiary. The formula for Destinations off the Tertiary depends upon ratios obtained at the Primary, Secondary, and Tertiary, as well as the volume counts. Using such ratios gives the formula:

$$\left(\frac{D_{t_{ij}}}{T}\right)^* = \frac{D_{t_{ij}}}{t_{ij}} \times \left\{ \frac{t_{ij}}{S_i} \times \left(\frac{T_p}{T}\right) \times \frac{\left(\frac{T_p}{T}\right)\sum \frac{S_i}{T_p} + \left(\frac{B_S}{T}\right)}{\left(\frac{T_p}{T}\right)\sum \frac{S_i}{T_p}} \right\}$$

$$= \frac{D_{t_{ij}}}{t_{ij}} \times k_{ij} ,$$

where the k_{ij} are the quantities in brackets which depend upon the particular Tertiary. Values of k_{ij} corresponding to the particular Tertiaries are listed in Table 7.

TABLE 7

Number of Pieces in Sample and Constants used in Computational Formula for Destinations off the Tertiaries for Los Angeles

i,j	t_{ij}	No. Pcs.	k_{ij}
1,1	Arizona Scheme	4,581	.00050
1,2	Colorado-New Mexico Scheme	5,627	.00074
	Total	10,208	.00124

Although percentages were computed for each Destination on these two cases, these Destinations were found to be duplicates of the Destinations on the Arizona - Colorado - New Mexico Secondary cases. Therefore, duplicates were added together to give one combined percentage for the final tabulation.

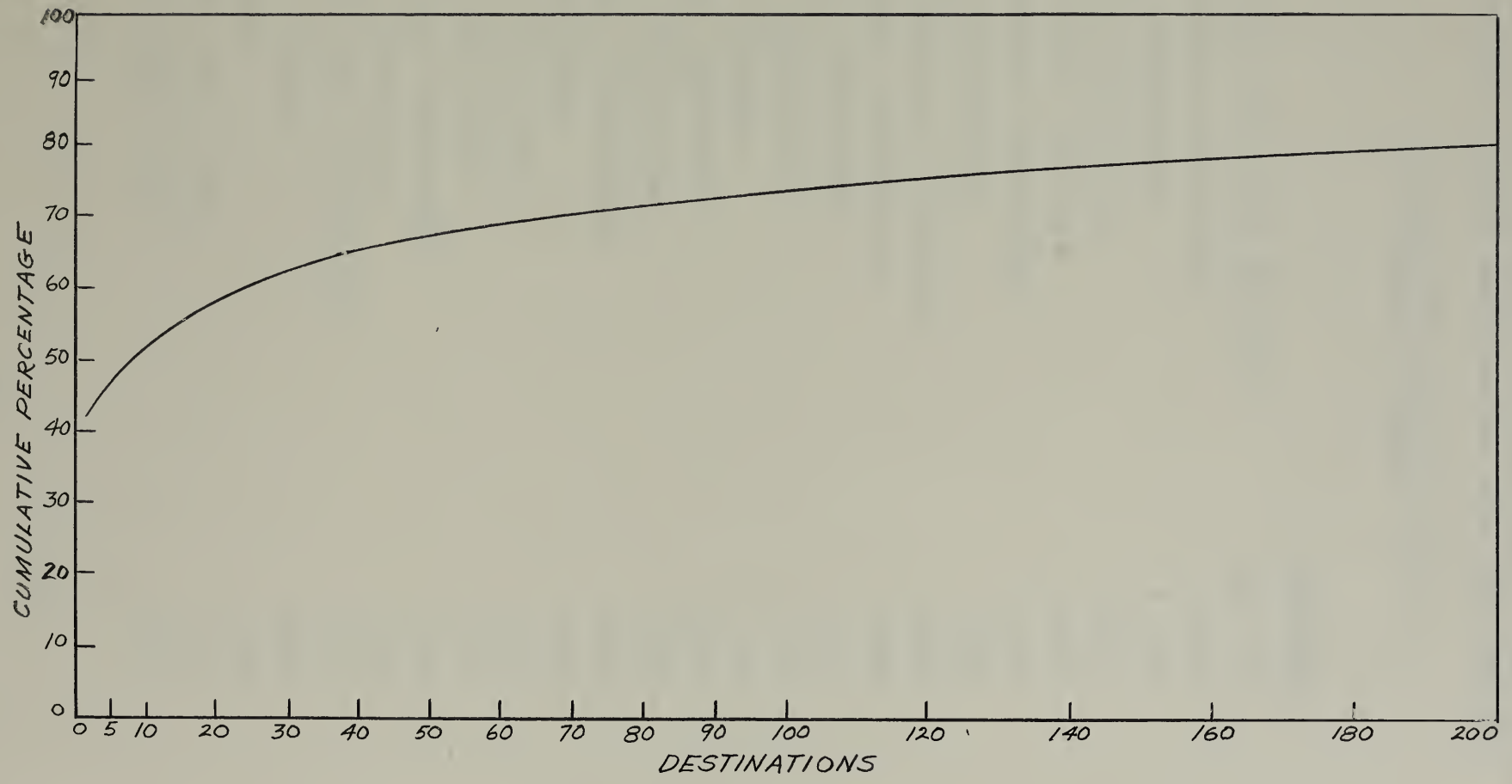


Figure 10

Graph of Largest 200 Destinations for Los Angeles

TABLE 8

TABULATION OF ESTIMATED PERCENTAGES OF THE TOTAL VOLUME TO EACH DESTINATION FOR LOS ANGELES

Largest 200 Destinations
Listed by Name

		Percent	Cumulative Percent
1.	Los Angeles, Inc. City By-pass	42.403	42.403
2.	Beverly Hills, California	1.816	44.219
3.	Pasadena, California	1.377	45.596
4.	Long Beach, California	1.343	46.939
5.	New York City, New York	1.219	48.158
6.	San Francisco, California	1.151	49.309
7.	Glendale, California	.989	50.298
8.	North Hollywood, California	.955	51.253
9.	Santa Monica, California	.949	52.202
10.	San Diego, California	.814	53.016
11.	Burbank, California	.765	53.781
12.	Chicago, Illinois	.759	54.540
13.	Inglewood, California	.753	55.293
14.	Van Nuys, California	.698	55.991
15.	Sacramento, California	.681	56.672
16.	Washington State	.640	57.312
17.	Whittier, California	.583	57.895
18.	Compton, California	.540	58.435
19.	Culver City, California	.498	58.933
20.	Alhambra, California	.489	59.422
21.	Huntington Park, California	.456	59.878
22.	Phoenix, Arizona	.384	60.262
23.	Oregon State	.378	60.640
24.	South Gate, California	.359	60.999
25.	Santa Ana, California	.341	61.340

		Percent	Cumulative Percent
26.	Montebello, California	.331	61.671
27.	Oakland, California	.328	61.999
28.	San Bernardino, California	.326	62.325
29.	Sherman Oaks, California	.303	62.628
30.	Gardena, California	.299	62.927
31.	Denver, Colorado	.289	63.216
32.	Torrance, California	.285	63.501
33.	Newark, New Jersey	.280	63.781
34.	San Gabriel, California	.269	64.050
35.	Santa Barbara, California	.265	64.315
36.	S. Pasadena, California	.256	64.571
37.	Fresno, California	.250	64.821
38.	Arcadia, California	.248	65.069
39.	Anaheim, California	.248	65.317
40.	Hawthorne, California	.248	65.565
41.	El Monte, California	.236	65.801
42.	Downey, California	.236	66.037
43.	Bakersfield, California	.235	66.272
44.	Riverside, California	.233	66.505
45.	Monrovia, California	.228	66.733
46.	Norwalk, California	.228	66.961
47.	San Fernando, California	.224	67.185
48.	Pomona, California	.216	67.401
49.	Washington, D. C.	.214	67.615
50.	Philadelphia, Pennsylvania	.212	67.827
51.	Venice, California	.206	68.033
52.	Detroit, Michigan	.189	68.222
53.	San Jose, California	.186	68.408
54.	Redondo Beach, California	.183	68.591
55.	Dallas, Texas	.181	68.772

		Percent	Cumulative Percent
56.	Monterey Park, California	.176	68.948
57.	Bell, California	.174	69.122
58.	Cleveland, Ohio	.172	69.294
59.	Boston, Mass.	.170	69.464
60.	Reseda, California	.170	69.634
61.	San Marino, California	.164	69.798
62.	Covina, California	.160	69.958
63.	San Pedro, California	.160	70.118
64.	Tuscon, Arizona	.159	70.277
65.	Lancaster, California	.148	70.425
66.	Lakewood, California	.148	70.573
67.	Salt Lake City, Utah	.148	70.721
68.	Berkeley, California	.148	70.869
69.	Brooklyn, New York	.147	71.016
70.	Fullerton, California	.146	71.162
71.	Minneapolis, Minnesota	.145	71.307
72.	Temple City, California	.143	71.450
73.	Garden City, New York	.140	71.590
74.	St. Louis, Missouri	.138	71.728
75.	Manhattan Beach, California	.134	71.862
76.	Stockton, California	.133	71.995
77.	Pacoima, California	.129	72.124
78.	Lynwood, California	.127	72.251
79.	Pacific Palisade, California	.126	72.377
80.	Canoga Park, California	.124	72.501
81.	Pittsburgh, Pennsylvania	.123	72.624
82.	Houston, Texas	.123	72.747
83.	Garden Grove, California	.121	72.868
84.	Wilmington, California	.121	72.989
85.	Cincinnati, Ohio	.118	73.107

		Percent	Cumulative Percent
86.	Encino, California	.117	73.224
87.	West Covina, California	.114	73.338
88.	Oxnard, California	.114	73.452
89.	Palm Desert, California	.111	73.563
90.	Altadena, California	.108	73.671
91.	La Cresenta, California	.108	73.779
92.	Rivera, California	.104	73.883
93.	Ventura, California	.104	73.987
94.	Azusa, California	.102	74.089
95.	Las Vegas, Nevada	.101	74.190
96.	La Canada, California	.099	74.289
97.	Bellflower, California	.098	74.387
98.	Kansas City, Missouri	.098	74.485
99.	Ontario, California	.097	74.582
100.	Studio City, California	.094	74.676
101.	Palo Alto, California	.093	74.769
102.	Hermosa Beach, California	.092	74.861
103.	La Puente, California	.092	74.953
104.	El Segundo, California	.091	75.044
105.	Baldwin Park, California	.091	75.135
106.	Northridge, California	.089	75.224
107.	Sun Valley, California	.087	75.311
108.	Woodland Hills, California	.087	75.398
109.	Maywood, California	.086	75.484
110.	Palm Springs, California	.082	75.566
111.	Milwaukee, Wisconsin	.081	75.647
112.	Baltimore, Maryland	.080	75.727
113.	Laguna, California	.080	75.807
114.	Puente, California	.079	75.886
115.	La Habra, California	.079	75.965

		Percent	Cumulative Percent
116.	Newport Beach, California	.077	76.042
117.	San Luis Obispo, California	.077	76.119
118.	Rosemead, California	.077	76.196
119.	Indianapolis, Indiana	.077	76.273
120.	Albuquerque, New Mexico	.076	76.349
121.	Dayton, Ohio	.073	76.422
122.	Lawndale, California	.072	76.494
123.	Chula Vista, California	.072	76.566
124.	La Jolla, California	.072	76.638
125.	Fontana, California	.071	76.709
126.	Orange, California	.071	76.780
127.	Palos Verdes Estate, California	.071	76.851
128.	Costa Mesa, California	.070	76.921
129.	Redlands, California	.070	76.991
130.	Oceanside, California	.070	77.061
131.	St. Paul, Minnesota	.069	77.130
132.	El Paso, Texas	.068	77.198
133.	Tujunga, California	.068	77.266
134.	Paramount, California	.066	77.332
135.	Louisville, Kentucky	.066	77.398
136.	Fort Worth, Texas	.066	77.464
137.	El Centro, California	.065	77.529
138.	Santa Maria, California	.065	77.594
139.	Sierra Madre, California	.065	77.659
140.	San Antonio, Texas	.065	77.724
141.	Pico, California	.064	77.788
142.	South San Gabriel	.064	77.852
143.	New Orleans, Louisiana	.064	77.916
144.	Terre Haute, Indiana	.064	77.980

		Percent	Cumulative Percent
145.	La Mesa, California	.063	78.043
146.	Claremont, California	.063	78.106
147.	Columbus, Ohio	.062	78.168
148.	Omaha, Nebraska	.062	78.230
149.	Vet. Adm. Denver, Colorado	.061	78.291
150.	San Mateo, California	.060	78.351
151.	Granada Hills, California	.058	78.409
152.	Sunland, California	.058	78.467
153.	Vista, California	.058	78.525
154.	Salinas, California	.057	78.582
155.	Buena Park, California	.055	78.637
156.	Sepulveda, California	.055	78.692
157.	San Clemente, California	.055	78.747
158.	Saugus, California	.054	78.801
159.	La Mirada, California	.054	78.855
160.	Camarillo, California	.054	78.909
161.	Tarzana, California	.054	78.963
162.	Richmond, California	.054	79.017
163.	San Ysidro, California	.054	79.071
164.	Modesto, California	.053	79.124
165.	Chino, California	.053	79.177
166.	Carona, California	.052	79.229
167.	Bronx, New York	.052	79.281
168.	Pleasantville, New York	.052	79.333
169.	Glendory, California	.051	79.384
170.	El Cajon, California	.051	79.435
171.	Escondido, California	.050	79.485
172.	Indio, California	.050	79.535
173.	Lomita, California	.050	79.585

		Percent	Cumulative Percent
174.	Oklahoma City, Oklahoma	.050	79.635
175.	Daly City, California	.049	79.684
176.	Santa Paula, California	.048	79.732
177.	Toledo, Ohio	.048	79.780
178.	Tulsa, Oklahoma	.048	79.828
179.	Upland, California	.047	79.875
180.	Palmdale, California	.046	79.921
181.	Santa Rosa, California	.046	79.967
182.	Duarte, California	.045	80.012
183.	Des Moines, Iowa	.045	80.057
184.	Hayward, California	.045	80.102
185.	Malibu, California	.045	80.147
186.	Montrose, California	.045	80.192
187.	Taft, California	.045	80.237
188.	Santa Cruz, California	.044	80.281
189.	Memphis, Tennessee	.043	80.324
190.	Colton, California	.043	80.367
191.	Los Altos, California	.042	80.409
192.	Camp Pendleton, California	.042	80.451
193.	Universal City, California	.042	80.493
194.	Victorville, California	.042	80.535
195.	Vallejo, California	.042	80.577
196.	Visalia, California	.042	80.619
197.	Rolling Hills, California	.042	80.661
198.	Reno, Nevada	.041	80.702
199.	National City, California	.041	80.743
200.	Buffalo, New York	.040	80.783

Rank	No. in Group	Individual Percent	Group Percent	Cumulative Percent
201-	1	.039	.039	80.822
202-203	2	.038	.076	80.898
204-205	2	.037	.074	80.972
206-209	4	.036	.144	81.116
210-214	5	.035	.175	81.291
215-217	3	.034	.102	81.393
218-219	2	.033	.066	81.459
220-224	5	.032	.160	81.619
225-227	3	.031	.093	81.712
228-233	6	.030	.180	81.892
234-236	3	.029	.087	81.979
237-238	2	.028	.056	82.035
239-247	9	.027	.243	82.278
248-253	6	.026	.156	82.434
254-256	3	.025	.075	82.509
257-265	9	.024	.216	82.725
266-276	11	.023	.253	82.978
277-281	5	.022	.110	83.088
282-286	5	.021	.105	83.193
287-300	14	.020	.280	83.473
301-311	11	.019	.209	83.682
312-316	5	.018	.090	83.772
315-327	11	.017	.187	83.959
328-343	16	.016	.256	84.215
344-356	13	.015	.195	84.410
357-373	17	.014	.238	84.648
374-388	15	.013	.195	84.843
389-408	20	.012	.240	85.083
409-428	20	.011	.220	85.303
429-455	27	.010	.270	85.573

Rank	No. in Group	Individual Percent	Group Percent	Cumulative Percent
457-489	33	.009	.297	85.870
490-528	39	.008	.312	86.182
529-584	56	.007	.392	86.574
585-646	62	.006	.372	86.946
647-716	70	.005	.350	87.296
717-839	123	.004	.492	87.788
840-980	141	.003	.423	88.211
981-1178	198	.002	.396	88.607
1179-1413	235	.001	.235	88.842
1414-1587	174	<.001	.030	88.872
	Air Mail		.485	89.357
	Postage Due		.375	89.732
	Uncanceled		5.483	95.215
	Foreign		.529	95.744
	Go Backs		.392	96.136
	Residue		3.864	100.000

Breakdown of Residue:

Illinois	.267
Ohio	.161
Michigan	.158
Minnesota	.098
North Dakota	.025
South Dakota	.063
Wisconsin	.092
Arizona	.050
Colorado, New Mexico	.074
North Carolina	.055
Kentucky	.057

Maryland	.030
Texas	.200
Idaho	.033
Montana	.033
Nebraska	.061
Utah	.069
Wyoming	.023
Iowa	.091
Kansas	.073
Missouri	.094
Tennessee	.048
Indiana	.122
Massachusetts	.110
Pennsylvania	.218
Nevada Scheme	.025
California Scheme	.087
Arkansas	.083
Alabama	.043
Florida	.062
Georgia	.044
Louisiana	.074
Mississippi	.051
South Carolina	.022
Delaware	.010
Connecticut	.051
Maine	.019
New Hampshire	.021
Rhode Island	.013
Virginia	.050
West Virginia	.030
New Jersey	.125

New York State	.206
Oklahoma	.056
California A-B	.057
California C	.056
California H-L	.141
California M-N	.058
California T-Z	.071
She Scheme	.039
California R. San	.043
Colorado, N. Mex. Res.	.008
Elp and La. No. 4	.001
Alb. and La. 18-20	.001
Res. to Arizona	.007
Alb. to La., N.M.	.001
Alb. and La., Colo.	.001
Gr. Jct. and Ogd.	.002
Om. and Ogd., Colo.	.001
TOTAL	3.864

7.4 Tabulation of Estimated Distribution and Observations.

The tabulation of the estimated percentages of the Total Volume of mail going to each Destination is given in Table 8. These are listed in order of descending value. The largest 200 are listed by name and the remainder grouped by percentages. Figure 10 graphically portrays the largest 200 Destinations by percentage. Several observations, based on the tabulation, are given here:

1. The largest 200 Destinations received 81% of the Total Volume

2. Seventy-eight percent of the Total Volume remained in the state of California (not including Air Mail and Go backs).

3. Forty-two percent of the Total Volume remained in Los Angeles.

4. Six Destinations: Los Angeles, Beverly Hills, Pasadena, Long Beach, New York City, and San Francisco, were the only cities that received more than one percent of the Total Volume.

5. Seventy-nine percent remained on the West Coast (not including Air Mail and Go backs).

8. Baltimore Study.

Baltimore represents the initial attempt to develop a method of sampling for estimating the distribution of mail by Destination. Baltimore was a conveniently located post office that gave an opportunity to try a new procedure in an office where a previous complete count study was made.

8.1 Volume Count Data. Special volume counts were made in Baltimore to determine what percentage of the Total Volume flowed into the Primary, how much by-passed the Primary and flowed either into the Secondary or into the city section for local Distribution. These counts were made on January 17, 18, 21, 22, 23, 24, 25, 28, 29, 30, 1957, between 11:00 A.M. and 11:00 P.M. Volume control counts of mail flowing into the Secondary that by-passed the Primary was about 10.5% of the Total Volume. Therefore, Baltimore is analyzed according to Section 4.3.3., and therefore footage counts of mail into each Secondary had to be obtained. These figures were kept for the entire sampling period.

The Total Volume figures and corresponding percentages are summarized in Table 9. Figure 11 shows the consistency of these percentage figures during the entire sample period, based on a day by day comparison. Table 10 gives the basic volume data used to determine ratios of Secondary mail to Total Volume and Figure 12 shows the consistency of these ratios for each Secondary, based on a day by day comparison. The flow chart given in Figure 13 contains the basic percentage figures which are then applied in the appropriate formula.

8.2 Sampling Procedure. The sampling procedure adopted for Baltimore is the same as that described in Section 4.2.

TABLE 9

Baltimore Volume Count Data
(January 1957)
In Pieces

Mail to:	1-17-57	1-18-57	1-21-57	1-22-57	1-23-57	1-24-57
Primary						
Total	931,755	918,185	953,917	886,040	817,605	811,490
Percent	64.88	69.08	78.22	68.37	77.34	65.49
Sec-By-Pass						
Bundle Dis.	35,287	25,400	36,400	33,700	30,500	44,500
From City Sec.	8,990	27,453	8,216	15,007	22,789	22,571
By-Pass Dis.	60,248	51,596	25,785	30,430	69,095	58,774
By-Pass Mtrd.	56,732	28,387	27,280	36,346	24,020	29,190
Total	161,257	132,836	97,681	115,483	146,404	155,035
Percent	11.23	9.99	8.01	8.91	13.85	12.51
City-By-Pass						
Bundle-To City	90,223	59,300	38,600	60,800	53,900	53,800
Mtrd to City	252,876	218,920	129,270	233,702	39,260	218,774
Total	343,099	278,220	167,870	294,502	93,160	272,574
Percent	23.89	20.93	13.77	22.72	8.81	22.00
TOTAL	1,436,111	1,329,241	1,219,468	1,296,025	1,057,169	1,239,099

TABLE 9 (Continued)

Mail to:	1-25-57	1-28-57	1-29-57	1-30-57	GRAND TOTAL
Total	828,923	700,158	856,561	995,452	8,700,086
Percent	62.80	64.99	64.46	67.66	68.10
Sec-By-Pass					
Bundle Dis.	36,600	42,500	49,400	47,600	381,887
From City Sec.	12,085	7,105	52,104	23,589	199,909
By-Pass Dis.	39,805	20,155	17,667	53,667	427,222
By-Pass Mtrd.	47,060	23,260	44,686	38,539	355,500
Total	135,550	93,020	163,857	163,395	1,364,518
Percent	10.27	8.63	12.33	11.11	10.69
City-By-Pass					
Bundle-To City	72,100	54,700	76,300	72,800	632,523
Mtrd. to City	283,336	229,457	232,200	239,682	2,077,477
Total	355,436	284,157	308,500	312,482	2,710,000
Percent	26.93	26.38	23.21	21.23	21.21
TOTAL	1,319,909	1,077,335	1,328,918	1,471,329	12,774,604

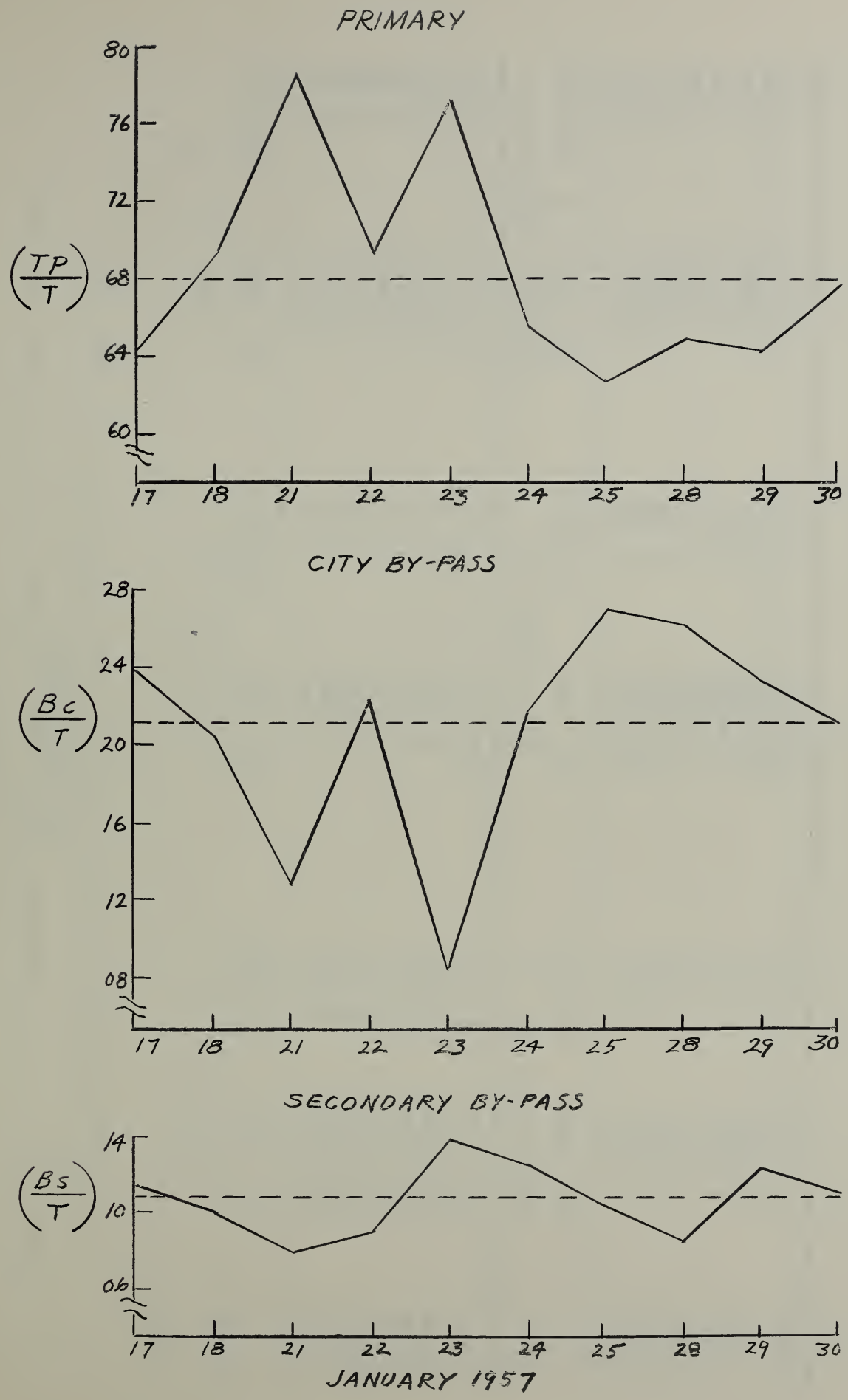


Figure 11

Graphs of Daily Volume Ratios for Baltimore

TABLE 10

Volume Data for Determining Percentage of Total Volume to Each Secondary for Baltimore

(Pieces quoted are Total Volume from 11:00 A.M. to 11:00 P.M)

Date	Maryland, S_1		Delaware, S_2		New York, S_3	
	No. Pcs.	Percent	No. Pcs.	Percent	No. Pcs.	Percent
1/17	145,459	33.56	7,102	1.64	27,235	6.28
1/23	126,730	30.15	7,395	1.76	23,224	5.52
1/24	132,627	32.16	6,284	1.52	21,774	5.28
1/25	125,762	31.35	6,670	1.66	15,954	3.98
1/29	138,498	29.64	5,123	1.10	30,908	6.62
1/30	152,370	34.49	6,791	1.54	26,582	6.02
Total	821,446	31.89	39,365	1.53	145,677	5.65

Date	Massachusetts, S_4		New Jersey, S_5		Conn.,Me.,N.H.,R.I., Vermont, S_6	
	No. Pcs.	Percent	No. Pcs.	Percent	No. Pcs.	Percent
1/17	8,723	2.01	20,977	4.84	12,171	2.81
1/23	9,304	2.21	21,122	5.02	9,811	2.33
1/24	11,865	2.88	17,714	4.30	10,658	2.58
1/25	9,811	2.45	15,200	3.79	9,062	2.26
1/29	11,359	2.43	19,164	4.10	15,514	3.32
1/30	9,691	2.19	20,058	4.54	10,440	2.36
Total	60,753	2.36	114,235	4.43	67,656	2.63

TABLE 10 (Continued)

Date	Pennsylvania, S_7		Virginia, S_8		Florida, S_9	
	No. Pcs.	Percent	No. Pcs.	Percent	No. Pcs.	Percent
1/17	36,250	8.36	37,869	8.74	8,749	2.02
1/23	38,449	9.15	34,485	8.20	16,335	3.89
1/24	37,868	9.19	35,694	8.66	8,821	2.14
1/25	34,653	8.64	40,406	10.07	10,850	2.71
1/29	44,636	9.55	30,764	6.58	10,851	2.32
1/30	35,041	7.93	41,349	9.36	15,563	3.52
Total	226,897	8.81	220,567	8.56	71,169	2.76

Date	Georgia, S.C., S_{10}		Miss.,Tenn.,Ala.,La., S_{11}		North Carolina, S_{12}	
	No. Pcs.	Percent	No. Pcs.	Percent	No. Pcs.	Percent
1/17	12,253	2.83	7,806	1.80	20,590	4.75
1/23	12,396	2.95	11,236	2.67	19,189	4.56
1/24	11,431	2.77	9,569	2.32	15,152	3.67
1/25	8,942	2.23	9,738	2.43	17,519	4.37
1/29	10,271	2.20	12,542	2.68	22,016	4.71
1/30	11,382	2.58	11,165	2.53	13,340	3.02
Total	66,675	2.59	62,05	2.41	107,806	4.18

Date	Texas, S_{13}		Ind.-Ky., S_{14}		California, S_{15}	
	No. Pcs.	Percent	No. Pcs.	Percent	No. Pcs.	Percent
1/17	5,997	1.38	5,678	1.31	8,797	2.03
1/23	10,005	2.38	6,597	1.57	7,467	1.78
1/24	6,524	1.58	8,845	2.14	9,521	2.31
1/25	7,660	1.91	8,482	2.11	9,449	2.36
1/29	6,307	1.35	7,999	1.71	15,877	3.40
1/30	5,365	1.21	4,326	0.98	10,779	2.44
Total	41,858	1.62	41,927	1.63	61,890	2.40

TABLE 10 (Continued)

Date	West States, S_{16}		Mo.-Mich., S_{17}		Ia.-Ill.-Wisc., S_{18}	
	No. Pcs.	Percent	No. Pcs.	Percent	No. Pcs.	Percent
1/17	13,560	3.13	11,551	2.67	10,875	2.51
1/23	12,518	2.98	10,512	2.50	8,965	2.13
1/24	14,355	3.48	10,440	2.53	12,010	2.91
1/25	14,065	3.51	11,914	2.97	10,923	2.72
1/29	21,338	4.57	18,269	3.91	7,830	1.68
1/30	13,436	3.04	12,712	2.88	11,068	2.51
Total	89,272	3.47	75,398	2.93	61,671	2.39

Date	West Virginia, S_{19}		Ohio, S_{20}		Star Route, S_{21}	
	No. Pcs.	Percent	No. Pcs.	Percent	No. Pcs.	Percent
1/17	10,610	2.45	17,593	4.06	3,552	.82
1/23	10,850	2.58	16,650	3.96	7,153	1.70
1/24	11,745	2.85	13,775	3.34	5,703	1.38
1/25	10,561	2.63	16,118	4.02	7,347	1.83
1/29	12,083	2.59	23,103	4.94	2,755	.59
1/30	11,382	2.58	15,612	3.53	3,285	.74
Total	67,231	2.61	102,851	3.99	29,795	1.16

Date	TOTALS
1/17	433,397
1/23	420,393
1/24	412,375
1/25	401,086
1/29	467,207
1/30	441,737
Grand Total	2,576,195

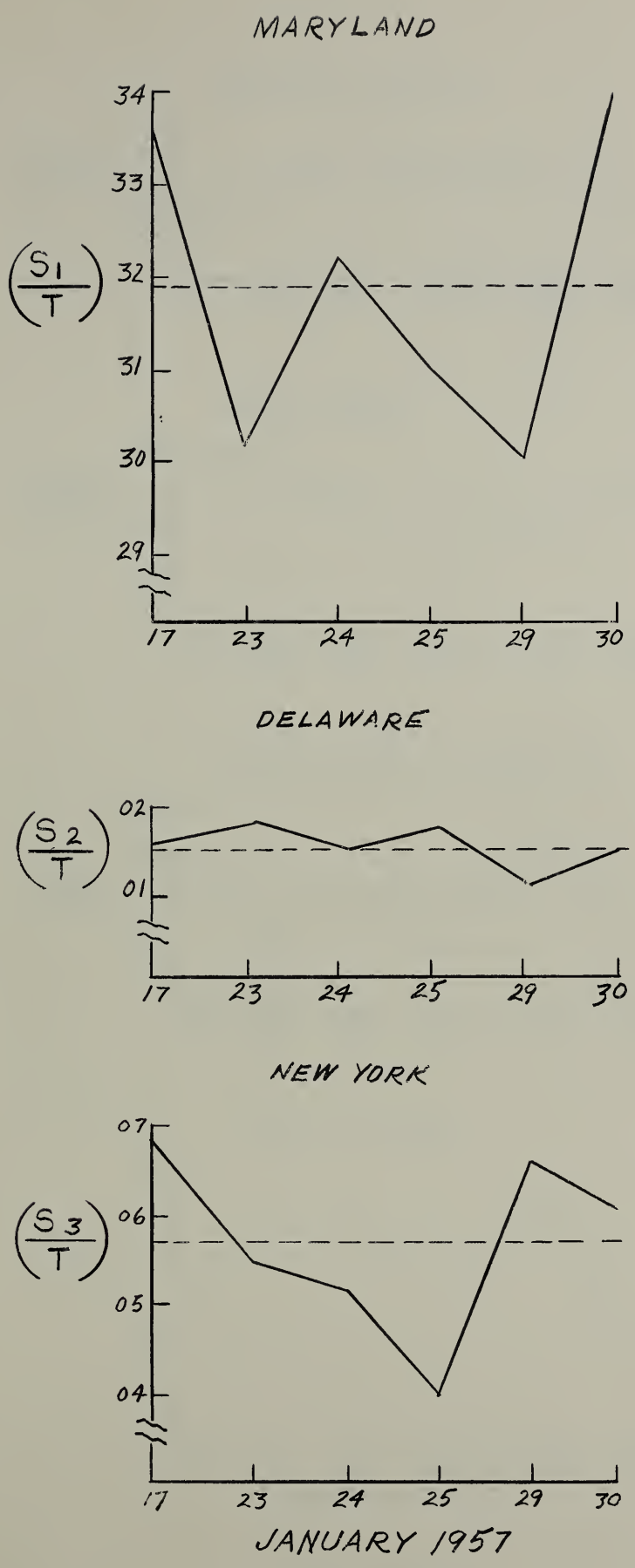


Figure 12

Graphs of Daily Volume Ratios for Each Secondary for Baltimore

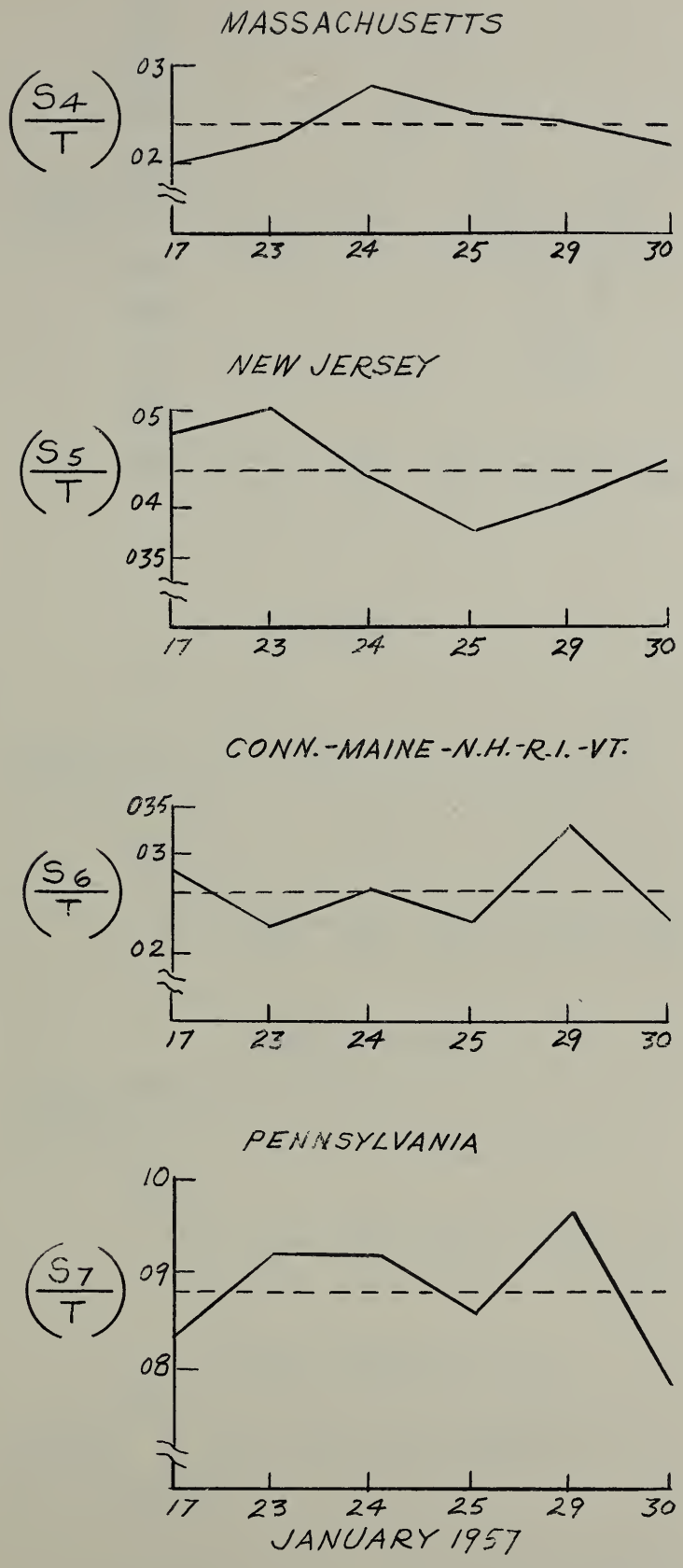


Figure 12
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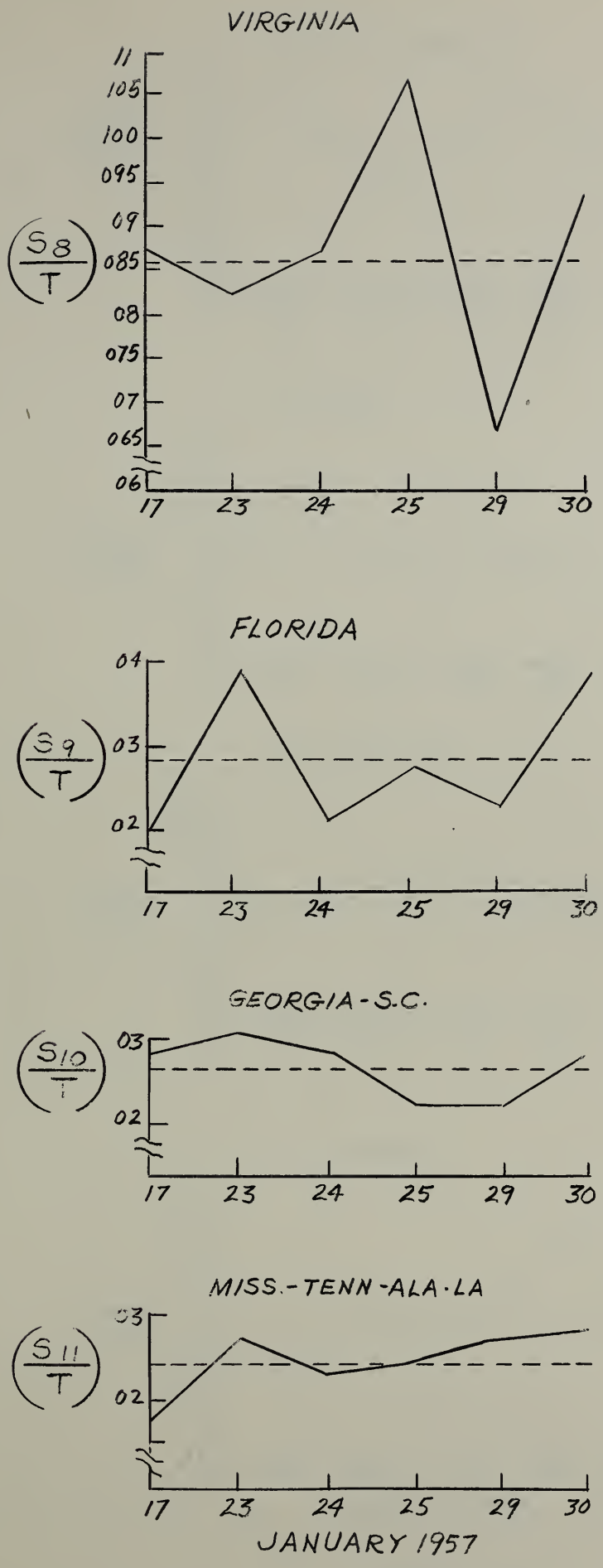

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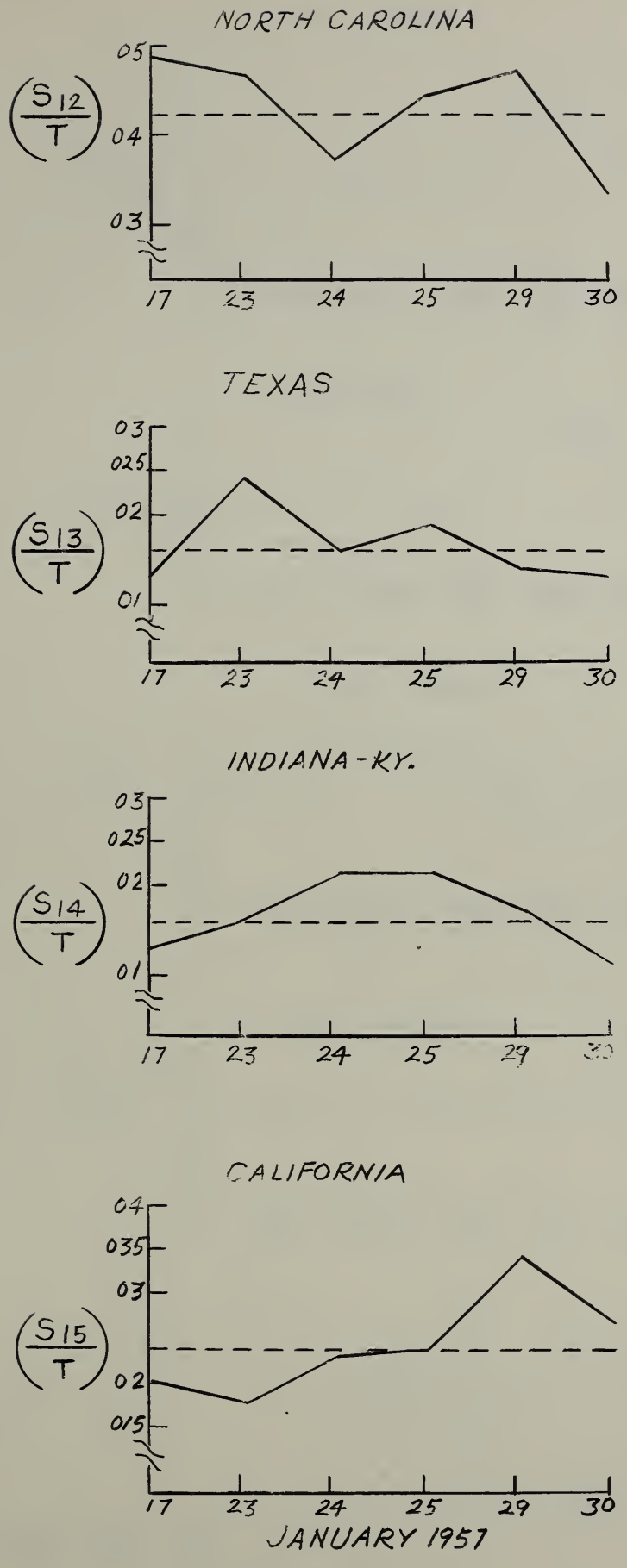

Figure 12
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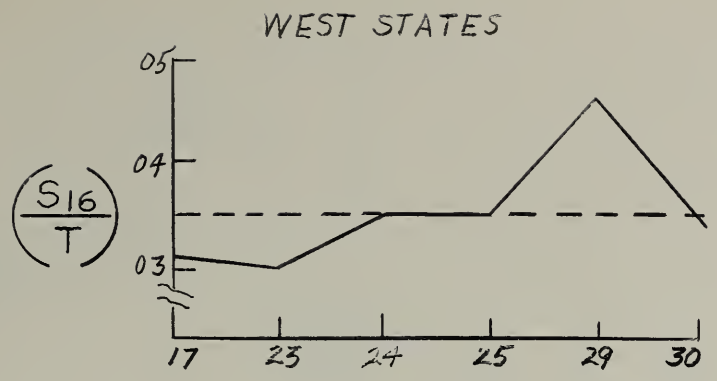

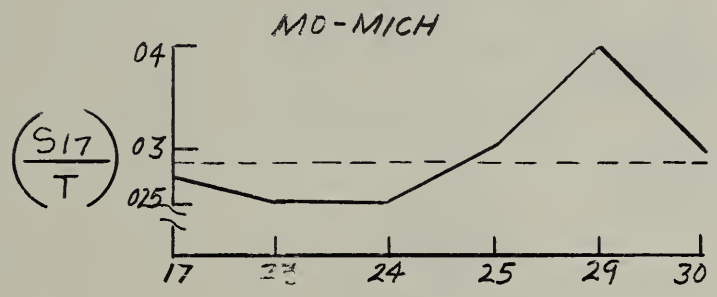

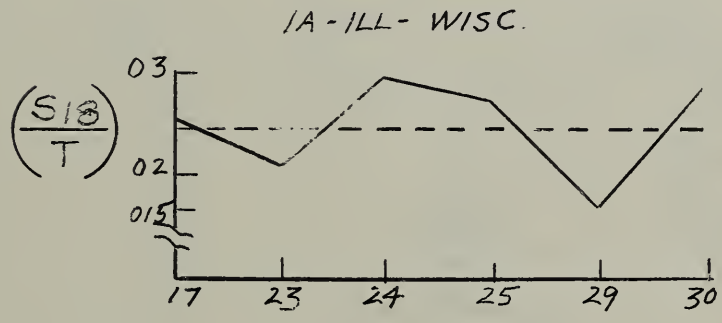

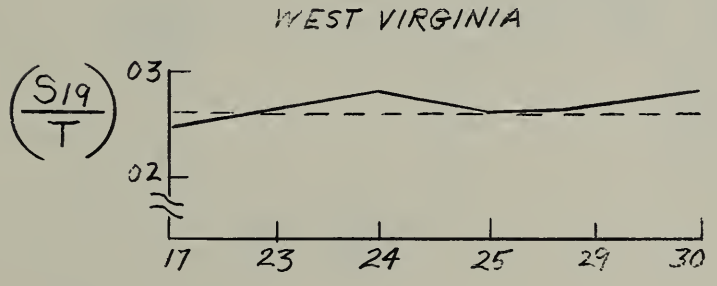

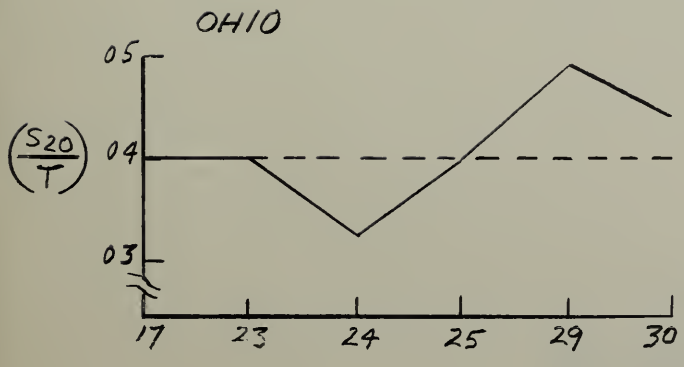

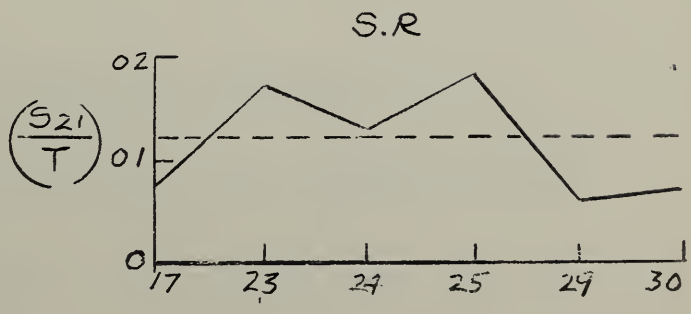

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Figure 12
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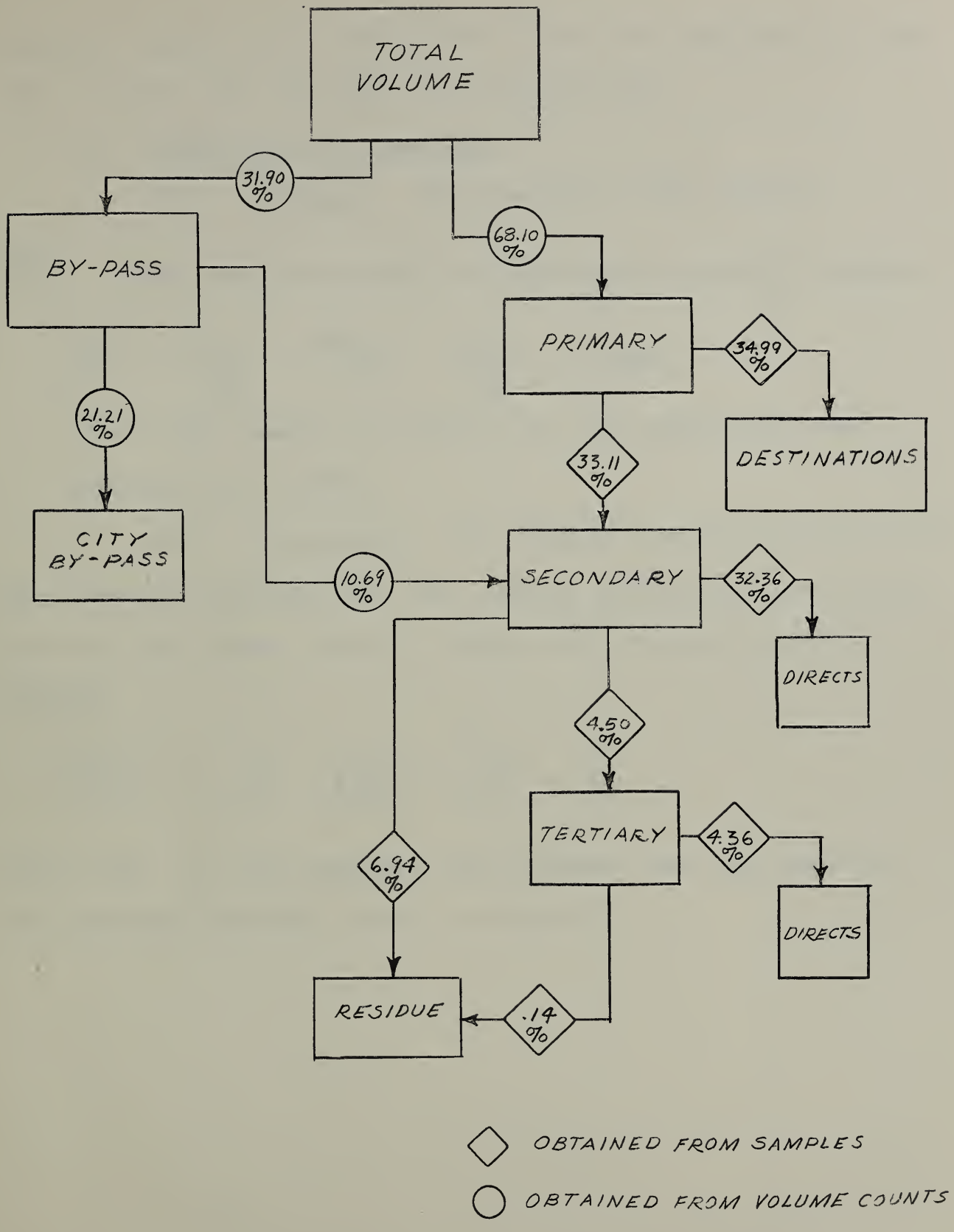

Figure 13

Baltimore Flow Chart

However, samples were taken once a day and consisted of four feet, rather than two feet, of letters each.

8.3 Computational formulae.

8.3.1 Primary. From Figure 13 the value of $\left(\frac{\Sigma D_P}{T}\right) = .3499$ and therefore the appropriate formula becomes:

$$\left(\frac{D_P}{T}\right)^* = \frac{D_P}{\Sigma D_P} \times \left(\frac{\Sigma D_P}{T}\right) = \frac{D_P}{\Sigma D_P} \times .3499$$

(The total number of letters in the samples off the Primary was 10,978).

8.3.2 Secondary. The formula for Destinations off the Secondary depends upon the ratios obtained at the Secondary and the volume counts. Using such ratios gives the formula:

$$\left(\frac{D_{S_i}}{T}\right)^* = \frac{D_{S_i}}{S_i} \times \left(\frac{S_i}{T}\right) = \frac{D_{S_i}}{S_i} \times c_i \ ,$$

where the c_i are constants that depend upon the particular Secondary and are listed in Table 11.

TABLE 11

Number of Pieces in Sample and
Constants used in Computational Formula for Destinations
off the Secondaries for Baltimore

i	S_i	No. Pcs.	c_i
1	Maryland	3,293	.13966
2	Delaware	1,719	.00669
3	New York	5,631	.02477
4	Massachusetts	4,410	.01033
5	New Jersey	3,129	.01942
6	New England(Conn.-Maine,N.H.,R.I., Vermont)	2,956	.01150
7	Pennsylvania	1,890	.03858
8	Virginia	2,057	.03750
9	Florida	2,776	.01210
10	Georgia-S.C.	2,751	.01134
11	Ala.-La.-Miss.-Tenn.	2,290	.01055
12	North Carolina	2,875	.01833
13	Texas	1,130	.00712
14	Ind.,-Kentucky	1,356	.00713
15	California	3,137	.01053
16	West States	1,865	.01518
17	Mo.-Michigan	2,701	.01282
18	Ia.-Ill.-Wisc.	1,142	.01049
19	West Virginia	3,676	.01143
20	Ohio	5,055	.01749
21	Star Route	1,958	.00507
	Total	57,797	.43803

8.3.3 Tertiary. The formula for Destinations off the Tertiary depends upon ratios obtained at the Secondary and Tertiary, as well as the volume counts. Using such ratios gives the formula:

$$\left(\frac{D_{t_{ij}}}{T}\right)^{*} = \frac{D_{t_{ij}}}{t_{ij}} \times \left\{ \frac{t_{ij}}{S_i} \times \left(\frac{S_i}{T}\right) \right\} = \frac{D_{t_{ij}}}{t_{ij}} \times k_{ij} ,$$

where the k_{ij} are the quantities in brackets that depend upon the particular Tertiary. Values of k_{ij} corresponding to the particular Tertiaries are listed in Table 12.

TABLE 12

Number of Pieces in Sample and Constants used in Computational Formula for Destinations off the Tertiary for Baltimore

i,j	t_{ij}	No. Pcs.	k_{ij}
1,1	Md. DEF, GH	3,821	.00123
1,2	Md. OPQR, T-Z	5,721	.00967
1,3	Md. AB, C	3,109	.00827
1,4	Md. S	2,695	.00619
1,5	Maryland	4,912	.00119
7,1	Penna. QRS-T-Z	1,305	.00359
7,2	Penna. EFG	525	.00161
7,3	Penna. HIJKL	565	.00184
7,4	Penna. MNOP	1,030	.00247

TABLE 12 (Continued)

i,j	t_{ij}	No. Pcs.	k_{ij}
7,5	Penna. AB, CD	977	.00247
8,1	Virginia A-C, D-K	1,643	.00277
8,2	Virginia L-Z	2,108	.00243
12,1	North Carolina A-Z	626	.00131
	Total	29,037	.04504

8.4 Tabulation of Estimated Distribution and Observations.

The tabulation of the estimated percentages to each Destination is given in Table 13. These are listed in order of descending value. The largest 200 are listed by name and the remainder grouped by percentages. Figure 14 graphically portrays the largest 200 Destinations by percentages. Several observations, based on the tabulation, are given here:

1. The largest 200 Destinations received 78% of the Total Volume

2. Sixty-six percent of the Total Volume remained in the state of Maryland (not including Air Mail and Go backs).

3. Fifty-one percent of the Total Volume remained in Baltimore.

4. Four Destinations: Baltimore, Washington, New York, and Philadelphia were the only cities to receive more than one percent of Total Volume.

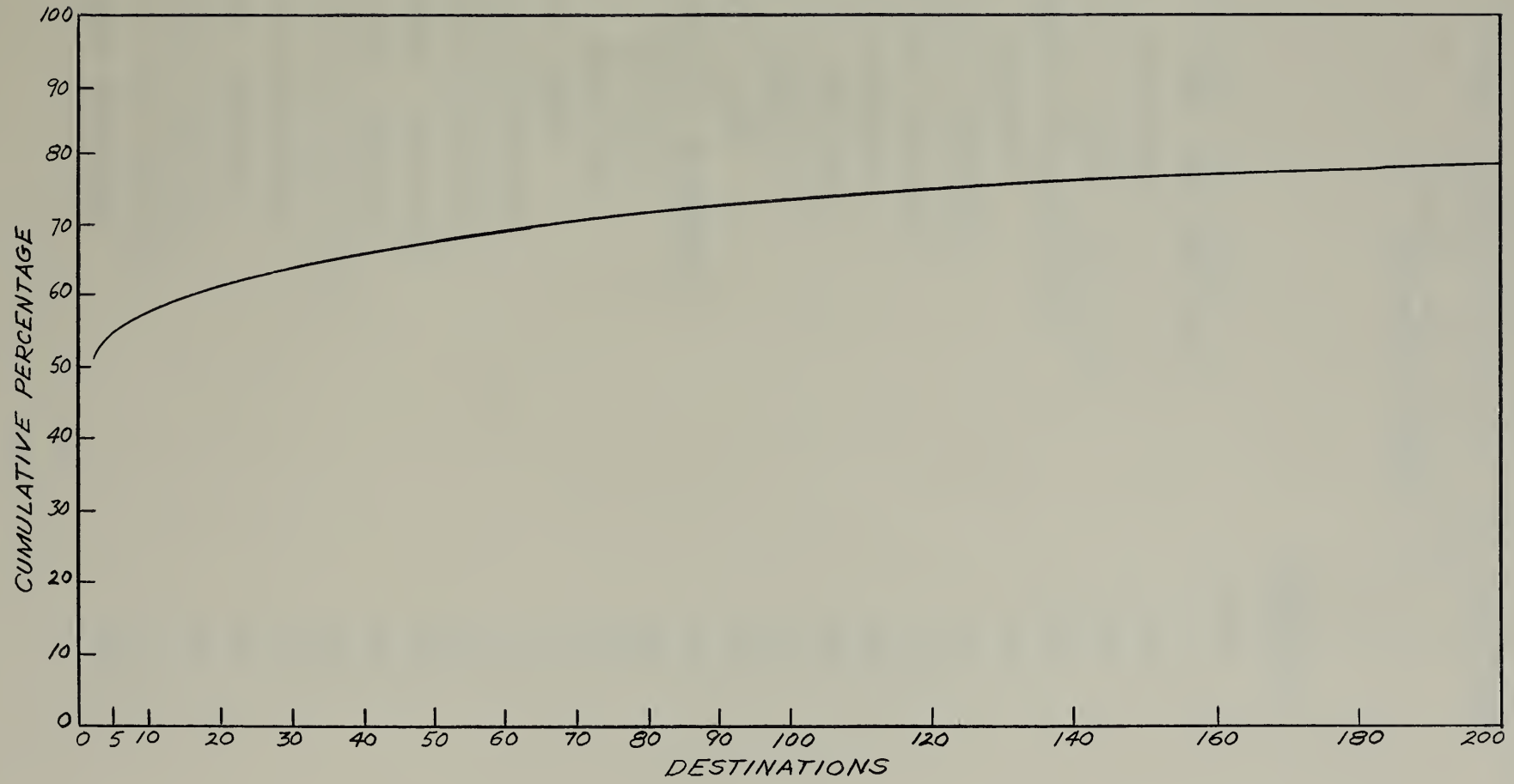

Figure 14

Graph of Largest 200 Destinations for Baltimore

TABLE 13

TABULATION OF ESTIMATED PERCENTAGES OF THE TOTAL VOLUME TO EACH DESTINATION FOR BALTIMORE

Largest 200 Destinations
Listed by Name

		Percent	Cumulative Percent
1.	Baltimore Incl. Int. Rev. Incl. City By-pass	50.908	50.908
2.	New York, New York	1.979	52.887
3.	Wash., D. C. (Incl. official)	1.283	54.170
4.	Philadelphia, Pennsylvania	1.094	55.264
5.	Chicago, Illinois	.678	55.942
6.	Glen Burnie, Maryland	.547	55.489
7.	Reisterstown, Maryland	.522	57.011
8.	Richmond, Virginia	.498	57.509
9.	Annapolis, Maryland	.462	57.971
10.	Norfolk, Virginia	.357	58.328
11.	Cincinnati, Ohio	.351	58.679
12.	Silver Spring, Maryland	.339	59.018
13.	Pasadena, Maryland	.327	59.345
14.	Brooklyn, New York	.315	59.660
15.	Cleveland, Ohio	.313	59.973
16.	Wilmington, Delaware	.298	60.271
17.	Hagerstown, Maryland	.297	60.568
18.	Westminster, Maryland	.293	60.861
19.	Kansas City, Missouri	.284	61.145
20.	Pittsburgh, Pennsylvania	.278	61.423
21.	Sykesville, Maryland	.267	61.690
22.	Frederick, Maryland	.267	61.957
23.	Lutherville, Maryland	.258	62.215
24.	Ellicott City, Maryland	.256	62.471
25.	Bainbridge, Maryland	.256	62.727

		Percent	Cumulative Percent
26.	Linthicum Heights, Maryland	.237	62.964
27.	Pleasantville, New York	.227	63.191
28.	Newark, New Jersey	.217	63.408
29.	Hyattsville, Maryland	.225	63.633
30.	Cumberland, Maryland	.225	63.858
31.	St. Louis, Missouri	.209	64.067
32.	Bel Air, Maryland	.208	64.275
33.	Roanoke, Virginia	.204	64.479
34.	Long Island, New York	.195	64.674
35.	Arlington, Virginia	.184	64.858
36.	Miami, Florida	.182	65.040
37.	Severna Park, Maryland	.179	65.219
38.	Randallstown, Maryland	.179	65.398
39.	Bethesda, Maryland	.179	65.577
40.	Minneapolis, Minnesota	.176	65.753
41.	Univ. of Md. (College Park), Maryland	.175	65.928
42.	Rockville, Maryland	.175	66.103
43.	Owings Mills, Maryland	.175	66.278
44.	Garden City, New York	.173	66.451
45.	Harrisburg, Pennsylvania	.169	66.620
46.	Salisbury, Maryland	.165	66.785
47.	Timonium, Maryland	.161	66.946
48.	Ft. George G. Meade, Maryland	.161	67.107
49.	Cockeysville, Maryland	.161	67.268
50.	Naval Academy, Maryland	.152	67.420
51.	Charlottesville, Virginia	.151	67.571
52.	Boston Station, Mass.	.145	67.716
53.	Cambridge, Maryland	.144	67.860
54.	Columbus, Ohio	.143	68.003
55.	Alexandria, Virginia	.142	68.145

		Percent	Cumulative Percent
56.	Hampstead, Maryland	.140	68.285
57.	College Park, Maryland	.140	68.425
58.	Arnold, Maryland	.140	68.565
59.	Detroit, Michigan	.135	68.700
60.	York, Pennsylvania	.125	68.825
61.	Los Angeles, California	.124	68.949
62.	Flushing, New York	.123	69.072
63.	Westbury, New York	.121	69.193
64.	Glenarm, Maryland	.119	69.312
65.	Havre de Grace, Maryland	.115	69.427
66.	Charlotte, North Carolina	.109	69.536
67.	Dallas, Texas	.109	69.645
68.	Bridgeport, Connecticut	.109	69.754
69.	Easton, Maryland	.106	69.860
70.	Greensboro, North Carolina	.106	69.966
71.	Milwaukee, Wisconsin	.105	70.071
72.	Dayton, Ohio	.104	70.175
73.	Stevenson, Maryland	.103	70.278
74.	Denver, Colorado	.103	70.381
75.	Louisville, Kentucky	.102	70.483
76.	Odenton, Maryland	.102	70.585
77.	Atlanta, Georgia	.099	70.684
78.	Hartford, Connecticut	.099	70.783
79.	St. Petersburg, Florida	.096	70.879
80.	Camden, New Jersey	.094	70.973
81.	Buffalo, New York	.092	71.065
82.	Parkton, Maryland	.089	71.154
83.	Newport News, Virginia	.089	71.243
84.	New Haven, Connecticut	.088	71.331
85.	Winston Salem, North Carolina	.088	71.419
86.	Rochester, New York	.087	71.506

		Percent	Cumulative Percent
87.	Aberdeen, Maryland	.085	71.591
88.	Scranton, Pennsylvania	.084	71.675
89.	Elkton, Maryland	.081	71.756
90.	Trenton, New Jersey	.081	71.837
91.	Miami Beach, Florida	.080	71.917
92.	Lancaster, Pennsylvania	.079	71.996
93.	Boston (zones 1-18), Mass.	.079	72.075
94.	Detroit (unzoned), Michigan	.079	72.154
95.	Reading, Pennsylvania	.076	72.230
96.	Upper Darby, Pennsylvania	.076	72.306
97.	Memphis, Tennessee	.075	72.381
98.	Lynchburg, Virginia	.075	72.456
99.	Houston, Texas	.073	72.529
100.	Laurel, Maryland	.073	72.602
101.	Emmitsburg, Maryland	.073	72.675
102.	Jamaica, New York	.070	72.745
103.	Jersey City, New Jersey	.070	72.815
104.	Jacksonville, Florida	.070	72.885
105.	Nashville, Tennessee	.069	72.954
106.	Chevy Chase, Maryland	.069	73.023
107.	Durham, North Carolina	.069	73.092
108.	Atlantic City, New Jersey	.068	73.160
109.	Akron, Ohio	.068	73.228
110.	Raleigh, North Carolina	.068	73.296
111.	Birmingham, Alabama	.066	73.362
112.	Altoona, Pennsylvania	.065	73.427
113.	Brooklandville, Maryland	.064	73.491
114.	Portsmouth, Virginia	.064	73.555
115.	Orlando, Florida	.064	73.619
116.	Providence, Rhode Island	.063	73.682
117.	Cambridge 38, Mass.	.063	73.745

		Percent	Cumulative Percent
118.	Parkersburg, West Virginia	.062	73.807
119.	Falls Church, Virginia	.062	73.869
120.	Staunton, Virginia	.062	73.931
121.	Indianapolis, Indiana	.061	73.992
122.	Mt. Vernon, New York	.061	74.053
123.	White Hall, Maryland	.060	74.113
124.	Tampa, Florida	.060	74.173
125.	Dover, Delaware	.060	74.233
126.	Newark, Delaware	.059	74.292
127.	Ft. Knox, Kentucky	.059	74.351
128.	Bethlehem, Pennsylvania	.059	74.410
129.	Ft. Lauderdale, Florida	.058	74.468
130.	Ft. Jackson, South Carolina	.057	74.525
131.	Columbia, South Carolina	.056	74.581
132.	Hanover, Pennsylvania	.055	74.636
133.	Omaha, Nebraska	.055	74.691
134.	Mt. Airy, Maryland	.054	74.745
135.	Chestertown, Maryland	.054	74.799
136.	Toledo, Ohio	.052	74.851
137.	Hampton, Virginia	.051	74.902
138.	Williamsport, Pennsylvania	.051	74.953
139.	Camden Term. 1, New York	.051	75.004
140.	Charleston, South Carolina	.051	75.055
141.	Clarksburg, West Virginia	.050	75.105
142.	Riverdale, Maryland	.050	75.155
143.	Crisfield, Maryland	.050	75.205
144.	Clarksburg, Pennsylvania	.050	75.255
145.	Petersburg, Virginia	.050	75.305
146.	Centreville, Maryland	.050	75.355
147.	Wilmington, North Carolina	.049	75.404
148.	Haddonfield, New Jersey	.049	75.453
149.	Erie, Pennsylvania	.049	75.502

		Percent	Cumulative Percent
150.	Fairmont, West Virginia	.049	75.551
151.	Madison, Wisconsin	.047	75.598
152.	Chambersburg, Pennsylvania	.047	75.645
153.	Johnstown, Pennsylvania	.047	75.692
154.	Ft. Worth, Texas	.047	75.739
155.	Portland, Oregon	.047	75.786
156.	Severn, Maryland	.047	75.833
157.	Ft. Benning, Georgia	.047	75.880
158.	Martinsburg, West Virginia	.046	75.926
159.	Greenville, South Carolina	.046	75.972
160.	Princess Ann, Maryland	.046	76.018
161.	Gettysburg, Pennsylvania	.045	76.063
162.	Knoxville, Tennessee	.044	76.107
163.	Princeton, New Jersey	.044	76.151
164.	Camden Term. 2, New Jersey	.044	76.195
165.	Des Moines, Iowa	.044	76.239
166.	San Antonio, Texas	.044	76.283
167.	New Brunswick, New Jersey	.043	76.326
168.	Crownsville, Maryland	.043	76.369
169.	Great Neck, New York	.043	76.412
170.	Danville, Virginia	.042	76.454
171.	Charleston, West Virginia	.042	76.496
172.	Fallston, Maryland	.042	76.538
173.	Aberdeen Proving Grounds, Maryland	.042	76.580
174.	Street, Maryland	.042	76.622
175.	Battle Creek, Michigan	.041	76.663
176.	Carlisle, Pennsylvania	.041	76.704
177.	Phoenix, Maryland	.041	76.745
178.	New Orleans, Louisiana	.041	76.786
179.	Springfield, Mass.	.041	76.827
180.	Sparks, Maryland	.040	76.867

		Percent	Cumulative Percent
181.	Oakland, California	.039	76.906
182.	Berlin, Maryland	.039	76.945
183.	Elizabeth, New Jersey	.039	76.984
184.	Backbay (zones 15-16-17), Mass.	.038	77.022
185.	Worcester, Mass.	.038	77.060
186.	San Diego, California	.038	77.098
187.	Youngstown, Ohio	.038	77.136
188.	Taneytown, Maryland	.038	77.174
189.	Warren, Pennsylvania	.037	77.211
190.	Allentown, Pennsylvania	.037	77.248
191.	Poconoke City, Maryland	.037	77.285
192.	Fayetteville, North Carolina	.036	77.321
193.	Canton, Ohio	.036	77.357
194.	Paterson, New Jersey	.036	77.393
195.	Rockhall, Maryland	.036	77.429
196.	White Marsh, Maryland	.036	77.465
197.	Morgantown, West Virginia	.036	77.501
198.	Smithsburg, Maryland	.035	77.536
199.	Tucson, Arizona	.035	77.571
200.	Chattanooga, Tennessee	.035	77.606

Rank	No. in Group	Individual Percent	Group Percent	Cumulative Percent
201-202	2	.035	.070	77.676
203-205	3	.034	.102	77.778
206-212	7	.033	.231	78.009
213-221	9	.032	.288	78.297
222-230	9	.031	.279	78.576
231-234	4	.030	.120	78.696
235-242	8	.029	.232	78.928
243-245	3	.028	.084	79.012
246-252	7	.027	.189	79.201
253-260	8	.026	.208	79.409
261-269	9	.025	.225	79.634
270-280	11	.024	.264	79.898
281-287	7	.023	.161	80.059
288-302	15	.022	.330	80.389
303-316	14	.021	.294	80.683
317-331	15	.020	.300	80.983
332-345	14	.019	.266	81.249
346-357	12	.018	.216	81.465
358-373	16	.017	.272	81.737
374-399	26	.016	.416	82.153
400-415	16	.015	.240	82.393
416-445	30	.014	.420	82.813
446-477	32	.013	.416	83.229
478-515	38	.012	.456	83.685
516-544	29	.011	.319	84.004
545-587	43	.010	.430	84.434
588-642	55	.009	.495	84.929
643-699	57	.008	.456	85.385
700-767	68	.007	.476	85.861
768-859	92	.006	.552	86.413
860-982	123	.005	.615	87.028
983-1125	143	.004	.572	87.600
1126-1295	170	.003	.510	88.110
1296-1544	249	.002	.498	88.608
1545-1780	236	.001	.236	88.844
1781-1887	107	less than .001	.046	88.890
Residue			11.110	100.000

	Percent	Cumulative Percent
Uncanceled	2.879	91.769
Special Delivery	.011	91.780
APO Foreign	.148	91.928
Star Route	.507	92.435
Nixies	.216	92.651
Go Backs	.030	92.681
Air Mail	.172	92.853
Misfiles	.073	92.926
Residues	7.074	100.000
TOTAL	11.110	

Breakdown on Residue

Alaska	.004
Idaho	.023
Montana	.030
New Mexico	.082
Nebraska	.070
Oregon	.046
Nevada	.011
Arizona	.022
Utah	.024
Arkansas	.059
Colorado	.046
Kansas	.080
Minnesota	.069
Oklahoma	.044
Washington State	.062
Wyoming	.005
New Jersey	.509

Virginia RPO	.414
Wash. D.C., Mtr. Route	.004
Maryland	.107
Wash. D.C., Mtr. Route	.001
Wash. D.C., Mtr. Route	.015
Maryland RPO	.029
Louisiana	.058
Tennessee	.178
Mississippi	.093
New York	.395
Maine	.081
Vermont	.042
Connecticut	.176
Rhode Island	.074
North Carolina RPO	.427
California RPO	.531
Delaware RPO	.010
Iowa	.085
Alabama	.175
Illinois A-K L-Z	.274
Wisconsin	.113
Ohio RPO	.370
Indiana RPO	.034
Kentucky RPO	.063
N. Y. and Pitts., Ind.	.046
Wash. and Grafton, Kentucky	.057
Wash. and Cinn., Kentucky	.023
Georgia RPO	.028
South Carolina RPO	.068
Wash. and Bristol, Georgia	.039
Wash. and Hamlet, South Carolina	.036
Wash. and Flor, Georgia	.012
Wash. and Flor., South Carolina	.056

Wash. and Charl., Georgia	.045
Wash. and Charl., South Carolina	.068
West Virginia	.048
Texas RPO	.178
N.Y. and Pitts., Texas	.078
Massachusetts	.229
Florida 1 and 2	.282
Michigan A-K L-Z	.207
Missouri	.082
Pennsylvania	.494
New Hampshire	.058
TOTAL	7.074

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APPENDIX A

San Francisco Special Primary Study

The question often arises as to just how much difference, if any at all, exists among the distributions (by Destinations) of various types of mail, namely: metered long, metered short, stamped long,and stamped short letters. Special data were taken in San Francisco in an effort to help answer this question and these are included in Figure A.1. Figure A.2 gives summary percentages of the raw data. Judging from a rough comparison of these percentages there are apparently very little differences among these different types of mail for the given separations (with the possible exception of Nixies and San Francisco which seem to be different for metered and stamped mail).

5 { 6-24-57 4:30 PM 6:12 PM 7:15 PM

6 { 6-25-54 2:00 PM 5:54 PM 6:36 PM

1) - SHORTS - } STAMPED
2) - LONGS - }
3) - LONGS - } METERED
4) - SHORTS - }

5			6			Foreign						Hawaii						Seattle, Wash						Portland Ore.						Sacramento Calif.						San Mateo					
3	0	3	1	0	0	1	2	1	0	2	0	1	0	0	0	0	1	1	3	1	5	5	5	2	3	2	1	3	2	5	5	2	6	11	13	4	4	2	3	3	4
1	3	2	0	1	0	0	12	0	0	2	0	0	0	0	2	0	0	0	3	0	5	9	2	0	3	2	1	5	3	12	13	3	6	14	17	4	4	12	5	7	4
0	1	2	0	0	0	0	0	0	9	0	0	0	0	0	1	1	0	0	11	8	2	16	0	5	4	3	1	14	0	17	17	4	12	13	4	1	6	3	5	7	3
0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	14	4	2	3	1	0	11	1	2	1	0	0	8	2	8	5	9	28	3	2	16	11	10	9
Ariz., N.Mex. & Texas						Chicago, Ill						New York, NY						Wash. State						Oregon St						Berkeley						Ill, Ind, Iowa Mass-Mich-Minn					
13	4	5	6	15	12	5	9	4	9	5	6	10	11	5	9	11	11	6	4	2	8	3	5	6	10	1	3	5	5	3	10	3	6	8	5	18	15	16	20	15	8
6	5	5	8	1	4	4	3	0	4	1	4	3	3	5	9	3	5	0	4	0	4	1	0	0	3	0	1	1	1	3	3	4	2	8	6	6	2	4	2	1	2
5	8	1	11	31	1	0	3	1	0	1	5	4	3	46	11	5	2	0	6	3	10	15	1	15	9	0	10	18	6	8	4	9	10	5	5	1	3	10	6	1	4
3	1	0	5	2	0	0	1	1	0	1	0	0	7	0	1	1	0	27	2	1	7	36	0	21	5	1	10	1	0	7	5	17	3	13	17	1	26	0	2	0	0
Southern States						Rocky Mt. States						A-B						H-I-J-K-L						-S-						Los Angeles						N.York, N.J. Ohio, Pa.					
14	11	3	15	25	14	13	12	8	21	8	5	9	14	6	14	12	22	11	16	10	18	17	15	6	11	11	10	8	25	12	14	13	23	19	24	16	17	11	26	35	27
3	2	0	5	4	8	9	13	15	8	25	8	10	9	10	18	15	12	8	10	11	9	15	12	10	12	7	7	14	13	8	20	10	10	31	17	7	2	3	5	3	10
1	0	0	3	6	13	30	28	7	23	30	20	47	20	13	17	17	37	13	18	11	15	19	23	8	13	5	15	13	23	13	23	10	19	23	9	103	1	27	2	1	2
2	15	2	5	3	0	59	4	4	4	8	9	26	11	27	25	38	24	39	17	35	15	22	29	11	20	39	24	18	18	22	5	0	12	5	4	0	33	2	3	2	0
Stockton						San Jose						C-D						M-N-O						San-Santa						San. Fran.						East. States & Canada					
2	4	2	2	2	3	1	13	5	9	4	8	3	16	15	16	6	9	9	23	8	10	20	22	12	20	19	36	17	22	118	163	193	165	165	138	18	10	10	20	12	19
4	6	0	1	9	4	4	5	2	2	12	7	10	8	6	11	20	15	10	11	8	7	33	15	17	19	17	16	19	15	152	107	81	111	81	143	5	5	1	12	4	6
3	8	2	5	3	5	4	8	5	13	8	8	26	10	10	15	38	30	7	24	31	31	22	25	21	23	12	37	28	23	63	52	58	57	25	28	2	1	5	9	5	4
9	0	1	2	3	6	6	5	8	3	7	17	26	23	30	43	40	31	29	19	27	29	52	48	33	30	40	26	67	23	65	51	83	42	26	78	0	23	2	1	1	0
Fresno						Oakland						E-F-G						P-Q-R						T-U-V W-X-Y-Z						S.Fran (Zoned)						Oakland					
1	4	0	5	0	3	13	5	9	8	13	9	15	8	12	10	5	2	8	8	44	19	23	18	17	7	17	12	10	6	15	114	103	75	82	74	80	83	40	49	41	73	45
0	7	1	4	13	4	15	13	10	15	26	25	14	3	1	7	13	6	6	12	13	15	21	25	1	8	9	4	29	11	97	41	65	89	32	43	48	8	8	6	3	2
3	6	3	10	6	3	7	34	19	24	30	15	10	9	5	21	10	20	23	28	19	16	21	24	7	23	11	17	20	18	18	23	39	42	17	19	10	8	0	0	4	0
5	0	2	11	1	9	14	40	30	10	24	38	19	13	5	11	49	26	26	24	22	30	34	56	22	9	24	8	43	25	7	14	26	25	8	13	0	0	0	0	3	4
Go Backs																																									
14	0	38	12																																						
85	32	39	80																																						
19	20	23	11																																						
13	1	6	46																																						

Figure A.1 - Sample Data for San Francisco Special Primary Study (Worksheet)

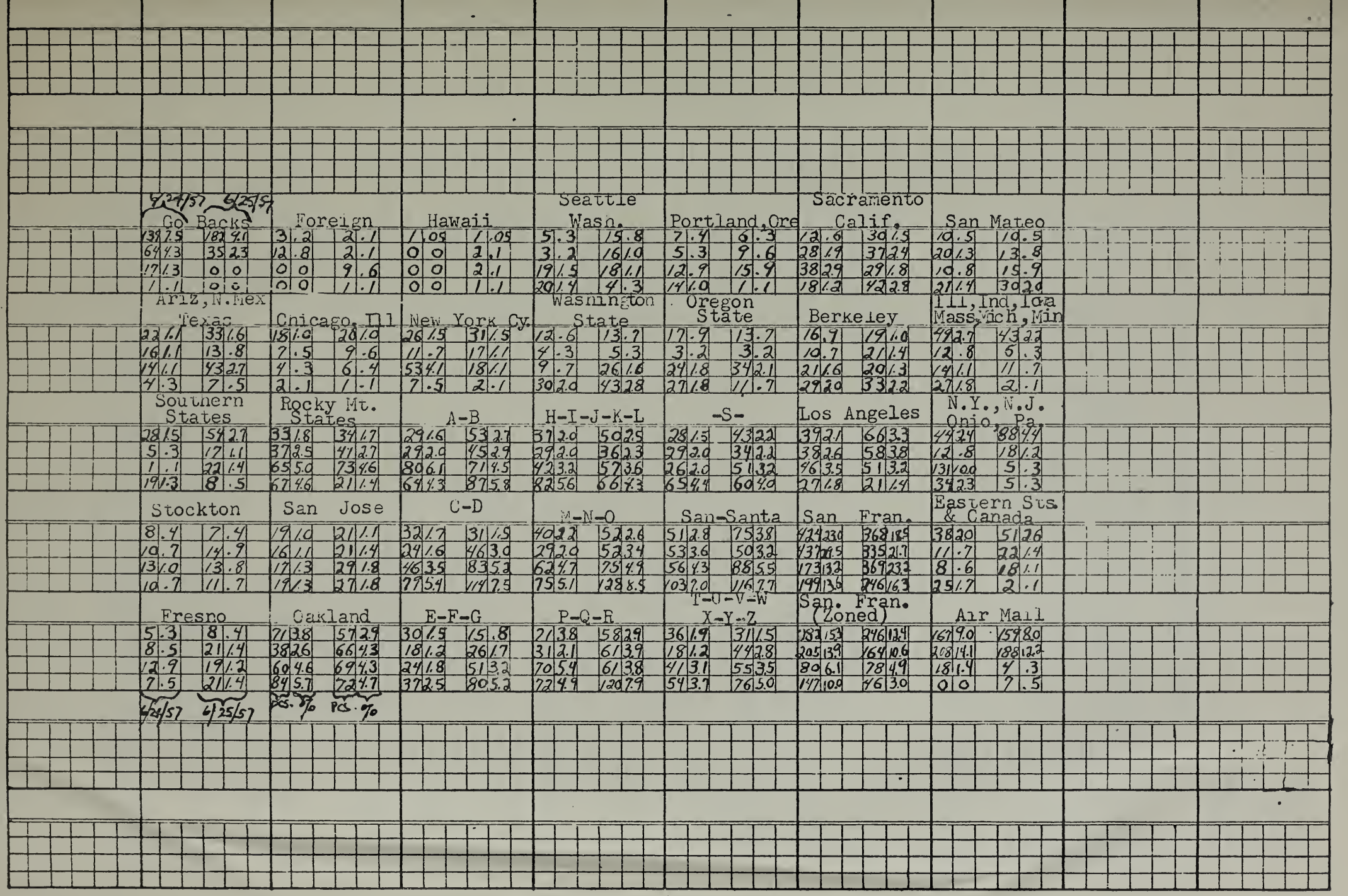

Figure A.2 - Summary of Sample Data for San Francisco Special Primary Study (Worksheet)

U. S. DEPARTMENT OF COMMERCE

Sinclair Weeks, *Secretary*

NATIONAL BUREAU OF STANDARDS

A. V. Astin, *Director*

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