HIGHWAY RESEARCH
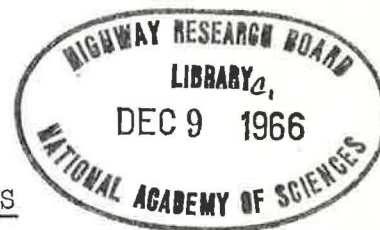# CIRCULAR

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COMMITTEE ACTIVITY
Committee on Origin and Destination
Department of Traffic and Operations
Highway Research Board

QUALITY CONTROL OF ORIGIN-DESTINATION SURVEYS

Contents

The opinions and conclusions expressed in this publication are those of the
authors and not necessarily those of the Highway Research Board.

MODERATOR"S STATEMENT ON QUALITY CONTROL OF ORIGIN-DESTINATION SURVEYS*

By

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Most of the basic data used in urban transportation planning studies come from a standard home interview orgin-destination survey. The information collected in these surveys include not only trip information but socio-economic data and family composition data as well.

These data are then used as a basis for determining future travel demand and in the subsequent development of a recommended transportation system to serve that demand. Consequently, the need for obtaining good basic data cannot be overemphasized.

The major goal of an O-D survey then, is to obtain good basic data that are truly reflective of actual conditions occuring during the study period. Various quality control procedures have been developed and used by individual transportation study groups; they vary from the "Report Card Procedure" used in Spokane, Washington, to the computer-based system used in the Tri-State (Connecticut, New Jersey, New York) area.

Some of the various quality control procedures in use have become very sophisticated and as such are worthy of a panel discussion by the members of the Origin-Destination Committee. The panelists chosen to give papers represent four different urban study groups; also included is a discussion of the procedure expected to be included in the revised home interview manual.

These panelists represent urban population of about 24 million persons, or about 40 percent of the total urbanized area population where home interview surveys have been conducted between 1962 and 1965. The panelists have been responsible for maintaining the quality of 156,000 home interviews and as can be seen by the attached papers, considerable thought and effort has been devoted to this important aspect of the home interview survey.

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*   This paper was presented January 17, 1966, at the meeting of the Orgin-Destination Committee, Report of Panel Number 1, Quality Control of Origin-Destination Surveys, of the Department of Traffic and Operations, Highway Research Board of the National Academy of Sciences.

    All of the other papers in this Circular were given at the Quality Control Meeting.

PRODUCTIONS AND QUALITY CONTROL OF TRAVEL SURVEYS

Presented by

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Personal interview surveys of travel in the Tri-State region involved over 200 persons operating out of eight field offices. From the outset we regarded these surveys (Home Interview, Truck and Taxi) as production oper-ations. We attempted to apply, insofar as possible, principles of production control which have been widely applied to industrial production. A group re-sponsible for control was established separate from survey operations, and reported to the Technical Director. This group was responsible for drawing the samples, assigning interviews for designated dates to district offices, and monitoring both quantity and quality of output. With this arrangement, the survey managers and supervisors could concentrate on the massive chores of personnel recruiting, training, logistics, and other considerable administra-tive loads.
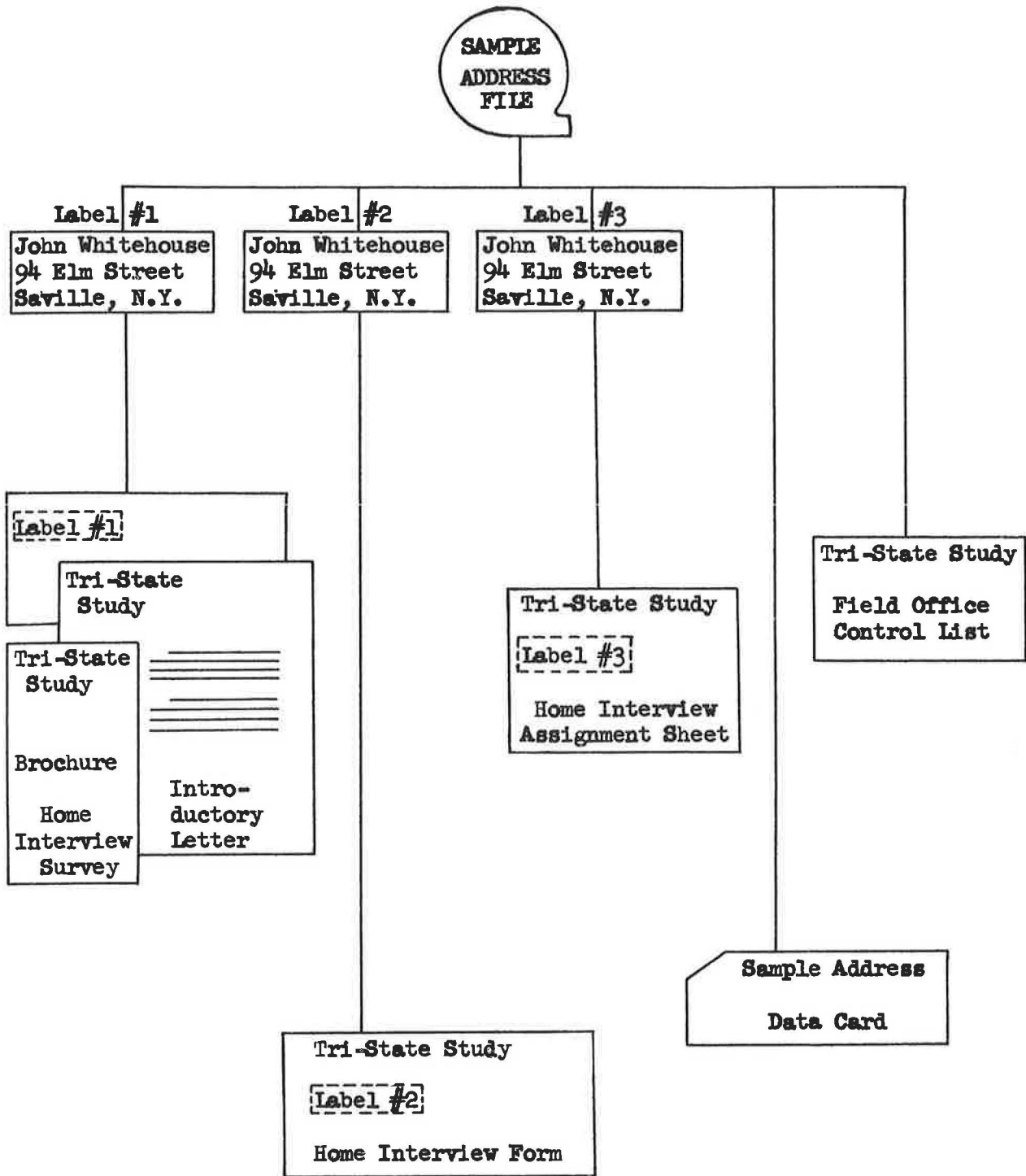
In addition to normal supervision, computer-based systems were devised for quality control and production control of the Home Interview Survey field work. One means of maintaining control of quality was a re-check by the field office of at least one interview out of each day's work assigned to an interviewer. Other statistical checks of interview quality were made as part of a production control process.

A sample address file was produced on magnetic tape, listing household addresses at which interviews had to be taken. As illustrated in Figure I, every week this sample address file was processed on Tri-State's IBM 1401 computer, and the following material produced comprising a week's work load for each field office:

> Three gummed labels were printed with the address, sample number and travel date for each dwelling unit to be interviewed. One label was designated for the envelope containing a letter which was sent to the household to be interviewed ten days before the travel day; the second label was used to make up an assignment sheet representing one day's work for the interviewer; the third label was pasted on the home interview form by the interviewer.

> A punched card containing the sample number, travel date and sample address was used by each district office supervisor to distribute the work load so that an interviewer's work fell within as small a geographic areas as possible.

Figure - I

SAMPLE
ADDRESS
FILE

Label #1
John Whitehouse
94 Elm Street
Saville, N.Y.

Label #2
John Whitehouse
94 Elm Street
Saville, N.Y.

Label #3
John Whitehouse
94 Elm Street
Saville, N.Y.

Label #1

Tri-State
Study

Tri-State
Study

Brochure

Home
Interview
Survey

Intro-
ductory
Letter

Tri-State Study

Label #3

Home Interview
Assignment Sheet

Tri-State Study

Field Office
Control List

Sample Address

Data Card

Tri-State Study
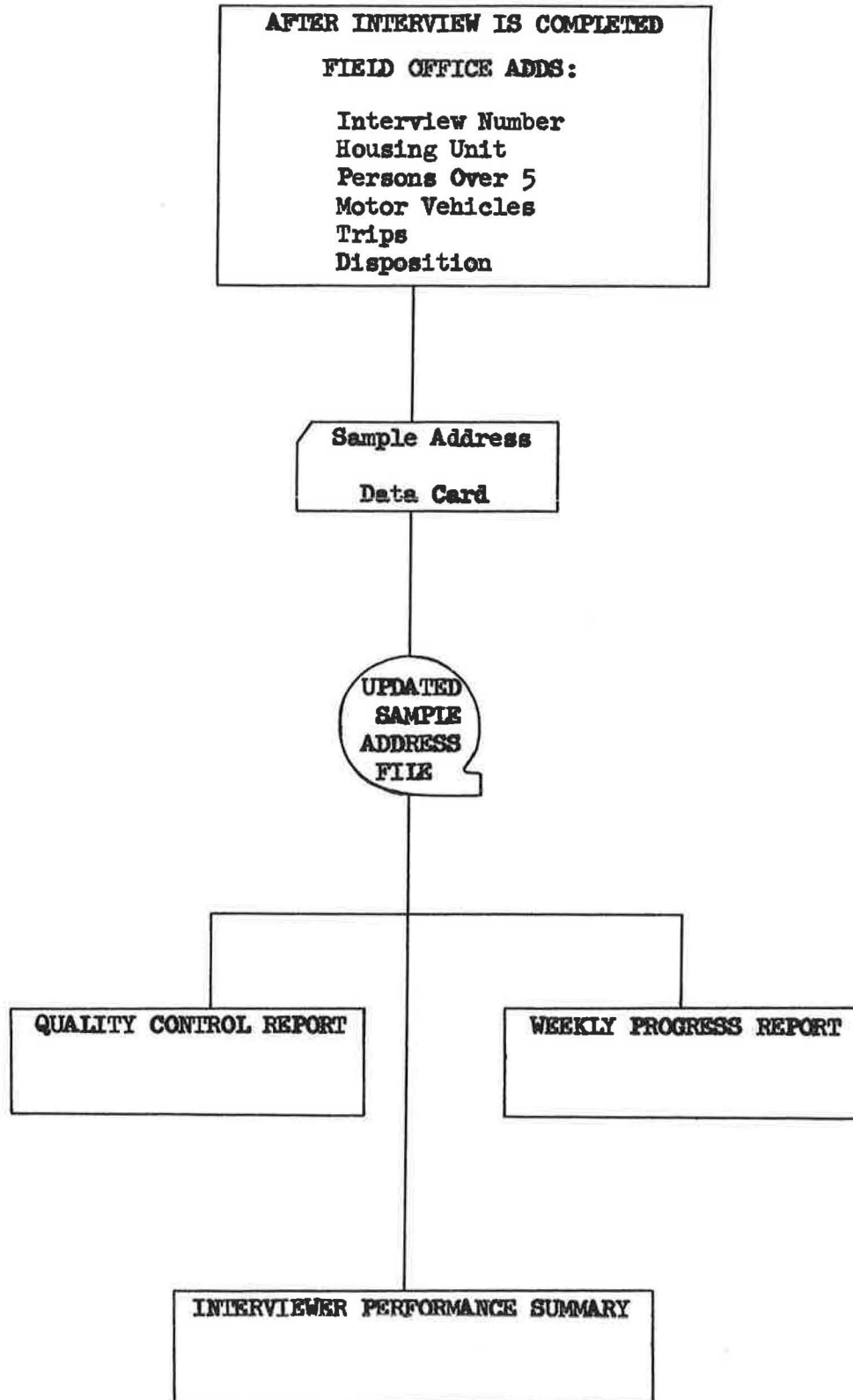
Label #2

Home Interview Form

A production control list for each office showing
every address to be interviewed was used as a master
control within the field office to assure that each
sample was assigned. Notations were made on these
sheets showing the interviewer to whom this sample
was assigned, disposition code indicating type of
interview completed, or reason for non-completion.
The list also served as the means for recording
progress of each completed interview from through the
editing, control and coding stations and finally to
the Central Office.

After each interview was completed, the punched card was annotated with
interviewer number, interview disposition code, and summary information obtained
during the interview such as: the number of persons five years and older; the
number of motor vehicles available; and the number of trips made. After each
week's interviewing, the cards were transmitted to the Central Office. To com-
plete the cycle, the production control cards were keypunched with the informa-
tion noted in the field office and used to update the sample address file, thus
accounting for every sample. Figure II shows how the sample address file was
updated and summary statistics tabulated. Weekly progress and quality control
reports were run. Summary tabulations were produced which enabled an overall
evaluation of the quality of the work being performed by each district office.
Statistical quality control reports were also produced showing every inter-
viewer's performance. In addition, interviewer performance summaries served
as the basis for an incentive pay program.

For any area certain statistics are generally consistent; for example, in
Manhattan most families make two to four trips per day. A person reviewing a
quality control report can quickly pinpoint when an interviewer is obtaining
results which radically depart from the general averages. The Quality Control
Report shows the average number of trips per completed interview in various
ways: by low, medium, and high income; by number of vehicles available; and
by low, medium, or high housing density. When suspicious statistics appeared
in the Quality Control Report, special checks were made of the responsible
interviewer's work to insure that the information on the interview form was
correct. It was essential to check these results and follow up as soon as
possible after the interview was obtained. In this way incomplete, inacurate,
or even fraudulent interviewing could be dealt with promptly by retrieval of
information, retraining, or dismissal.

The production control cards also proved to be a useful source of pre-
liminary information about trips generated by residents of the Tri-State
region.

Figure - II

AFTER INTERVIEW IS COMPLETED

FIELD OFFICE ADDS:

Interview Number
Housing Unit
Persons Over 5
Motor Vehicles
Trips
Disposition

Sample Address

Data Card

UPDATED
SAMPLE
ADDRESS
FILE

QUALITY CONTROL REPORT

WEEKLY PROGRESS REPORT

INTERVIEWER PERFORMANCE SUMMARY

A separate "Technical Auditing Group" was established to control technical aspects of the surveys. This group monitored interviewing and coding for correctness and consistency among the far-flung offices. This work was carried out by transportation planning engineers experienced in survey analysis, one full-time and several part-time. Having participated in development of the survey questionnaries and manuals, they were well acquainted with intent and interpretation of each item. They trained interviewers in the purpose and technical requirements of the surveys.

Each district office was assigned one or more control clerks who were technically responsible to the Production Control Manager, not the district supervisor. These persons maintained control records for each interview sample as it was: assigned to an intervierwer; completed or otherwise disposed of; checked; edited; coded; and returned to the central office. The control clerks edited interviews as they were turned in, verifying completeness and checking for obvious discrepancies. It was learned as the survey progressed, that a careful review of every interview yielded higher quality and completeness. A special effort was made to train selected interviewers as technical editors, and thoroughly examine each interview for discrepancies and consistancy. Timely recontacts by phone cured otherwise defective interviews and cleared up ambiguities.

A Technical Audit Group member visited every office at least once every two weeks.

During each visit a Group member reviewed the Home Interview schedules at three levels of completion: (1) prior to editing; (2) following editing; and (3) during coding. Most of the Group's time was spent on the first two steps since another team from the central office did a comprehensive quality control check of the coding. Out of the Group's reviews came recommendations to each field office supervisor for improving the quality of the work being done.

In order to determine the quality of the Survey, a special rating form was developed, as shown on Page 8. A minimum of two schedules per interviewer were reviewed during each visit, and any errors uncovered were noted by category on the form. In addition, a numeric rating system was developed. Whenever a major error (for instance, trip purpose error) occurred, the particular column on the Interview Evaluation Form was assessed four points. Similarly, a minor error (e.g., omission of the parking data) caused an assessment of two points. Error-free work was rated one point. The evaluation rating of each schedule was obtained by averaging the columnar assessments; the closer it was to 1.0, the higher the quality of work. Poor quality interviewing and editing work became obvious through use of this system and steps could be taken for their improvement. In addition, numeric comparisons were made between field offices, and the offices with poor ratings were given special technical assistance in the form of additional training sessions.

As a direct result of the Technical Auditing Group's field visits came many of the Home Interview Technical Memoranda. This series of memoranda either amended or expanded upon the preliminary Home Interview Survey manual and has become the documentation of interpretations made in the Survey.

INTERVIEW EVALUATION FORM

District Office : _____   Page ____ of _____

Inter-viewer Number	Sample Number	Travel Data	Parts II, III, Structure Data	Part IV, Personal Data	PART V Person Trip & Purpose	Address, Land Use	TRIP DATA Trip Times & Mode	Screenline & Auto Data	Part VI Mobility Data	Pt. VII, VIII Household & Summary Data	Eval-uation Rating

Evaluator: _____   Date: _____

A two-stage sampling procedure was designed for quality control of coding, as described in the attached article. A unique feature is that control is imposed in two dimensions: on individual coders (across the row Form 2253. 1A illustrated), and on each item (down the column).

In order to know the reliability of data obtained in the surveys, calculations are being made of the variances of different data items. Since error varies directly with variance and inversely with sample size, accuracy statements can be made for various degrees of stratification or disaggregation of the survey data.

HOME INTERVIEW QUALITY CONTROL MEASURES

Presented by

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Many improvements have been made in data processing techniques since the first home interview origin-destination study was conducted more than twenty years ago. These vast improvements were made possible mainly from the use of high speed computers. As a consequence, there is a serious quality gap between the collection and organization of data for the more sophisticated analysis techniques and this gap will widen unless greater effort is made to develop and use more quality control measures in field studies.

Although we have not found any reliable mechanical techniques to aid the interviewer-respondent relationship, there are available some quality control measures which can be used to improve the reliability of the collected data.

The basic interview methods as described in the Bureau of Public Roads Manual of Procedures for Home Interview Study were used on the Boston Study. However many refinements to these methods were used to increase the accuracy of the collected data. The effectiveness of these quality control measures are indicated by the comparisons of actual to expanded trips with the northeast and southeast screenlines showing a comparison of ninety-five and ninety-six percent respectively.

The refinements, or quality control measures used on the Boston Project can be categorized in three major groups, (1) capable conscientious workers, (2) easily understood instructions, and (3) weekly qualitative check of ten percent of each interviewer's work.

PERSONNEL SELECTION

Effective interviewers are the most difficult segment of the quality control measures to achieve and consequently great effort was made to hire qualified persons residing throughout the region. Prospective interviewers were reached by contact with state and private employment offices and through help wanted columns in various metropolitan and suburban newspapers published in the region. The best interviewers were usually housewives who wanted to work mainly as a temporary escape of household duties.

The interview application is critical in obtaining a concise description of prospective workers. The form used in Boston contained over one hundred pieces of information which included many items of a personal nature. For example, it was desirable to know if a housewife must prepare a meal for her family each night since this is the most productive interviewing time of the day.

To supplement the information obtained on the application form, each applicant was given a battery of tests as an aid in estimating his or her effectivness as an interviewer. These tests consisted of, (1) a preference test to determine general likes and dislikes, (2) a test to determine basic mathematical and grammatical skills, (3) a test to determine legibility of handwriting under pressure, and (4) a test to determine how well the applicant could read a map, general knowledge of the area, and the ability to spell difficult street names and sections of the city.

The applicant's tests were immediately graded, and the results were provided to the person interviewing the applicant. Following a thorough examination of the application form and test results and a personal interview with the applicant, the applicant was given a percentile rating. The social grade was an indicator describing the social classes with which the interviewer could easily converse. Appearance was the second rating which generally indicated if the applicant's appearance and mannerisms were deemed acceptable for a person-to-person interview. The third incator was a rating of the applicant's ability and was a combination grade based on test results and personal interview.

SPECIAL TRAINING

The instructions used on the Boston Study were similar to those used in many other studies and could be classified as being difficult to understand for the average interviewer. As indicated by the attached "Trip Problem" which graphically describes how some of the difficult trip movements should be recorded, the instructions contained some visual aids. Further effort could certainly be made in improving home interview instructions with the inclusion of more visual aids. Two sets of instruction manuals should be used. The first instruction manual should be of general nature and used primarily for instructional purposes. The second should contain specific instructions and be indexed to the items on the interview form.

QUALITY CONTROLS

Two of the most recent innovations for assuring accurate results from home interviews were strictly adhered to on the Boston study. These two quality control measures are, (1) personal contact with each person in the household sixteen years of age or older, and (2) a partial re-interview of ten percent of each interviewer's work. Each adult sixteen years or older was contacted for trip information at each interview address since in most households there is not anyone who can accurately describe the many minute details of travel for other adults in the household, although there is usually an adult in each household who thinks that this is possible. This requirement does not give the interviewer the alternative of accepting trip data for other adults in the household from a so-called knowledgeable adult.

Ten percent of each interviewer's completed interviews were checked in the field or by telephone to make certain that the interviewer was recording the data in accordance with instructions. Usually, only a few questions on each form were checked as confirmation of accuracy, however the questions checked for each interviewer were rotated during the check-back process to ensure that

each item on the form was being properly answered and that information for each trip made on the interview day had been recorded. The results of each check-back were recorded on a special form and filled with the interviewer's weekly performance records. A by-product of the ten percent check-back system was the prevention of bias resulting from ficticious interviews.

Although there is much controversy regarding incentive pay systems for interviewers, we used the "Plateau Incentive System" to reward the productive interviewers. This incentive system was based on completed interviews or recorded trips, with a bias toward recorded trips. Each interviewer was hired at a base rate of $1.75 per hour and was raised to the next increment of pay after each plateau was reached. Over ninety percent of the increases in pay were reached through the trip plateau. This achieved the design of the incentive system as it was devised to stress the importance of recording every trip. Critics of the system argue that incentive pay will generate ficticious trips, however, if the ten percent check-back system is adhered to, ficticious trips should not occur.

"Plateau Incentive Pay System"

Hourly Rate of Pay	Number of Interviews	Interview Trips
1.75	50	250
1.80	100	500
1.85	200	1000
1.90	400	2000
1.95	600	3000
2.00	800	4000
2.05	1000	5000
2.10	1200	6000
2.15	1400	7000
2.20	1600	8000
2.25	1800	9000

Quality control consists of many items, and only a few of the more important ones can be discussed in the time alloted, however, in closing I would like to point out some of the more important aspects of home interview quality control:

1. Make a major effort to hire good personnel. The actual process of attracting applications, grading these applicants, and placing them on the payroll should be thoroughly analyzed for optimum results. Since the training period takes several weeks, it is most important that every effort be made to retain the good interviewers. A properly administered "Plateau Pay System" is a valuable incentive for retention of good interviewers.
2. Require that interviewers contact each person at the household sixteen years of age or older for trip information.
3. Develop concise interviewing instructions which can be easily understood by the average interviewer. Use as many visual aids as possible. Index instructions to the interview form.

4. Each week check a portion of the information on ten percent of each interviewers forms by phone and in the field to determine if the interviewer is recording the data in accordance with instructions.

5. Give each interviewer an examination periodically to determine if she understands the instructions.

6. During the training process, require that the interviewer code some of her interview forms. Later, each interviewer should be required to code other interview forms. This coding is for instruction pruposes only and the data should be re-coded by the coding section.

7. Develop a color system to identify all annotations on each interview form. Suggested system is, (1) interviewer-black pencil, (2) field supervisor-green pencil, (3) office telephone checking section-blue pencil, (4) office editing-brown pencil, and (5) coding-red ball point pen. The color coding system should be devised also to show the date and to identify the persons who handled the interview form.

8. Each form should be signed by the interviewer. The signature line should state that, "I certify that all information on this form is correct and true".

9. Keep a file on each week's telephone and field checks. This file should be readily accessible.

10. Begin coding immediately after initiation of interviewing as the coding operations will serve as a good measure for many aspects of the quality control system.

11. Print a column on the trip report form for describing odd trips. This column should be used by the interviewer to record the details of any unusual trip which would be questioned by the editing or checking sections. For a person who drives from home to work in the morning and whose second trip is recorded as driving from shopping to home, the interviewer would record in the odd trip column that the person walked from work to shopping.

12. Record the number of autos in each family and relate these autos by numer for each auto driver trip made by persons at the household. This is not only useful data, but also provides an excellent check on the recorded trip data by showing the location of each car during the travel day. Auto driver trips made in borrowed or rented cars should be indicated by a specific car code. Auto passenger trips should also be coded to determine if they were made in a car owned at the household or in a borrowed or rented car.

13. Make certain that all written and verbal instructions place proper emphasis on the travel portion of the study. Since the front side of most interview forms pertain primarily to household information, it is easy to understand why many interviewers don't realize that the major purpose of the study is to collect travel data. A properly administered "Plateau Pay System" will help place the emphasis on collecting data for all trips made during the travel day.

# DWELLING UNIT INTERVIEW TRIP PROBLEMS
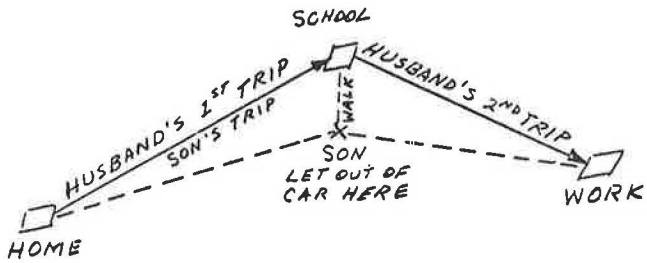
PROBLEM: Husband and son leave home at 8:A.M.; husband drives son to within two blocks of his school at 8:32 A.M., then continues to work and arrives at 8:45 A.M.; son walks remaining distance to school in two minutes.

Husband's 1st trip: from home address at 8:25 A.M. to school address at 8:34 A.M.

Husband's 2nd trip: from school address at 8:34 A.M. to work address at 8:45 A.M.

Son's trip: from home address at 8:25 A.M. to school address at 8:34 A.M.
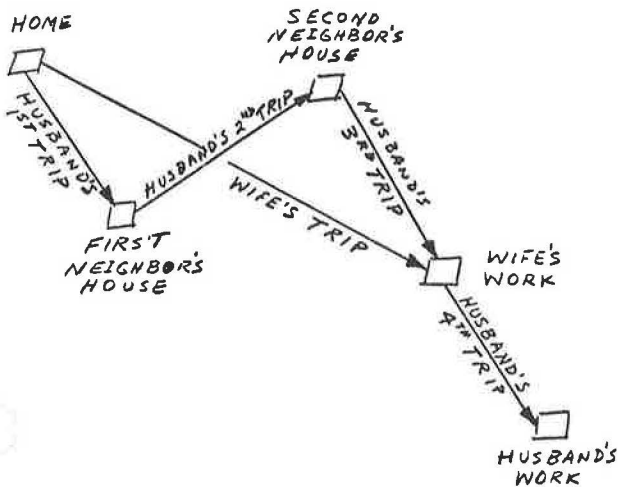
PROBLEM: Husband and wife leave home to go to work. Enroute to work, the husband makes two stops to pick up neighbors who work in his office. He then drives to his wife's work address; from there, he drives to his work address.

Husband's 1st trip: from home to "serve passanger: at first neighbor's house.

Husband's 2nd trip: from "serve passenger" at first neighbor's house to "serve passenger" at second neighbor's house.

Husband's 3rd trip: from "serve passenger" at second neighbor's house to "serve passenger" at wife's work address.

Husband;s 4th trip: from "serve passenger" at wife's work address to "work" at his work address.

Wife's trip: from "home" to "work" at her work address.
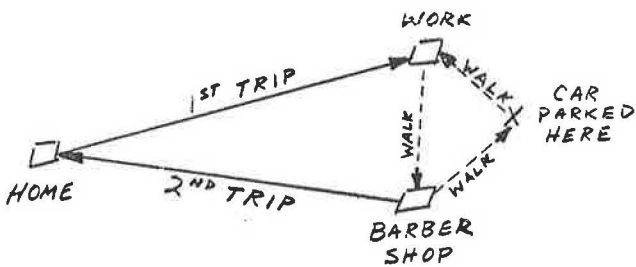
PROBLEM: Husband drives from home to work in the morning and parks his car 3 blocks from his work address. After work, he walks to the barber shop for a haircut. From the barber shop, he walks to his car and drives home.

1st trip: from home address to work address.

2nd trip: from barber shop address to home address.

Remarks: Indicate his walk trip from work to barber shop.
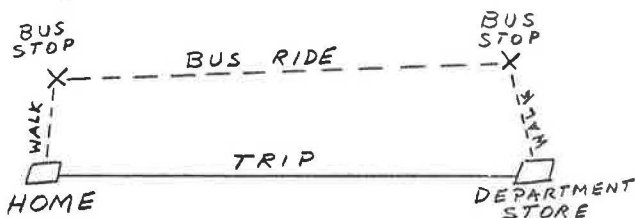
PROBLEM: Wife leaves home at 8:12 A.M. and walks to bus stop. She boards the bus at 8:15 A.M. At 8:27 A.M. she gets off the bus and walks to a department store where she arrives at 8:29 A.M.

Trip: Show her trip from home address to department store address. Show starting time as 8:12 A.M. and arrival time as 8:29 A.M.
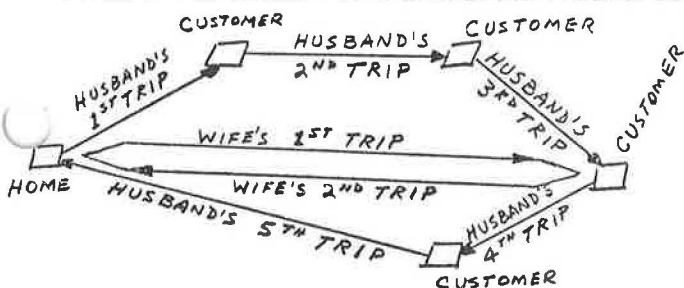
PROBLEM: Wife leaves home with husband as he collects from four customers on insurance debit.

Husband's trips: from "home" to "work"; from "work" to "work"; from "work" to "work"; from "work" to "work"; and from "work" to "home".

Wife's trips: from home to farthest address and from farthest address to home; show purpose as "home" to "recreation"; and "recreation" to "home".

QUALITY CONTROL IN DATA COLLECTION
AT THE SPOKANE METROPOLITAN AREA TRANSPORTATION STUDY

Presented by

James E. Clark, III
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Spokane is a city in the eastern part of the State of Washington - the center of a very large rural region with the next closest metropolitan area some 289 miles away. With a 1960 urbanized area population of 227,000, Spokane is one of the 224 metropolitan areas affected by the urban transportation planning prerequisite for highway Federal-Aid. The Spokane metropolitan area transportation study, under the leadership of Edward L. Falk, Study Director, is currently engaged in a planning program which, due partly to limited budget and partly to their interest in latest technology, incorporates several interesting features.

Household Interviewing

In keeping with their desire to improve methods and hold costs to a minimum, the study has investigated telephone interviewing as a means of collecting household travel data. Interest in this technique was brought about through the findings of the earlier telephone pilot study conducted in Salem, Oregon, (which will be reported on later today at another O-D committee session).

The interviewing survey program consisted first of a comparative study between telephone and field interviewing procedures first using a sample size of approximately 1,000 dwellings. Finding no significant differences in the parameters from both sets of interviews, the survey was carried to completion with a 50-50 split between telephone and field interview methods.

Rigid quality control measures were especially important in these surveys to insure that interview errors did not give erroneous results in the comparability study. And of course, the quality of travel data regardless of collection technique can seriously affect the validity of simulated traffic patterns. Moreover, in a situation where personnel work without direct supervision is involved, quality control checks are the only assurance of accurate results. SMATS therefore maintained accuracy checks throughout the telephone and field interviewing phases of data collection.

Quality Control Techniques

Two indirect methods of quality evaluation were developed. Both indirect, in that direct observation was not practical, one of them required an analysis of completed interviews; the other quality control measure was a reinterview program.

Content Analysis

Running averages were calculated for each interviewer. Persons per dwelling unit, automobiles per dwelling unit and trips per dwelling unit were the variables used to detect marked variations by one or a few interviewers from the rest. Where significant differences occurred, a more detailed analysis was made on all of that interviewer's work to determine whether this was a legitimate variation resulting from socio-economic factors or errors due to poor reporting. In cases where interview quality was to blame, the original interview was checked by conducting a reinterview.

Reinterview Program

One out of five dwelling units were reinterviewed in the field quality control program. Half of these dwelling units were selected on a random basis so that each interviewer was checked the same number of times, the other half (10 percent of the total sample) consisted of reinterviews recommended by the quality control team on the basis of their content analyses of interview forms. In other words 50 percent of the reinterviews were distributed equally among all the interviewers; 50 percent were distributed in proportion to the interviewer's quality ratings. If necessary, 100 percent of an interviewer's work was checked for accuracy.

In the reinterviews, trip data was not requested, unless the quality control team had sufficient reason to believe that trips were not being reported properly. The following more constant items were generally included in the reinterviews:

1. Structural type of dwelling
2. Type of living quarters
3. Total resident persons
4. Persons 5 years or older
5. Out of area visitors
6. Passenger car ownership
7. Family income
8. Personal information such as position in household, age, sex, driving status, occupation, and industry.

Using the above items, the total number of items in a reinterview varied from 12 to over 30, depending on size of the family, for measuring the accuracy of the original interview.

Reports and Interviewer Improvement

Averages for three dwelling unit variables were maintained for each interviewer. An accounting of the number of items checked by reinterview and the percent of error for each interviewer were recorded on charts by the quality control team. From these continuing records, interviewer performance in terms of both quality and production rates were constantly available. These charts were used primarily for determining which interviewers needed checking. Other uses included quick estimates of survey progress, and comparisons of field and telephone results.

Another purpose the office chart served was that of a source for compiling weekly critique sheets or "report cards" sent to each interviewer. The report cards showed the number and kinds of errors made by each interviewer during the preceeding week. Each interviewer, therefore, was informed of their particular weaknesses in data gathering.

A competitive spirit among interviewers leading to better scores and improved accuracy was another objective in providing weekly critique sheets.

Interviewer meetings were held approximately every two weeks. Common kinds of errors or problems were discussed by the interviewer and quality control staffs. Improved morale was thought to be one direct benefit of these meetings, in addition to the prime goal of reducing errors.

Improving the caliber of the telephone interviewing was, in one respect, perhaps a more feasible operation than for field interviewing. Telephone interviews were normally conducted from the interviewer's residence. However, telephone interviewers were brought into the office and under supervision made series of taped sessions. By reviews and discussions with the interview supervisor, interviewers were advised of individual shortcomings. This procedure was followed on a routine basis. A similar procedure was used in the field. However, because of the time and travel expenses incurred for an accompanying supervisor, field critiques were only made if an interviewer was providing marginal quality.

Results of Quality Control Methods

It is highly improbable that "manufactured" or poor quality data infiltrated the SMATS travel survey. Collected data was evaluated for validity by comparisons between interviewers and by checking original returns against reinterview results. Reinterviews were scheduled randomly for an initial indication of data accuracy. Indications of poor quality were further checked by intensifying the number of reinterviews at dwelling units originally contacted by the interviewer registering a poor rating.

The program was successful. Early in the survey, error ratings ranged from 0 percent (first place) to 7.9 percent (last and 11th place). Five weeks later, the poorest error rating was lowered to only 3.4 percent. Two interviewers were dicharged during the survey. In both instances, interviewer inadequacy was discovered by analysis of reported items. Each of the interviewers, one was from the field and the other was with the telephone team, was checked for accuracy by reinterviewing every dwelling they visited. Low trip producting rates were the major indicator of their inferior performance and subsequent analysis traced the cause to their inability of phrasing questions well. Interviews made by these personnel were eliminated and rescheduled.

Unit cost figures reflected a lower cost for collecting O-D data by telephone - telephone interviews averaged approximately 3/5ths of the field interview cost. Later in the survey, unit costs were reduced since training no longer comprised as much time as at the beginning of the project, but relative costs remained the same. Quality control, while primarily concerned with accuracy of data, also contributed to more efficient and economical data gathering.

Quality Control in Coding

In another attempt to reduce both costs and errors, SMATS has turned to optic sense equipment for the preparation of punch cards. Key punching is eliminated in this operation - equipment will scan coded interview forms for marks that appear in binary number boxes. All raw data is coded in the binary system and the same interview form used in the field is used for coding and input to the optic sense equipment.

Summary

A quality control program is necessary to insure that dwelling unit data is satisfactory for simulating a real world situation. Even though telephone and field interviewers are not directly supervised, accuracy checks can quickly reveal where direct supervision is necessary. Continuous accounts of household averages and of interviewer error rates will indicate interviewer performances and will show progress of the survey and initial trends of area characteristics. A "report card" sent to each interviewer showing the number and types of errors made will inform interviewers how they can become better. Quality control can not only eliminate worthless data, it can also add to interviewer morale and efficiency.

ORIGIN-DESTINATION SURVEY QUALITY CONTROL METHODS

Presented by

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The purpose of a quality control program for the origin-destination surveys is to maintain the accuracy and completeness of the reported travel information. Complete reporting is the more important of these two because it establishes the total magnitude of surveyed travel on which later studies depend. The quality of accuracy can largely be controlled by mechanical editing of the trip data.

Controlling complete reporting is more difficult. Errors occur in two ways during a survey. First, carelessness on the part of the interviewers accounts for some error. Occasionally an interviewer will deliberately make up data to cover the fact that some of his interviews were not conducted. Unintentional errors can be minimized through comprehensive classroom and on-the-job training. Fictitious data reporting rarely occurs if good supervisory practices are maintained.

The second source of incomplete data reporting can be traced to lack of communication within a household about trip making. It is becoming evident that the person interviewed frequently does not know how many trips the absent members of the family made during a day. Trip information that is not brought to the interviewer's attention during the interview is difficult to detect and correct. The source of the greatest error can be traced to the interviewee.

The Rochester home interview data show the value of personally interviewing each household member sixteen years of age or older. The 5,819 workers interviewed made an average of 4.2 person trips per day, while the 2,464 workers, who were not interviewed, were reported to have made an average of 3.6 trips per day - - a sizeable difference.

The average non-interviewed worker tended to have a higher income and car ownership and had an occupation requiring a greater amount of education than the average interviewed worker. Higher income and car ownership rates usually result in higher household trip generation. Therefore, it was concluded that the actual trip rate for this group of non-interviewed workers is probably over 4.2 trips per day. Hence the total number of trips for non-interviewed workers appears to be at least sixteen percent too low. This would result in at least a five percent error in the total number of trips by workers.

There are three levels of quality control used by the subdivision. First, telephone calls are made to households to check on the completeness of the information. Also the interviewer's conduct and effectiveness can be ascertained.

Second, a thorough editing check of each form is made by a trained editor. Telephone calls are made to the household to ascertain the accuracy of unusual responses, to amplify the reasons for discontinuous information, and in many cases to pick up missing trip information.

And third, interviewer performance records are kept on a weekly basis for analysis and possible corrective action.

The number of trips per completed interview and the percentage of household members sixteen years of age and older who were personally interviewed are recorded. While the number of completed interviews is somewhat subject to factors beyond the control of the interviewer (e.g., the vacancy rate in an area), the other two items are not. Trips per interview should be more or less uniform among districts which have similar economic and density characteristics. The number of trips per household will increase moderately with distance from the central business district. The percent of household members sixteen years of age and older interviewed should be approximately constant from district to district. This provides a measure to indicate whether the interviewer has made a conscientious effort to contact all household members.

As a result we have placed renewed emphasis on the importance of personally interviewing all household members. Where this is not possible the trip information gathered during the interview is reviewed over the telephone with the members of the household who were absent during the personal interview.

There is a temptation in travel surveys to increase the sample size and decrease the direct costs per sample. Sometimes this results in biased data. A fully developed quality control procedures directed toward both the interviewer and interviewee more than compensates for the added cost per sample unit.

QUALITY CONTROL ELEMENTS EXPECTED TO BE
INCLUDED IN REVISED HOME INTERVIEW MANUAL

Presented by

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Home interview traffic studies have been in existence for over two decades, and we have considered the results of this phase of an urban transportation study as being one of the most reliable. The home interview survey method is still basically sound as a means of obtaining travel data and the socio-economic characteristics of the residents of an urban area. However, since the inception of this data collection technique, giant strides have been taken in the development of analysis techniques which involve the use of automatic data processing (ADP) equipment. Based upon the experience gained over the past years in the conduct of home interview studies, we are now in a position to revise the original home interview manual to reflect this experience, as well as to include in it the most advanced ADP techniques available at the present time.

Let me first emphasize that the primary purpose of interviewing the residents of an urban area as part of the comprehensive transportation planning process is to obtain accurate information describing the trip making characteristics of the residents, and to determine the relationships between those trips and the social and economic characteristics which generate travel. These relationships are then used as a basis for making an estimate of the future travel demand for some target year. Therefore, it is imperative that adequate control be exercised during the collection of home interview data to insure the quality of these data and, consequently, to increase the reliability of future transportation plans.

Many studies have been quite diligent in maintaining the quality of the data that are being collected in the field. The four preceding papers have given some excellent examples of what should be done. Experienced transportation planners are aware of the importance of quality control. However, we have found that in studies conducted by inexperienced staffs, not enough emphasis has been placed on this very important aspect of the home interview study. Therefore, in the revision of the existing manual we plan to include several recommendations on quality control for data collection, so that those staffs who will be conducting home interview studies in the future will be better guided in this area.

Some form of quality control has been used in every home interview survey. This has usually included the use of telephone callbacks or a revisit to a small percentage of sample dwelling units as a means of insuring that an interviewer did in fact make an interview at the home. Some of the larger studies have employed the use of a computer to summarize certain key factors concerning the data being collected so that any unusual circumstances could be uncovered immediately.

Most of the control techniques used in the past have been concerned with checking on the interviewer, to be sure that he has actually interviewed his assigned dwelling units. This type of control is necessary and should be of prime concern to the home interview supervisor. Unfortunately, not enough emphasis has been placed on insuring that a complete set of trip data be obtained from each sample dwelling unit. This may be one factor which is causing such unusually poor accuracy checks in some urban areas, when comparing ground counts to O-D data at apecific locations.

One thing I believe we have definitely learned after examining the results of many O-D studies is that people must be encouraged by the interviewer in order to obtain a complete set of travel data. I believe that in many instances a person is not really reluctant to divulge this information, but only that his memory must be prodded somewhat. Therefore, the interviewers must have more than an average ability to converse with people, and he must also be trained properly so that he will be well equipped for his task. This, of course, brings to mind the numerous problems associated with recruiting and retaining the type of individual who is best suited for the job of interviewing, problems which I am sure all of you who have been concerned with O-D surveys are well aware of.

The only way to combat this problem is to develop training programs for prospective interviewers which will be as thorough as possible, and to establish quality control procedures which will help to isolate those interviewers who, for one reason or another, do not have the ability to perform adequately. It would be desirable to keep a continuous record of the performance of each interviewer, so that if he is not obtaining a complete and accurate log of trip data he can be counseled, retrained, or dismissed. A method has been developed which will allow the home interviewer supervisor to maintain this type of record for each interviewer, as well as for the entire study area. This method is described below.

Research has shown that the variation in the number of trips per dwelling unit is explained most significantly by the number of persons residing in that dwelling unit and by the number of autos available. A computer program has been written which stratifies trip data submitted by each interviewer into the following groups:

I. For one person households

    A. Having 0 autos available
    B. Having 1 auto available
    C. Having 2 or more autos available

II. For two person households

    A. Having 0 autos available
    B. Having 1 auto available
    C. Having 2 or more autos available

III. For three or more person households

    A. Having 0 autos available
    B. Having 1 auto available
    C. Having 2 or more autos available

It is assumed that each of these nine groups contain data for households having similar trip making characteristics.

The computer program compares the average number of trips per dwelling unit submitted by each interviewer to the average reported for the entire study area, for each of the nine strata shown above. It makes a statistical comparison of these values, using a "Z test" to determine if there is a statistically signi-ficant difference between the values reported by an individual interviewer and that reported for the entire study area (which contains the work submitted by all interviewers).

It is a well established theory that travel of the residents within an urban area follows a similar and reproducible pattern - this is the theory upon which most of our mathematical models are based. Thus, it is reasonable to assume that after a certain number of interviews have been made by an individual, the results of his data should fall into a definite discernible pattern. When the pattern is broken, it may be due to the existance of some unusual travel or social characteristics of the households he has interviewed; it may be caused by his inability to obtain the necessary data from the respondant; or, it may result from the interviewer's attempt to falsify the data being submitted. In any event, the cause of the apparent discrepancy in the data should be investi-gated, and the necessary action taken.

An interviewer whose work consistently appears to be significantly different than that submitted by other interviewers for households having similar trip mak-ing characteristics will be identified by the "Z test" described above. This information can be obtained weekly for each interviewer, on the basis of all work submitted to that time (cumulative totals); thus, the supervisor will have the ability to maintain a continuing check on the adequacy of each interviewer's work.

The use of this technique to identify unacceptable data obtained in an actual home interview survey has shown that it is effective. We plan to make more field tests to prove its validity using data from several other studies.

A second feature of this program provides weekly and cumulative study totals, for each interviewer as well as for the total study area, of the folow-ing data:

    1. Completed interviews per hour
    2. Trips per completed interview
    3. Incomplete interviews per hour
    4. Summary of reasons for incomplete interviews

These data provide both a report on the progress of the study, and another check on the quality of the data. For example, each interviewer should report about equal values for items 1, 2, and 3 above in most cases. The summary of reasons for incomplete interviews submitted by each interviewer may reveal a particular weakness that an interviewer has. For example, if one person is found to be reporting an unusually large number of refusals it may be that he is not suited for the task of meeting and talking with people. If he is a good worker, he could be retrained for another position; a coder, for example.

This type of quality control technique has another important feature. Since the interviewers will know that their work is being checked in this manner, it should stimulate them to increase their efforts in obtaining quality data. It could also serve to promote a spirit of friendly competition among individual interviewers.

Finally, to obtain complete travel data it is important that every member of the household who is 16 years of age or older be interviewed in person or, as a last resort, by telephone. Research has shown that when this is not done, a considerable amount of significant data is missed.

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