Rest Area Use Study Procedure Guide

• DURING THE 1960 meeting of the Highway Research Board's Committee on Shoulders and Medians, the Committee adopted and recommended publication of a Highway Shoulder Use Study Procedure Guide in recognition of the growing need for comparable and reliable data on driver-stopping practices on highway shoulders. It was published as Highway Research Board Correlation Circular 426, August 1960. During the discussion at the 1960 meeting, it was pointed out that in addition to shoulder use data, factual data on roadside rest area use and occupancy were needed for the intelligent planning and justification of roadside emergency and rest stop facilities. As a result, it was recommended that a Rest Area Use Study Procedure Guide be developed as an adjunct to the Shoulder Use Study Procedure Guide. The Bureau of Public Roads 1959 policy statement (1) indicating that "convenience and comfort facilities provided at the safety rest areas are to be non-participating items for Federal-aid funds except where, because of specially significant, historical or national values, especially high continuing use may be expected" was of special concern. It underscored the need for factual information on the amount and character of rest area use which can only be obtained through extensive "on the site" studies.

The Rest Area Use Study Procedure Guide has been prepared to develop and standardize procedures for conducting studies of rest area use. It is hoped that this guide will be used by all States interested in obtaining data of this type. The purpose of the guide is to describe study procedures that will be adaptable to various study conditions, and that will provide reasonably uniform, comparable, and accurate data of greatest utility and benefit to the States preparing and using future rest area study data.

The Oregon State Highway Department, in cooperation with the U.S. Bureau of Public Roads, prepared the basic guide for committee adoption. They also predicated all of the items contained herein on actual field experience at some eight locations during 1960 and 1961.

GLOSSARY

Arterial Highway.—A general term denoting a highway primarily for thru traffic, usually on a continuous route.

Automatic Traffic Recorder.—A mechanical device for counting vehicular traffic on a highway.

Average Daily Traffic.—The average 24-hr volume, being the total volume during a stated period, divided by the number of days in that period. Unless otherwise stated, the period is a year and the term is commonly abbreviated as ADT.

Freeway.—A divided arterial highway for thru traffic with full control of access and with grade separations at intersections.

Light Vehicle.—A motor vehicle with size and operating characteristics similar to those of a passenger car; including specifically passenger cars, station wagons, and light panels, pickups, or delivery trucks of 6,000-lb gross weight or less.

Highway (or Street or Road).—A general term denoting a public way for purposes of vehicular travel, including the entire area within the right-of-way.

Interviewer-Observer.—A study crew member whose primary duties are the interviewing and observing of vehicle occupants.

Peak Moment.—The interval of the day during which the number of vehicles accumulated in (occupying) the rest area is a maximum.

Safety Rest Area.—A roadside area separated from the roadway with provisions for stopping and resting by motorists for short periods.

Rest Area Facilities.—The accouterments or improvements installed in a safety rest area for use by occupants of vehicles parking in the rest area (tables, restrooms, drinking water, fireplaces, telephones, etc.).

Vehicle-Classifier.—A study crew member whose primary duty is counting traffic by vehicle type.

Vehicle Party.—All of the occupants of a single motor vehicle. Used to provide an animate measure when the occupants of a vehicle are considered as a unit and not individually.

INTRODUCTION

During the last decade, there has been an increasing emphasis on, and a recognition of, the need for providing adequate facilities for rest and emergency stops on arterial highways. The combined effects of increased vehicle ownership, higher traffic volumes, high vehicle speeds, and major developments in automotive and highway design have created a need for the control of and planning for emergency and rest stops on rural arterial highways. Parking on highway shoulders and the attendant hazard while leaving or re-entering the traveled way constitutes a recognized accident hazard, particularly to high-speed freeway traffic. As a result, it has become necessary to control and restrict highway shoulder parking (see Fig. 1), chiefly on high-speed multi-lane freeways.

There is now general acceptance of the premise that highways must be designed not only for the moving but also for parked vehicles (2). The AASHO Policy on Safety Rest Areas for the National System of Interstate and Defense Highways (3) states "... use of shoulders is to be limited to emergency and vehicle breakdown stops. Shoulders should not be considered as space for safety rest areas. In the interest of safety and convenience to the motoring public, safety rest areas are necessary." The importance of providing safe stopping places to break long trips is pointed out by highway safety experts who advise continuous driving should not exceed 1½ to 2 hr (4) (see Fig. 2). Thus, with the tremendous expansion of freeway travel expected and the large investment being made on the hundreds of miles of the Interstate Highway System completed or under construction, there is a basic need for data on which to base planning of adequate safety rest areas.

This study guide indicates the basic considerations in planning a rest area use study, the data to be collected, and the methodology and procedures to be followed in collecting, compiling, and analyzing the data, and a suggested outline for a report. As in the Shoulder Use Study Procedure Guide (5), the suggested procedures should not be considered as all-inclusive or limitational in respect to future studies that may be conducted. It may be necessary for the various States conducting studies to adapt the procedures to the immediate study conditions and goals, keeping in mind the need for uniformity in definitions and basic procedures, so that the reliability and comparability for the data are assured and maximum utility derived from the various studies.

Figure 1. Shoulder parking signing on Interstate 5 in Oregon.

Figure 2. Rest area signing on Interstate highway in Idaho.

PRELIMINARY PLANNING AND GENERAL PROCEDURE

Study Objectives

The first step in the planning of any study should be the careful definition of the study objectives. The following are among the more important objectives of a rest area study:

1. The measurement of rest area use on certain classes or types of highways and systems.
2. The determination of rest area use relative to its location to other rest areas, parks, and private roadside service facilities.
3. The determination of rest area facility use with respect to the various facilities available (parking, table-bench units, rest rooms, shelters, fireplaces, drinking water).
4. The determination of the effect of various types of signing, illumination, signboards, telephones, and other facilities on rest area use.
5. The determination of the adequacy of existing rest area facilities in meeting present user needs.
6. The measurement of data which provides the base for predictions of future rest area use necessary for design purposes.

Selection of Study Sites

Selection of study sites will depend primarily on the major objectives of the study and secondarily on the rest area sites available for study. The following are factors to be considered in site selection:

1. Rest area type and design.
2. Location.
3. Suitability of the site for collection of traffic volume data and interview and observation data.
4. The manpower and equipment available for the study.

Obviously, the rest area study sites should be of the type and design required to meet study objectives. For example, use of roadside rest areas located on major highways may not be representative of safety rest areas on freeways. The sites selected must be situated so that their locations are representative of the highway system, type of highway, or other conditions required by the study purpose. Sites selected for study of rest area use on a selected highway system should be representative of the various geographic, population, and terrain characteristics encountered on that highway system. The types and number of rest area access points and access roads are important in planning for the collection of accurate traffic data, either by manual or traffic recorder equipment. Rest areas with highway shoulder access will not be suitable for obtaining traffic volumes with automatic traffic recorders.

The number of automatic traffic recorders available for a study may be an important factor in site selection. A site requiring the installation of several traffic recorders to obtain accurate counts of entering vehicles will be less desirable, discounting other factors, than one requiring a single traffic recorder. A site located on the same section of highway as a permanent automatic traffic recorder would be most desirable, because it will obviate the installation of traffic recorders on the highway adjacent to the rest area in order to relate rest area use to highway traffic.

Sites with rest area facilities located on both sides of the highway will require additional interviewer-observers. Rest areas selected for the study should be situated so that the interviewer-observers may obtain vehicle entrance and exit times for all cars leaving and entering the rest area. Finally, the number and type of facilities, signing, recreational aspects, and regulation of overnight stops may be important considerations depending on the purposes of the study.

As an aid to planning, it is recommended that field inspection be made of the proposed study sites before final site selection. Planning of the stationing of interviewer-observers and location of traffic counting equipment will be materially aided by personal knowledge of the rest area study sites and will afford information useful later in re-

viewing and analyzing data collected. Also, problems that would arise without first-hand knowledge of the sites may often be anticipated.

The form "Description of Rest Area and Related Information" (see Appendix) should be completed at the time of observations of proposed study sites. The information required for this form will be valuable as reference material in site selection, and provide basic information required in analysis of the rest area data and preparation of a final report.

Summary of Study Procedure

The essential study procedural steps listed are those suggested for conducting a comprehensive study of rest area use:

1. Establish study objectives.
2. Select study sites.
3. Count traffic to obtain reliable average daily traffic volumes on the rest area access road and highway.
4. Interview vehicle-parties entering rest areas and observe use of rest area.
5. Count and classify highway traffic adjacent to rest area during interview periods.
6. Review and tabulate data collected.
7. Compile, analyze, and present data.

Limited surveys of rest area use may be made by the collection of traffic volume data on the rest area access road and adjacent highway. It is suggested, however, that such surveys be supplemented with manual counts by vehicle type of vehicles entering the rest area, and counts of vehicles accumulated in the rest area at regular intervals (5 or 10 min). A 1960 Oregon rest area survey indicated that substantial rest area access road traffic did not stop in the rest areas, but drove on through without stopping. Thus, traffic volume data alone may considerably overstate actual rest area use.

COLLECTION OF FIELD DATA

Personnel

Normally a team of three or more qualified men will be needed to collect the rest area study data at each site. The minimum crew will be comprised of one vehicle classifier, and two interviewer-observers. Additional crew members will be needed under the following conditions:

1. The highway traffic is so high as to require another vehicle classifier (daily traffic volumes of approximately 6,000 vehicles or more).
2. The number of vehicles stopping in the rest area requires additional interviewer-observers. (As a rule of thumb for estimating personnel requirements, an average of 10 interviewers per hour per interviewer may be assumed. A team of two interviewer-observers may be expected to handle approximately 15 interviews per hour when one of the interviewer-observers is also taking counts of the number of persons using a certain facility; for example, rest rooms or drinking water).
3. The number and location of rest area facilities for which usage counts are to be obtained requires additional observers.

One member of the team should be selected as a crew leader. He will coordinate the activities of the team, review the field data collected to insure completeness and compliance with established study procedures, act as a relief man for lunch periods, and perform other survey duties as required.

One or more interviewer-observers will make observations of vehicles entering and leaving the rest area and interview the driver or other responsible occupants of the vehicles stopping in the rest area. A Rest Area Interview Form (Fig. 3) should be completed insofar as possible by the interviewer-observers for each vehicle entering the rest area even though it does not stop. The duties of one of the interviewers-observers may also include the recording of the number of persons using specific rest area facil-facilities, such as drinking water and rest rooms.

In other instances, depending on the location of facilities and the amount of highway traffic, it may be desirable for the vehicle-classifier to take the counts of facility use, thereby relieving the interviewer-observers of this duty. The physical layout of the

STATE OF_____
REST AREA USE STUDY

REST AREA INTERVIEW FORM

I. INTERVIEW IDENTIFICATION:
- a. Serial Number (office entry) ☐☐☐☐
- b. Highway Number ☐☐☐
- c. Rest Area ☐☐☐
- d. Day ☐
- e. Date ☐☐☐☐

II. VEHICLE IDENTIFICATION:
- a. Description_____
- b. Number of Axles ☐
- c. Registration: ☐
  1. Study State
  2. States Bordering
  3. "
  4. "
  5. "
  6. Other States
  7. Foreign Country
  8. Unknown
- d. Vehicle Type ☐
  1. Light Vehicle
  2. Light Vehicle & Trailer Coach
  3. Light Vehicle & Other Trailer
  4. Truck or Bus
  5. Truck and Trailer Combinations

III. TIME (Military)
- a. Entered rest area ☐☐☐☐
- b. Departed rest area ☐☐☐☐
- c. Stay (minutes) ☐☐☐

IV. DIRECTIONS OF TRAVEL: ☐
1. Northbound 3. Southbound
2. Westbound 4. Eastbound

Occupant Comments:

V. NUMBER OF OCCUPANTS: ☐

VI. LAST STOP: (Office Entry)
- a. Location ☐☐☐
- b. Time ☐☐☐

VII. PURPOSE OF STOP: ☐
1. Rest or Nap
2. Eating
3. Restroom
4. Drinking Water
5. Recreation (Picnic, Fishing, etc.)
6. Other_____ (Describe)
7. Drive through (no stop)

VIII. FACILITY USE:
- Drinking Water ☐
- Restrooms ☐
- Tables and Benches ☐
- Fireplace or Cooking Facility ☐
- Shelters ☐
- Other_____ (Describe) ☐

IX. HOW DID YOU LEARN OF OR LOCATE THIS REST AREA? ☐
1. Located from Road Map
2. Located from Road Signs
3. Known from Previous Visits
4. Other_____ (Describe)

X. OTHER DATA (Optional) ☐

Interviewer Comments: ☐
1. Interview
2. No Interview

Interviewer_____

Figure 3. Rest area interview form.

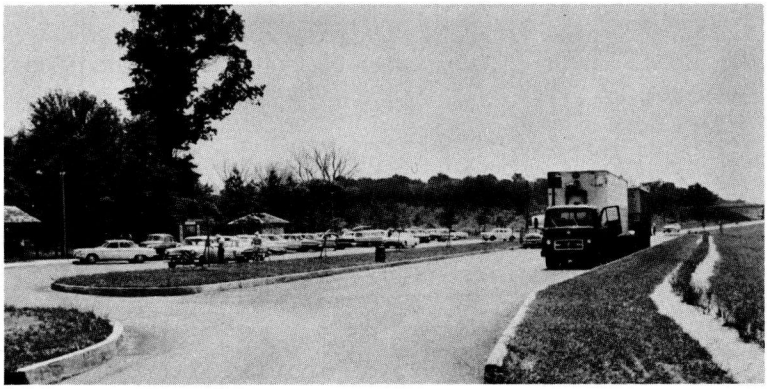


Figure 4. Interviewing at safety rest area on Interstate 71 in Ohio.

rest area, location and type of facilities, and volume of rest area traffic are all important factors in determining the amount of manpower required for the survey. It will be necessary for the crew leader to evaluate the conditions at each study site and assign personnel and duties accordingly.

Figure 4 shows a view of an Ohio safety rest area on Interstate 71 at the time interviews were being conducted for an eight-day rest area use survey in July 1961. The survey indicated 9.8 percent of the adjacent northbound traffic entered the rest area (6). The interviewer-observers in sun helmets can be seen in the figure near the exit of the light vehicle parking area.

When traffic volume data on the highway and rest area access road are to be collected by manual counts, rather than by mechanical recorders, for time periods outside the interview period, vehicle classifiers will be required.

Equipment and Supplies

The following equipment and supplies will normally be required for the collection of the rest area use data:

1. Passenger cars for the transportation of rest area study crew.
2. A multi-bank tally counter for use in counting traffic by vehicle type.
3. Clipboards, pencils, and note paper for each member of the survey crew.
4. A timepiece for each member of the survey team to record the vehicle entrance and departure times accurately.
5. State Highway maps and rest area or park guides for furnishing information to rest area occupants.
6. A supply of Rest Area Interview Forms (Fig. 3).
7. Daily report forms (tally sheet) for counting persons using specified rest area facilities (Fig. 5).
8. Daily traffic count summary forms for entering and summarizing hourly traffic totals by day and hour (Fig. 6).
9. Daily report of rest area operations (Fig. 7).
10. Automatic traffic counters for collecting traffic volume data.

The collection of traffic volume data on the rest area access road and highway by mechanical means will normally require the temporary installation of one automatic traffic recorder on the rest area access road and an additional automatic traffic recorder on the highway. In the instance of a four-lane divided highway having rest area units on opposite sides of the highway, a total of four traffic recorders would be normally required. If a permanent automatic traffic recorder were on the same section of highway as the rest area units, only rest area access road traffic counters would be required.

When manual counts of highway and rest area traffic volumes are to be obtained rather than mechanical counts, an additional car will be required for the transportation of the vehicle classifier, and a clipboard, pencils, and traffic summary forms supplied for his use.

STATE OF_____

REST AREA USE STUDY WORKSHEET

REPORT OF NUMBER OF PERSONS USING REST AREA FACILITIES

Highway No I-50 Date 7/7/61

Rest Area Shady Spot Day Friday

Facility Restrooms Observer RA

Time Period (Hour)		Number of Persons (tally) Using Facility	Total
1000	1100	𝍸 𝍸 𝍸 𝍸 𝍸 //	27
1100	1200	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸	40
1200	1300	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 //	52
1300	1400	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 ///	38
1400	1500	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸	35
1500	1600	𝍸 𝍸 𝍸 𝍸 /	26
1600	1700	𝍸 𝍸 𝍸 𝍸 ////	29
Daily Total			247

Comments Additional rest room facilities needed between 1200 and 1300.

(Data are for exemplary purposes only)

Figure 5. Report of number of persons using rest area facilities.

STATE OF_____

REST AREA USE STUDY WORKSHEET

SUMMARY OF HIGHWAY TRAFFIC BY VEHICLE TYPE

Highway No _____ Observation Period

Rest Area_____ Hours _____to_____

Date_____

Time Period		Direction						Direction					
		Light Vehicle	Lt. Veh & Trailer Coach	Lt Veh & Other Trailer	Single Truck or Bus	Truck & Trailer	Total	Light Vehicle	Lt Veh & Trailer Coach	Lt Veh & Other Trailer	Single Truck or Bus	Truck & Trailer	Total
Total													

Recorded by_____

Figure 6. Summary of highway traffic by vehicle type.

STATE OF_____

REST AREA USE STUDY

DAILY REPORT OF REST AREA OPERATIONS

Highway No._____ Day and Date_____
Rest Area_____ Observation Period ____to____
Observer_____

1 Weather Conditions
(Describe weather and noticeable effects on amount and character of rest area use).

2. Parking
(Comment on adequacy of parking space and any parking or rest area traffic problems).

3. Facility Use
(Comment on adequacy of facilities to accommodate occupants, unusual facility use, demands for facilities not available).

4. Rest Area Maintenance
(Comment on quality of maintenance, indicate maintenance needs such as repair of faucets or tables, rest room supplies).

5. Other Comments
(Indicate any other special events or incidents affecting operation of the rest area, or problems encountered in conducting the survey).

Figure 7. Daily report of rest area operations.

Schedule of Operations

Studies of rest area use should normally be conducted during the summer months so that the data will be respresentative of periods of maximum use. This is important so that data on rest area use during peak periods will be available for design purposes and evaluation of the rest area operations. It will also make possible valid comparison of the data with other rest area use studies.

It is recommended that the interview-observation days be scheduled so as to include at least one Saturday and Sunday, and a representative group of weekdays (preferably a minimum of five). By grouping the study periods in sets of not more than three days, preferably one or two days, the study periods may be dispersed to be representative of typical summer conditions.

Normally, interviews will be conducted during daylight hours. Where rest areas are illuminated and substantial nighttime use is expected, it is desirable to consider a supplementary schedule of nighttime observation. Interview and observation periods should include the hours of highest rest area use. Experience indicates that the hours from 11 AM to 3 PM will normally include the periods of peak use. A continuous six- to seven-hour study period starting at 10 AM is suggested. The continuous observation schedule may be maintained by the rotation of duties among the survey team to allow the relief of each member of the crew for eating and rest at appropriate "off peak" interview periods.

When the daily traffic volumes are to be obtained from automatic traffic recorders, it is suggested that a one-month data collection period be scheduled initially. Additional counts may be required, depending on the variability of the data (see section on Sample Size and Variability). The traffic recorder counts should cover as much of the interview-

observation study period as possible. When daily traffic volume counts are obtained from personal observation, practical considerations will probably limit the schedule of counts to a much shorter period. The rest area and highway traffic counts should be taken simultaneously, so that the percent of traffic entering the rest area may be accurately determined.

Traffic Volumes

Traffic volume data are required in the rest area use study for the determination of the average percent of highway traffic entering the rest area. To determine average percent of highway traffic entering the rest area, it is necessary that daily counts of traffic on the rest area access roads and adjacent highways be made concurrently over sufficient periods of time to establish their relationship with reasonable accuracy (see section on Sample Size and Variability).

It is desirable that the traffic counts be taken to establish the average daily traffic volumes with accuracy. If traffic recorder equipment is available, it will provide the most economical means of obtaining the required traffic counts, although manual counts may also be used.

In addition to the 24-hour traffic volume counts, manual vehicle classification counts of highway traffic should be taken during the interview-observation study period. These counts will usually be made by a member of the survey crew stationed in a parked car in the rest area, on the shoulder of the access road, or at some other nonhazardous location. Accurate counting will be materially aided by the use of a talley counter. The vehicle classification counts accumulated in the talley counter should be entered hourly on the forms, Summary of Highway Traffic by Vehicle Type (Fig. 6) and summarized daily. The vehicle classifier may also record axle counts of multiple axle vehicles and combinations, if such counts are required for adjustment of road tube traffic recorder data.

The collection of rest area traffic volumes by mechanical means will require the temporary installation of an automatic traffic recorder on the rest area access road. If a permanent automatic traffic recorder installation is located on the adjacent highway at a reasonable distance from the rest area without significant differences in traffic volume between it and the rest area, it should be used to supply the highway traffic counts. Otherwise, it will be necessary to install an additional traffic recorder to count the adjacent highway traffic. The rest area access road traffic recorder should preferably be placed to count entering traffic and at a distance as far as possible from the parking area and rest area facilities to prevent tampering by occupants and actuation of the counter by vehicles turning around, parking, backing, etc.

If traffic volume data are obtained from road tube type traffic recorders, classification of traffic by number of axles should be made, if not otherwise available, to provide the data for adjusting the traffic counts. Number of axles recorded under Item B of the Rest Area Interview Form (Fig. 3) will provide the data for adjustment of rest area access road traffic counts. Magnetic-type traffic recorders do not require this adjustment. Hourly recording traffic recorders are recommended for installation on the rest area access roads. Operational and mechanical troubles will show up in the hourly traffic counts, as well as unusual variations from tampering by rest area occupants, which will remain undetected in non-recording traffic recorder counts. Installation of traffic recorder equipment and collection of data will probably be most efficiently performed by crews normally doing this work. Figure 8 is an example of a traffic recorder installation at a safety-rest area on Ohio Interstate 71.

Interview and Observation Data

The reliability of the final rest area report and success of the study will depend on the accuracy and completeness of the rest area interview and observation data.

Much of the success of the interviews depends on the manner in which the interviewer-observer meets the public, explains the purpose of the survey, and asks pertinent questions. The interviewer-observers should present a neat appearance and be courteous and tactful, regardless of the rest area occupant's attitude toward the survey.

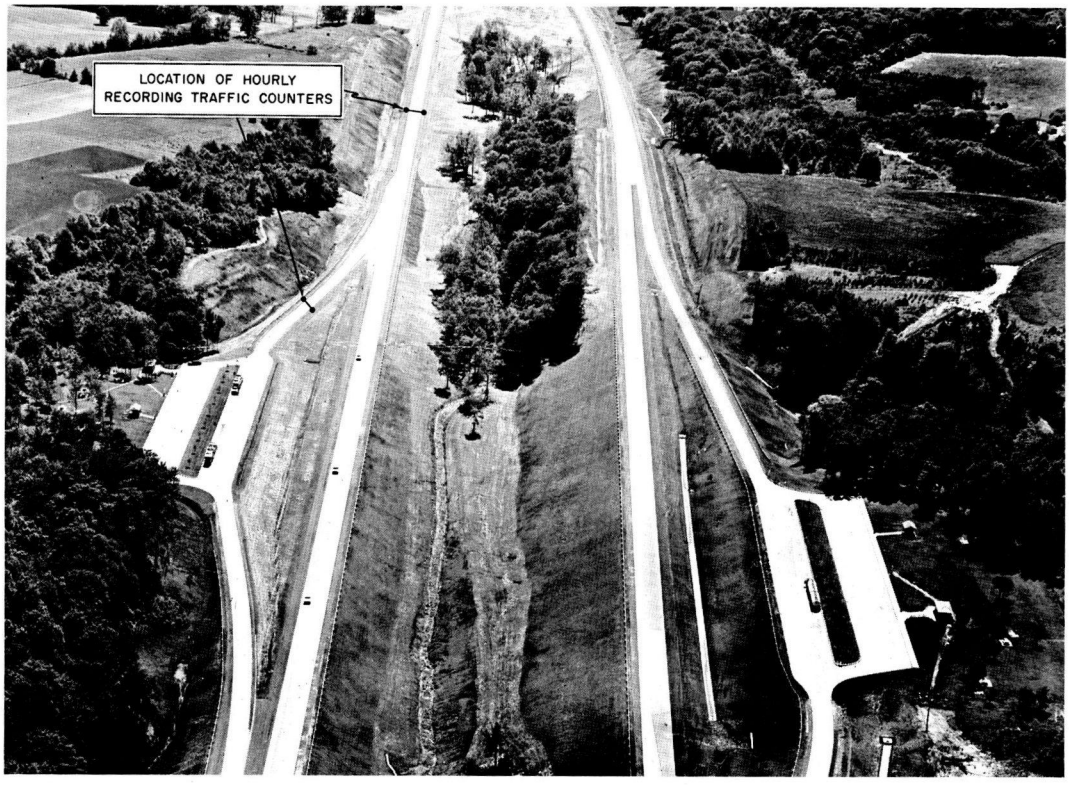


Figure 8. View of safety rest areas on Ohio's Interstate 71 showing location of automatic traffic recorders.

Experience has shown that most rest area occupants will be cooperative and interested in the survey, as they are the immediate beneficiaries of the rest area.

It is important that the survey crew be instructed in advance of their work assignments on the over-all purposes of the study, the general procedure that will be followed in processing the data collected, and their specific duties. Each member of the survey crew should be familiar with all work assignments as he will be required to rotate duties at various times during the study. Advance training of all crew members by making trial interviews prior to the actual beginning of the survey is recommended. A review of the trial interviews by the study supervisor or crew leader will bring out questions that need to be answered and provide opportunity for correction of errors and discussion of points of misunderstanding. One of the better training aids for interviewers is to have them review, code, or tabulate the rest area data that other members of the crew have collected. This practice will emphasize the need for obtaining accurate and complete data in the field.

The field crew supervisor should review the completed interview forms during and at the end of each day for completeness and accuracy. Corrections and deficiencies can then be discussed before the next day's work. Leaving the initial review to the office force at a later date is not advisable as missing information cannot be recalled accurately, and errors initially made cannot be corrected and will be continued.

The Rest Area Interview Form (Fig. 3) should be prepared for all vehicles entering the rest area, regardless of whether the vehicle stopped or the occupants were interviewed. Normally, items I-VII, with the exception of "Last Stop" (item VI), will be apparent by observation of those vehicles making short stops or just driving through the rest area access road. Items for which information is not obtained should be coded as "X" in the appropriate code box. Interview information should be entered on the

form as completely as possible at the time of interview, as attempts to recall information later will lead to errors and incompleteness. If there is doubt as to the proper classification of data, supplementary explanatory remarks should be made on the form.

Entry I—Interview Identification

a. No serial number entry is required in the field as this is an office entry.
b. Enter the highway number designating the highway on which the rest area is located in the code boxes.
c. Enter the code for the day of week (1-7) in the code box, starting with Sunday as one and ending with Saturday as seven.

Entry II—Vehicle Identification

a. Indicate a useful quick description of the vehicle entering the rest area; e.g., red and white 1960 Ford Sedan. The only use of this item is by the interviewer-observers in maintaining control of the interviews and recording entrance and departure times.
b. Enter the total number of axles of the vehicle or vehicle-combination in the code box; e.g., station wagon-2, car and trailer coach-3. These axle count data are used to derive correction factors for rest area traffic volume counts made by road tube-type traffic recorders. The item may be omitted when using magnetic detectors for the vehicle recorders or manual counts for rest area traffic volumes.
c. Enter the code number designating the place of vehicle registration in the code box as determined by vehicle license plate. If the license plate is not visible, determine the place of registration by interview.
d. Enter the code number identifying the vehicle type in the code box. Light vehicles are defined as passenger cars, station wagons, and light panel or pickup trucks. Trucks towing resident-type trailer coaches are classified as truck-trailer combinations.

Entry III—Time

a. Enter the time the vehicle enters the rest area to the nearest minute in military time (0000-2400).
b. Enter the departure time of the vehicle.
c. The length of stay will normally be computed in the office or by the crew leader. No entry is required by the interviewer-observer.
Estimates of entry and departure times for vehicles which enter or leave the rest area before or after the interview study period may be obtained from occupants of the vehicle. Experience has shown that a supplementary listing of vehicle exits and entries by time of day made by the traffic classifier or one of the interviewer-observers will be helpful in establishing accurately the vehicle entrance and departure times. This supplementary listing is especially useful when all of the parking space cannot readily be observed from where the interviewers are stationed.

Entry IV—Direction of Travel

Indicate the direction of travel by entering the appropriate directional code in the code box.

Entry V—Number of Occupants

Enter the total number of occupants of the vehicle in the code box.

Entry VI—Last Stop

a. Enter the location of last stop on the line opposite "Location" as determined by the question, "Where was your last stop?" The answer to this question

should be specific enough so that the distance from last stop to the rest area may be readily estimated with use of highway mileage maps.
The code boxes for this item and item "b" will be left blank in the field as the elapsed time and distance since last stop will be computed in the office and then entered in the code boxes.
It is important to recognize probable differences in standard and daylight time and time zones during the interview and correct for this to maintain comparability of the rest area entrance and last stop times. A good practice is for the interviewer to indicate the current time as a point of reference. It is important for the interviewer to emphasize that the last stop will be any stop (emergency, rest, service, or recreational) and should not be considered in respect to trip origin only.

b. Enter the estimated time at which the vehicle left the place of last stop in military time on the line opposite "Time."

Entry VII—Purpose of Stop

Enter the number of the primary purpose of the rest area stop as listed in the code box. The primary purpose of the stop will, in most instances, be obtained during the interview by asking the question, "What was the primary purpose of your stop?" In certain instances, particularly where the stop is quite short, and there is no time for interview, the purpose of stop may be obtained by observation.
For example, the purpose of a five-minute stop for rest rooms or drinking water use, when these were the only facilities used, would be obviously classified as rest room or drinking water. Eating stops include stops for the purpose of eating meals, light lunches, snacks, or "coffee breaks." Recreational stops are defined as rest area use for the primary purpose of recreation such as picnicking, fishing, or sun-bathing, in which the rest area is regarded as the destination rather than a stopping place incidental to travel to another destination. Thus, recreational stops should not include a lunch or refreshment stop made by vacationers enroute to other destinations. Among the types of stops which are classified as "other" are checking vehicle, changing drivers, making short stops for reading historical markers, exercising pets, checking maps, obtaining information, changing tires, and overnight stops. If substantial rest area use other than described by the major purpose of stop is known to exist, it should be added to the form as a separate category.

Entry VIII—Facility Use

Indicate the use of each of the specified rest area facilities by any member of the vehicle-party interviewer by entering the code one (1) in the appropriate box. No facility use is indicated by the code zero (0). The facilities to be listed in this item will necessarily reflect those available at the selected study sites.

Entry IX—How Did You Learn of or Locate This Rest Area?

Enter in the code box the number designating the answer to the question of how the interviewer learned of or located the rest area. This is an optional question which may be used to indicate the effectiveness of advance signing, rest area informational boards, and other means in directing travelers to rest area, as well as the amount of repeated use of rest areas.

Entry X—Additional Optional Questions

Additional items of significance to the study objectives should be added to the questionnaire as required. Other items that might be included are trip pur-

pose, number of rest area stops during trip, residence of vehicle-party, or occupant's alternate choice of stopping place.

Occupant and Interview Comments

The interviewer should encourage the occupants to make comments or constructive criticism regarding the operation of the immediate rest area or rest areas in general. Abstracts of these comments should be written in the space provided at the bottom of the form. The space under "Interviewer Comments" should be used by the interviewer to explain any pertinent information about the rest area use associated with the particular interview. For example, if the table-bench units are all occupied and the party is eating in the car, a comment should made "tables all in use—party eating in car." Such comments are very useful in review of data and evaluating the adequacy of rest area facilities. The number 1 should be entered in the code box under Interview Comments to indicate an interview, or the number 2 to indicate no interview. These codes are also useful in reviewing the data.

The Daily Report of Rest Area Operations (Fig. 7), which is completed by the crew leader, provides a useful source of qualitative information for evaluating the operation of the rest area. This information should be of special interest to those responsible for maintaining and planning of rest area facilities, and will be of value in analyzing the other rest area study data. The daily reports should accompany the other data collected at the various study sites and be turned in to the study supervisor at frequent intervals.

SAMPLE SIZE AND VARIABILITY

The determination of the required sample size and periods of data collection to insure that the data will have the required degree of accuracy and be typical of the characteristics of the population under study is one of the most important and sometimes difficult elements in conducting a study. The sample size and timing of data collection to achieve accuracy and reliability are of particular significance when the scheduling of men and equipment is involved in the collection of the sample data—as in the rest area studies. The decisions as to the maximum errors to be tolerated in the most important statistics of the study and the degree of reliability desired must be evaluated in relation to the data variability. The determination of practical sample sizes must consider manpower, time, and equipment available for the study. It is, of course, desirable to make the results as accurate as possible within the limitations of the variability of the data being studied and practical considerations.

In the instance of Rest Area Studies, the following statistics are recommended for sample size determination:

1. The percent of highway traffic entering the rest area in a 24-hour period.
2. The number of vehicles occupying the rest area during the peak moment of a 24-hour period.

In reference to the percent fo highway traffic entering the rest area, it is recommended as a minimum requirement that the sample size be chosen to provide accuracy of at least ± 10 percent, 95 percent of the time. This recommendation is based on the fact that these data can be obtained using automatic traffic recorders which result in data that are less expensive and easier to collect over extended time periods than data obtained by manual methods. Experience in the analysis of traffic recorder data from rest area surveys in 1960 indicates the practicability of obtaining data with this accuracy. Analysis of traffic counter data collected during the summer of 1960 at two Oregon rest areas over a period of approximately two months showed that traffic recorder counts for sample periods of 22 and 24 days would have achieved the desired accuracy of ± 10 percent 95 percent of the time. Analysis of one week's traffic recorder data at an Ohio safety rest area (6) on Interstate 71 (Fig. 8) indicated variability such that the percent of highway traffic entering the rest area would have been within 10 percent of the true

average 95 percent of the time. Of course, a single week's data cannot be regarded as representative of the entire summer season, and additional sampling periods should be scheduled. However, the analysis indicates the relative consistency of the rest area traffic data.

On the basis of the foregoing analysis, a minimum sample data collection period of approximately four weeks is recommended which includes an allowance for the loss of a few day's data due to adverse weather conditions, or mechanical and other traffic recorder difficulties. Practical considerations of moving traffic recorder equipment and developing a traffic recorder counting schedule consistent with the interview schedule may make it preferable to install traffic recorders during the entire summer interview schedule (probably two months) in preference to scheduling several short periods for collection of traffic recorder data.

In reference to the required sample size for the number of vehicles accumulated at the peak moment, it is recommended that the sample be of sufficient size to provide accuracy of ± 20 percent, 95 percent of the time. The accuracy recommendation for rest area use data is the same as for the shoulder use study data (5).

An analysis of the variability of peak moment vehicle accumulations from data collected for Oregon rest areas in 1960 indicated errors in the average peak moment vehicle accumulation at individual rest areas ranging from 12 to 23 percent with a confidence level of 95 percent. The Oregon data were based on observations scattered throughout the summer of 1960 and included a 7-hour observation period for each of five weekdays, plus a Saturday and Sunday at each study site.

On this basis, it is recommended that the mimimum interview and observation data consist of a sample of data for seven days, preferably including one Saturday, one Sunday, and five weekdays. The days should be dispersed throughout the summer to prevent bias of the sample.

In regard to the adequacy of this sampling period (sample size), it is worth mentioning that other pertinent rest area use data will have a higher degree of statistical reliability than that of the peak-moment vehicle accumulation data previously discussed. Other data would include, for instance, the proportion of vehicle-parties using table-bench units for which the observed percentage of 45 percent at a 1960 Oregon study site was reliable within ± 4 percent at the 95 percent level of confidence. The reason, of course, is that such data as these are based on the total number of vehicle-parties observed, whereas the reliability of the peak moment accumulation, because it can occur only once a day, is based on the number of days of observation.

A discussion of a method of statistical analysis and formulas for analysis of sample variability and sample size appear in the Appendix.

TABULATION OF DATA

The services of a statistician and statistical clerk, supported by data-processing equipment, will usually meet the requirements for tabulation and analysis of rest area study data. As the volume of rest area interview data may be substantial, machine punch card processing of interview data is generally desirable. The suggested rest area interview form was designed for mechanical data processing. Detailed instructions for machine processing or tabulation are not included in the Guide as machine processing or tabulating procedures are dependent on the type of processing equipment available and data volume, and can best be determined by the data processing supervisor in consultation with the rest area study supervisor.

The following suggested procedures assume that the rest area interview form data (Fig. 3) are machine tabulated, with the exception of occupant and observer comments, and that the automatic traffic recorder data, manual traffic classification counts, and counts of persons using rest area facilities are manually processed with the aid of adding machines and calculators. The illustrations and explanations of suggested tables, charts, and figures in the Guide will indicate tabular data requirements. Basic data will be tabulated by rest area study site to provide the data required for a case history of each study site.

Traffic Volume Counts

The collection and analysis of highway traffic volume data are normally an important phase of the work of the State Highway Department. Forms used in collection and processing traffic volume data should be already available for use in processing the traffic volume data by day of week. If traffic counts are collected by mechanical equip-

OREGON STATE HIGHWAY DEPARTMENT
Traffic Engineering Division
Planning Survey

AUTOMATIC RECORDER TRAFFIC COUNTS

Portable Recorder ☐ Permanent Recorder ☐

Route or Highway No. _____ Station No. _____

Location _____

Week Beginning _____

Day of Week		Sun.	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.	Total
Day									
Hour of Day									
A. M.	12-1								
	1-2								
	2-3								
	3-4								
	4-5								
	5-6								
	6-7								
	7-8								
	8-9								
	9-10								
	10-11								
	11-12								
P. M.	12-1								
	1-2								
	2-3								
	3-4								
	4-5								
	5-6								
	6-7								
	7-8								
	8-9								
	9-10								
	10-11								
	11-12								
Automatic Recorder Total 24 Hours									
Axle Correction Factor									
Adjusted All Vehicle Total 24 Hr.									

REMARKS _____

Figure 9. Automatic traffic recorder counts worksheet.

ment, probably the most efficient procedure is to arrange for the collection and processing of the rest area traffic counter data by the personnel normally doing this type of work. Figure 9 shows a form suitable for tabulating and review of the traffic recorder data. It is important that the data be reviewed thoroughly after transcription from the counter tapes to check for inconsistencies in the counts resulting from mechanical failure, tampering by rest area occupants, and transcription errors. Obviously, erroneous data should be deleted.

The form "Summary of Highway Traffic by Vehicle Type" (Fig. 6) may also be used to summarize the daily classification counts of highway traffic adjacent to the rest area by vehicle type and day of week. The form is initially used to summarize the traffic classification counts by hour obtained from the tally counter. The daily traffic totals by vehicle type from the initial hourly summary are transcribed as line entries to the daily summary and totaled.

Rest Area Use Data

Rest Area Interview Data.—The rest area interview form is self-coding with the exception of Item VI, Last Stop, and Item X, Other Data and Comments. The data for Item VI, Last Stop, will usually be coded in the office, although if time permits the data may be coded by the field crew leader. The distance since last stop in miles, as determined by the location of last stop and mileages shown on current highway maps, is entered in the code boxes opposite "Location." The elapsed time between last stop and rest area stop is coded in the boxes opposite "Time."

It is important that a thorough review of the rest area interview data and coding be completed before the data are processed. All items should have entries entered in the appropriate code boxes. Items for which no data were obtained should be coded "X" and not left blank to differentiate between oversights in coding and items for which data were not obtained. The coded mileage and elapsed time (minutes) since last stop should be consistent with the location and time entries for last stop. Purposes of stop and facility use should be consistent. It is recommended that the forms for each rest area be sorted by date and time of vehicle entrance and number in sequence for identification purposes before key punching. A final review of the data before summarization of the data should be made by reviewing card listings by rest area, primary purpose of stop, day, and time of vehicle entry. The review of these listings should disclose any key-punching or coding errors and other inconsistencies in the data which will require correction before beginning summarization of the data.

Number of Persons Using Facilities.—Data on the average daily number of persons using specified facilities should be summarized from the form "Report of the Number of Persons Using Rest Area Facilities" (Fig. 5). Summarizing the daily totals for each rest area by day of week (weekday, Saturday, and Sunday) and computing the daily averages will provide the summary data required for analysis.

ANALYSIS OF DATA

The purpose of the analysis suggested here is to summarize and analyze the rest area study data in a simple and direct manner, oriented towards the practical use of the data for planning purposes. The suggested methods and types of analyses are indicated by narrative exemplary illustrations of tabular and graphic data presentation. The types of data analysis and report content suggested provide for the summary and analysis of data in two stages. The first stage is the summary and analysis of data for each individual study site which is used in the compilation of a case history for each rest area studied. The second stage is the summary and comparative analysis of data for more than one study site to provide a composite picture of rest area use on the highway system.

Case History Analysis

In studies of rest area use covering several study sites, it is recommended that a

case history be prepared for each rest area study site. The case history will summarize the detailed information collected at each study site in a logical sequence and serve as the source data for the summary analysis section of the report. Although it is not suggested that an extensive analytical narrative be included in each case history, the data presented should be supported by essential explanatory narrative and statements of the most significant aspects of the data. The case history should also contain a detailed description of the rest area, the adjacent highway, and related information pertaining to location of nearby cities, rest areas, parks, and service facilities. It is also desirable to mention any circumstances unique to a particular study site which affected the collection of data or required changes in the study procedures to fit the circumstances. The following section, "Compilation and Presentation of Analysis," is indicative of other case history content and format.

Summary Analysis

The summary analysis section is intended to provide a summary and comparative analysis of the principal data presented in the case histories of the various study sites. The order of presentation should be consistent with the case history data.

Compilation and Presentation of Analysis

The computations and tabulations required for the case history and summary analysis sections of the report are simple and require little explanation. The following comments supplemented by the exemplary tables and figures should provide adequate instructions for compiling and presenting the analysis.

Description.—Use the form, "Description of Rest Area and Related Information," prepared in the site selection process as a guide for preparation of the case history rest area descriptions. For the main body of the report, it is suggested that the more important descriptive information on each of the study sites be summarized (see Fig. 10), and supplemented by narrative description. A regional map showing the location

STATE OF_____

REST AREA USE STUDY

DESCRIPTION OF REST AREA STUDY SITES

Rest Area & Highway	ADT	Location	Facilities
Shady Spot, Interstate 50 M.P. 225.5	7,100	35 miles east of Metropolis, 25 miles west of Plainview in flat open country, adjacent to the Powder River.	Parking space for 30 vehicles, 12 table-bench units, 2 modern rest rooms, drinking water, artificial lighting, no fireplaces or camp sites.
Pleasant View Interstate 50 M.P. 342.2	6,500	40 miles east of Capitol City, 50 miles northwest of Westport, in the foothills of the Pine Mountains.	Parking space for 25 vehicles, 10 table-bench units, 2 modern rest rooms, spring water, no artificial lighting or fireplaces.
(etc.)	(etc.)	(etc.)	(etc.)

Figure 10. Description of rest area study sites.

of the study sites in respect to the highway system, major cities, and other important geographic places should be included.

Traffic Volumes.—For the case histories compute for each study site the weekday, Saturday, and Sunday average daily traffic volumes for the vehicles entering the rest area and those on the adjacent highway from the manual and/or traffic recorder count summaries (Fig. 9). The axle overcount adjustment factors required for counts from road tube recorders may be computed from a tabulation of the punch card data from Item II-b, Number of Axles, of the rest area interview form. The average daily traffic on the adjacent highway and entering the rest area are entered in Table 1, and the percent of highway traffic entering the rest area by day of week computed.

For the summary analysis Table 2 gives a comparison of the average daily summer rest area and adjacent highway traffic volumes, and the percentage of highway traffic entering the rest area at individual sites with the average for all study sites. The data for each study site are copied directly from the case histories.

TABLE 1

COMPARISON[a] OF HIGHWAY AND REST AREA TRAFFIC VOLUMES, SHADY STOP REST AREA

Day	Avg. Daily Summer Traffic		Percent Entering Rest Area
	Highway	Entering Rest Area	
Weekday	7,650	367	4.8
Saturday	8,665	450	5.2
Sunday	9,855	473	4.8
Avg.	8,110	394	4.9

[a]Data shown for exemplary purposes only.

Rest Area Use.—The following suggested analyses of data on rest area use are based on information obtained during the interview-observation study periods. These study periods will usually be of limited duration as compared to the traffic volume data collection periods; therefore, it is desirable that the report sections of the case history and summary analysis be prefaced with a description of the study periods to provide an indication of the reliability and comparability of the data.

Vehicles Entering.—The number of entering vehicles that are accumulated in (occupy) a rest area is an important measure of rest area use. Peak vehicle accumulations are of particular value for design considerations.

TABLE 2

COMPARISON[a] OF HIGHWAY AND REST AREA TRAFFIC VOLUMES

Rest Area	Hwy Route	Average Daily Summer Traffic		Percent Entering Rest Area
		Highway	Entering Rest Area	
Shady Spot	I-50	8,110	394	4 9
Oak Dell	I-50	8,640	482	5 6
Trout Creek	I-50	5,000	420	8 4
Pleasant View	I-50	7,210	425	5 9
Sleepy Hollow	I-50	5,100	310	6 1
Avg		6,812	406	6 2

[a]Data shown for exemplary purposes only

In this guide, two basic methods of obtaining the number of vehicle accumulations in the rest area during study periods are suggested. The first method suggested for obtaining rest area vehicle accumulation counts, and probably the most efficient assuming electronic data processing equipment is available, is to compute the number of vehicles accumulated in the rest area at regular short intervals from the entrance and departure times of the vehicles as recorded in Item III of the rest area interview form (Fig. 3), and the rest area interview punch cards. The number of vehicles accumulated in the rest area may then be machine computed at regular time intervals (preferably five minutes) throughout each interview day and listed in time order. Electronic data-processing equipment such as the IBM 650 or equivalent is suitable for this calculation. If the vehicle accumulation data are to be computed by an electronic calculator, the tabulation of other rest area data during the same "pass" of data cards through the calculator should be considered).

For a study involving only one rest area, a hand tabulation of the vehicle accumulation data may be more satisfactory than electronic data processing, although it requires

very careful checking. The hand tabulation may be accomplished by preparation of a tally sheet showing the hours of the study period divided into 5 minute intervals. The entry and exit time of each vehicle is observed by the person tabulating the data and a tally entered in the appropriate time intervals covering the duration of the vehicle's stay in the rest area. All vehicles traveling through the rest area without stopping (coded 7 for purpose of stop) would be excluded from this tabulation as they would not occupy any parking space.

The second method is for one of the interviewer-observers to make physical counts of the numbers and types of vehicles accumulated in the rest area at regular time intervals (5 to 10 minutes) during the study period. This method has the disadvantage of interference with the normal interviewing duties of the rest area study personnel and requires a high degree of concentration on the part of interviewers regularly to obtain accurate counts at the specified time intervals when absorbed with other duties. For example, experience has shown that rest area occupants may expect the interviewers to provide assistance in checking vehicles and assisting in routing trips. These activities may break into the schedule of the interviewers as situations requiring assistance to the public cannot be ignored. One solution to this problem is to assign one crew member to the full-time activity of making vehicle accumulation and facility use counts. In other instances, it may be possible to have the traffic-classifier to make the vehicle accumulation counts where visibility permits.

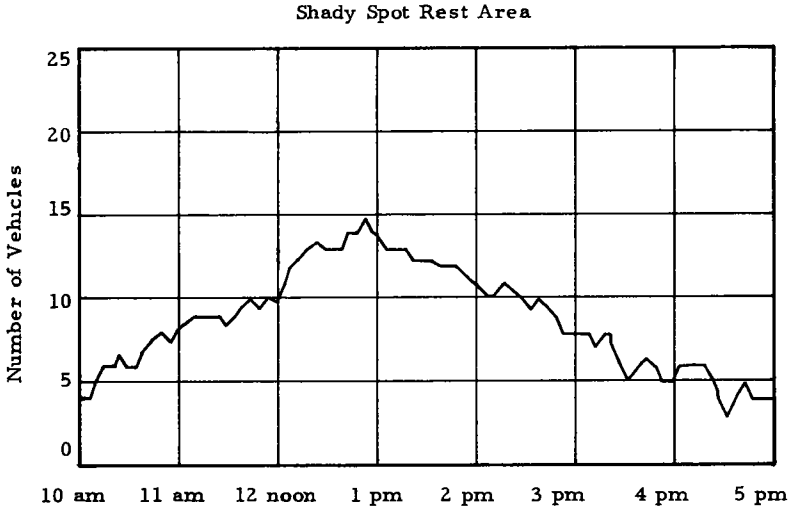
TABLE 3

RELATIONSHIP[a] OF VEHICLES ACCUMULATED DURING PEAK MOMENT TO VEHICLES ENTERING, SHADY SPOT REST AREA

Day	Number of Vehicles		Percent
	Entering[b]	Accumulated During Peak Moment	Accumulated During Peak Moment
Monday	380	20	5 3
Tuesday	365	19	5 2
Wednesday	340	17	5 0
Thursday	372	20	5 4
Friday	408	27	6 6
Weekday Avg	373	21	5 6
Saturday	460	32	7 0
Sunday	472	34	7 2
Avg	400	24	6 0

[a]Data shown for exemplary purposes only
[b]In 24 hours

Figure 11 shows the suggested form of presentation for the average number of vehicles accumulated in the rest area by time of day during the sample observation periods. The averages plotted are computed by totaling the vehicle accumulations during the specified time intervals for each observation day and dividing by the number of observation days.



(Data shown for exemplary purposes only)

Figure 11. Average number of vehicles accumulated in rest area by time of day.

For the summary analysis it is suggested that the average vehicle accumulation data be summarized as in Table 3. Here the minimum and peak-hour vehicle accumulations are expressed as a percentage of the average daily number of vehicles (24 hours) entering the rest area. The peak-hour time period and average peak-hour vehicle accumulations are determined by computing successive hourly totals of the average vehicle accumulations (the sum of 12 consecutive 5-minute average accumulations) starting near the beginning of peak period of use as shown in Figure 11. The highest hourly accumulation total obtained (the peak hour) is divided by the number of accumulation counts during the hour to determine the average peak hour accumulation. The minimum accumulation for the average day is determined by visual inspection of the average vehicle accumulations.

The number of vehicles accumulated during the peak moment is of special importance for determination of parking space requirements. The peak moment is defined as the interval during the day in which the number of vehicles accumulated in the rest area is

TABLE 4

RELATIONSHIP[a] OF VEHICLES ACCUMULATED TO VEHICLES ENTERING FOR AN AVERAGE SUMMER DAY

Rest Area	Route	Accumulation			
		Minimum (%)	During Peak Moment (%)	Average During Peak Hour	
				%	Hour Beginning
Shady Spot	I-50	0.8	6.0	3.4	12:15
Sleepy Hollow	I-50	1.0	7.1	4.1	11:55
etc.	etc.	etc.	etc.	etc.	etc.
Avg.		1.0	6.4	4.0	--

[a]Data shown for exemplary purposes only.

TABLE 5

CLASSIFICATION OF TRAFFIC, SHADY SPOT REST AREA

Vehicle Type	Vehicles Entering Rest Area		Highway Traffic	
	Number	Percent	Number	Percent Each Type Entering Rest Area
Light vehicle	1,189	85.0	17,130	6.9
Light vehicle & trailer coach	93	6.6	1,012	9.2
Light vehicle & other trailer	26	1.9	425	6.1
Bus or single unit truck	30	2.1	903	3.3
Truck-trailer combination	62	4.4	2,044	3.0
Total	1,400	100.0	21,514	6.5

[a]Data shown for exemplary purposes only.

a maximum. The determination of the peak moment vehicle accumulation may be made by a part of the electronic data processing program or may be easily made by visual inspection of all the vehicle accumulation totals listed for each day. The daily "peak moment" totals are then listed by the day of week for the case history as given in Table 4. The 24-hour counts of the number of vehicles entering the rest area given in Table 4 are traffic volume counts for the days that the peak moment accumulations were obtained. If 24-hour counts are not available for these days, estimates can be made by expanding the interview period rest area traffic count to a 24-hour count. The relationship between the peak moment accumulations and daily rest area traffic is shown. The summary analysis Table 3 includes a summary of the case history peak-moment accumulation data expressed as a percentage of daily number of vehicles entering.

Table 5 is a suggested form of presentation of case history data on rest area use by vehicle type. Data on the type of vehicles using rest areas are useful in parking area design. The data for this portion of the table are obtained from a tabulation of the interview data for Item II-d, Vehicle Type. The highway traffic data are obtained from the worksheet (Fig. 6). A similar table would be prepared for the summary analysis in which the case history traffic classification data for all sites would be combined to show the composite distribution and relation of rest area and highway traffic by vehicle type.

It is suggested that rest area vehicle occupancy data be presented in terms of persons per vehicle as given in Tables 6 and 7. The data for the case history are obtained from a tabulation of the interview form data for Entry V, Number of Occupants. If there are substantial amounts of use of the rest area by trucks, it may be desirable to show separate occupancy data for light vehicles and trucks. The summary analysis data are transcribed from the case histories and an all site occupancy average computed as in Table 7.

Vehicles Stopping.—Experience has shown that a significant number of vehicles entering the rest area access roads do not stop to use the rest area facilities, but drive on through the rest area without stopping. The following data and analyses pertain to vehicles stopping in the rest area.

The relationship between the number of vehicles stopping in the rest area and the number entering the rest area access road for the case history is given in Table 8. The data for Table 8 are obtained from the work sheet for classifying entering vehicles by purpose of stop (Fig 12). A table showing the case history data for the average daily percent of entering vehicles stopping in the rest area will be adequate for the summary analysis. The case history and summary analysis narratives should indicate reasons for vehicles driving through the rest area without stopping as obtained from a review of interviewer comments and the daily report of rest area operations (Fig 7).

The state of registration of vehicles stopping is indicative of the proportion of resident and out-of-state use of the rest area. Data for the case history, Table 9, are prepared from a tabulation of the interview data by place of registration (Entry II-c). Data for a similar table for the summary analysis section may be compiled by summarizing the case history data and computing the percentage distribution of vehicles stopping by place of registration. Comparisons of the percentages of out-of-state and resident light vehicle traffic entering the rest areas and traveling the adjacent highways will indicate whether the proportion of resident and out-of-state traffic using rest areas was significantly different.

The time and distance intervals since last

TABLE 6

VEHICLE OCCUPANCY,[a] SHADY SPOT REST AREA

Day	Vehicles Entering	Persons	
		No.	Per Vehicle
Weekday	185	594	3 2
Saturday	230	748	3. 3
Sunday	245	760	3 1
Avg	200	640	3. 2

[a] Data shown for exemplary purposes only.

TABLE 7

VEHICLE OCCUPANCY[a]

Rest Area	Route	Average Daily Number		Persons Per Vehicle
		Vehicles Entering	Persons	
Shady Spot	I-50	200	640	3.2
Sleepy Hollow	I-50	165	495	3.0
etc.	etc	etc.	etc.	etc.
Avg.		190	589	3.1

[a]Data shown for exemplary purposes only.

stop by rest area users are indicative of the needed spacing of rest areas. For the case histories the time and distance intervals traveled since last stop are obtained from tabulations of the interview data for Entry VI, Last Stop. The distribution of stops by mileage since last stop may be obtained from a tabulation of the mileage data in selected class intervals and presented as a bar chart of cumulative percentage distribution (Fig. 13). A similar tabulation of the rest area stops by time in minutes since last stop will furnish data for a similar case history figure. The average time and distance since last stop are computed by totaling the mileages (or times) since last stop and dividing the sum by "N" (the total stops with mileage or time entries). For the summary analysis, it is suggested the case history distributions of stops by time and distance since last stop be combined for all study sites and presented in two charts similar to those shown in the case history.

For the case history analysis of the length of stop, it is suggested that Table 10 be prepared. The length of stop is shown as the difference between the entrance and departure times in Entry III-c of the interview form. The data for the table may be obtained from a tabulation of the stop times in minutes grouped in appropriate intervals by stop purpose. The average length of stop is computed by summing the length of all stops (Entry III-c) and dividing by "N" (the number of stops). For the summary analysis a chart or table would be prepared from the combined length of stop data for all study sites.

Purpose of stop data for the case history (Table 11) and the summary analysis (Table 12) are derived from the rest area study worksheet (Fig. 12). The worksheet data are compiled from a tabulation of the interview data (Entry VII) by purpose and day of week. If a large proportion of the stops are classified as "other," an analysis of the composition of this group by stop purpose should be made.

Facility Use.--Data on rest area facility use in terms of the number of vehicle-parties or number of persons using specific rest area facilities are important considerations in the design of rest areas as to types and number of facilities required.

Facility use in terms of the percentage of vehicle-parties' use of specific facilities for the case history are given in the suggested Table 13. The data are derived from a tabulation of the interview data, Entry VIII. The percentage of vehicle-parties using the various facilities are computed by dividing the number of

TABLE 8

RELATIONSHIP[a] OF VEHICLES STOPPING TO VEHICLES ENTERING REST AREA, SHADY SPOT REST AREA

Day	Number of Vehicles		Percent Stopping in Rest Area
	Entering	Stopping	
Weekday	185	168	91
Saturday	230	205	89
Sunday	245	215	88
Avg.	200	180	90

[a]Data shown for exemplary purposes only.

STATE OF_____

REST AREA STUDY WORKSHEET

NUMBER OF VEHICLES ENTERING REST AREA CLASSIFIED BY PRIMARY PURPOSE OF STOP AND DAY OF WEEK

Highway No. I-50 Study Period 10 AM - 5 PM

Rest Area Shady Spot July 7, 8, 30, 31, Aug. 15, 16, 31

Date & Day	Primary Purpose of Stop: Rest or Nap	Eating	Rest-room	Drinking Water	Recreation	Other	Unknown	All Stops	Drive Thru	Total Vehicles Entering
Weekday	40	49	36	25	4	4	2	160	15	175
Weekday	41	48	41	30	2	5	1	168	12	180
Weekday	48	55	39	28	1	2	2	175	17	192
Weekday	31	57	34	31	2	8	3	166	19	185
Weekday	43	51	39	24	3	7	4	171	22	193
Weekday Total	203	260	189	138	12	26	12	840	85	925
Saturday	44	69	55	26	4	5	2	205	25	230
Sunday	40	82	52	30	5	3	3	215	30	245
Weekly Total	287	411	296	194	21	34	17	1,260	140	1,400

(Data shown for exemplary purposes only)

Figure 12. Number of vehicles entering rest area classified by primary purpose of stop and day of week.

vehicle-parties using each facility by the total number stopping on the respective day. For the summary analysis, the vehicle-party facility use data may be presented as in Table 14. Facility use data in terms of vehicle-parties are most significant in regard to tables, fireplaces, or shelters as a single party will usually occupy the unit regardless of the number of persons in the party.

The case history data for relationship of vehicle-parties stopping during noon hour to vehicle-parties stopping to eat (Table 15) are obtained from a tabulation of the interview form Entry VII data (purpose of stop) by hour of day. These noon-hour data provide an estimate of the potential peak use of table-bench units. It should be recognized that in certain instances the number stopping to eat may be limited by the type and number of eating facilities available in the rest area and weather conditions. The data for the summary analysis are transcribed from the case histories and an all-site average computed as in Table 16.

Restroom use data in terms of the number of persons counted using restrooms for the case history are given in Table 17. The data for Table 17 are obtained from the daily report of the number of persons using the rest area facilities (Fig. 5). The number of persons using the restrooms are related to the number of vehicle-parties entering the rest area and shown as a persons per vehicle-party average. A similar

case history table should be prepared for all other types of facility use which were counted during the study in terms of numbers of persons, such as drinking water or telephone use. For the summary analysis, the personal facility use data may be summarized as in Table 18.

Means of Locating Rest Area.—The data from the interview question "How did you learn of or locate this rest area?" are indicative of the effectiveness of signing, and other means in directing the motorist to the rest area. The data from this question are summarized in the case history as in Table 19 from a tabulation of the interview data by the codes (1-4) for Entry IX. If different types of rest area signing are installed on the highway for each direction of travel, analysis of the data by travel direction (Entry IV) should be considered.

These data may be presented in the summary analysis in the form of comparative percentage distributions of rest area stops, similar to the purpose of stop (Table 12).

Other Data.—Additional questionnaire items that were collected during the survey should be analyzed and appropriately presented in the case history section of the report. The question content will, of course, determine its proper relation in the report outline.

TABLE 9

VEHICLE REGISTRATION[a] OF REST AREA USERS, SHADY SPOT REST AREA

Place of Registration	Vehicles Stopping	
	No.	% of Total
State of study	683	54.2
Bordering State:		
No. 1	198	15.7
No. 2	155	12.3
No. 3	63	5.0
No. 4	39	3.1
Other State	76	6.0
Foreign country	36	2.9
Unidentified	10	0.8
Total	1,260	100.0

[a]Data shown for exemplary purposes only.

TABLE 10

PERCENTAGE DISTRIBUTION[a] OF REST AREA STOPS BY LENGTH OF STAY AND STOP PURPOSE, SHADY SPOT REST AREA

Length of Stay	Purpose				All Stops
	Rest or Nap	Eating	Restroom	Other	
Less than 10 min	9	5	55	16	25
10 - 19 min	17	18	25	18	22
20 - 29 min	23	22	9	15	14
30 - 39 min	36	35	8	12	12
40 - 49 min	10	18	3	10	8
50 - 59 min	2	1	-	9	6
1 - 1 1/2 hr	1	1	-	12	5
1 1/2 - 2 hr	1	-	-	4	3
2 - 3 hr	1	-	-	-	1
3 - 4 hr	-	-	-	-	1
4 hr or more	-	-	-	4	3
Total	100	100	100	100	100
Avg. (min)	30	38	14	46	32

[a]Data shown for exemplary purposes only.

TABLE 11

PERCENTAGE DISTRIBUTION[a] BY PRIMARY PURPOSE OF STOP, SHADY SPOT REST AREA

Day	Primary Purpose of Stop (%)							
	Rest or Nap	Eating	Rest-room	Drinking Water	Recrea-tion	Other	Unknown	All Stops
Weekday	24.2	31.0	22.5	16.4	1.4	3.1	1.4	100.0
Saturday	21.5	33.7	26.8	12.7	1.9	2.4	1 0	100.0
Sunday	18.6	38.1	24.2	14.0	2.3	1.4	1.4	100.0
Avg.	22.8	32.6	23.5	15.4	1 7	2.7	1.3	100.0

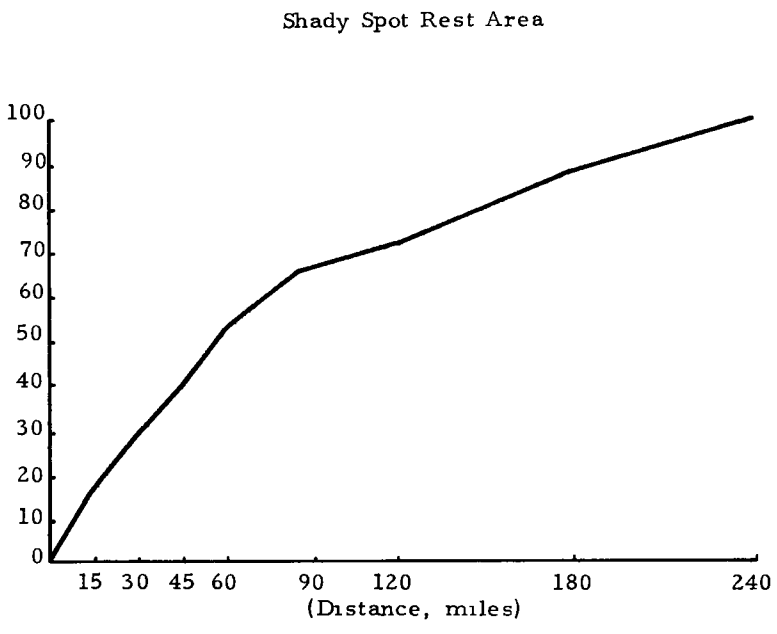
[a]Data shown for exemplary purposes only.

TABLE 12

PERCENTAGE DISTRIBUTION[a] BY PRIMARY PURPOSE OF STOP

Rest Area	Route	Primary Purpose of Stop (%)							
		Rest or Nap	Eating	Rest-room	Drink-ing Water	Recrea-tion	Other	Unknown	All Stops
Shady Spot	I-50	22.8	22.6	23.5	15.4	1.7	2.7	1.3	100.0
Sleepy Hollow	I-50	27.5	31.2	17.6	13.9	3.1	5.7	1 0	100.0
etc.	etc.	etc.	etc.	etc.	etc.	etc.	etc.	etc.	etc.
Avg.		24.5	33.0	21.0	14.2	2.9	3.3	1 1	100.0

[a]Data shown for exemplary purposes only.



(Data shown for exemplary purposes only)

Figure 13. Cumulative percentage of vehicle-parties by distance traveled since last stop.

TABLE 13

PERCENTAGE DISTRIBUTION[a]

Day	Type of Use[b] (%)						
	Drinking Water	Restrooms	Tables & Benches	Shelters	None	Unknown	Total
Weekday	75.1	52.3	31.0	15.9	11.4	1.0	100.0
Saturday	69.2	55.7	36.8	14.5	10.9	1.3	100.0
Sunday	71.7	60.2	29.9	13.1	14.1	1 4	100.0
Avg.	73.8	53.9	31.7	15.3	11.7	1.1	100.0

[a]Data shown for exemplary purposes only.
[b]Percentage of vehicle-parties stopping in rest area which used designated facility. Percentages will not add to total as one vehicle-party may use more than one facility.

TABLE 14

PERCENTAGE DISTRIBUTION[a] BY TYPE OF FACILITY USED

Rest Area	Route	Type of Use[b] (%)						
		Drinking Water	Rest-Room	Table-Bench Units	Shelters	None	Unknown	Total
Shady Spot	I-50	73.8	53.9	31.7	15.3	11.7	1.1	100.0
Sleepy Hollow	I-50	68.0	44.7	30.5	14.6	13.2	0.9	100.0
etc.	etc.	etc.	etc.	etc.	etc.	etc.	etc.	etc.
Avg		72.1	47.7	30.8	15.1	12.4	1.1	100.0

[a]Data shown for exemplary purposes only.
[b]Percentage of vehicle-parties stopping in rest area which used designated facility.

TABLE 15

RELATIONSHIP[a] OF VEHICLE-PARTIES STOPPING DURING NOON HOUR TO VEHICLE-PARTIES STOPPING TO EAT, SHADY SPOT REST AREA

Day	Vehicle-Parties (no.)		Percent of Vehicle-Parties Stopping During Noon Hour to Eat[b]
	Total Stopping	Stopping to Eat	
Weekday	19.2	10.6	55.2
Saturday	26	18	69.2
Sunday	31	23	74.2
Avg.	21.9	13.4	61.2

[a]Data shown for exemplary purposes only.
[b]Potential users of tables and benches.

General Comments.—Summaries of the rest area occupant and interview comments should be prepared from the remarks entered at the bottom of the rest area interview forms. The daily report of rest area operations made by the study crew chief will also aid in the analysis of the observer comments. As a means of organizing the many diverse comments received and shown on the interview forms, it is suggested that extracts of typical comments be compiled from the rest area interview forms into four categories:

1. Favorable occupants comments.
2. Unfavorable occupants comments.
3. Favorable observers comments.
4. Unfavorable observers comments.

TABLE 16

RELATIONSHIP[a] OF VEHICLE-PARTIES STOPPING DURING NOON HOUR TO VEHICLE-PARTIES STOPPING TO EAT

Rest Area	Route	Vehicle-Parties (no.)		Percent Stopping to Eat During Noon-Hour[b]
		Stopping	Stopping to Eat	
Shady Spot	I-50	21.9	13.4	61.2
Sleepy Hollow	I-50	19.0	12.2	64.2
etc.	etc.	etc.	etc.	etc.
Avg.		21.4	12.9	60.3

[a]Data shown for exemplary purposes only.
[b]Potential peak table use.

TABLE 17

RELATIONSHIP[a] OF PERSONS USING RESTROOMS TO VEHICLE-PARTIES ENTERING REST AREA, SHADY SPOT REST AREA

Day	Number of Vehicle-Parties Entering Rest Area	Number of Persons Using Restrooms	Restroom Use (persons/vehicle-party)
Weekday	185	293	1.6
Saturday	230	345	1.5
Sunday	245	373	1.5
Avg.	200	312	1.6

[a]Data shown for exemplary purposes only.

TABLE 18

RELATIONSHIP[a] OF PERSONS USING RESTROOMS TO VEHICLE-PARTIES ENTERING REST AREA

Rest Area	Route	Number of Vehicle-Parties Entering Rest Area	Number of Persons Using Restrooms	Restroom Use (persons/vehicle-party)
Shady Spot	I-50	200	312	1.6
Sleepy Hollow	I-50	165	250	1.5
etc.	etc.	etc.	etc.	etc.
Avg.		190	280	1.6

[a]Data shown for exemplary purposes only.

A review of this compilation will ordinarily disclose a pattern of typical comments, and an evaluation of the data then can be made.

PREPARATION OF REPORT

The following suggestions for report content are intended as a guide only and should not be considered as restricting the report content. A broad report outline is shown to indicate a logical order of data presentation and report content based on the data collection and analysis procedures previously described. The narrative accompanying the analysis tables and charts should summarize the most important and significant data, and indicate meaningful relationships shown by comparison of data at the various study sites.

TABLE 19

MEANS[a] OF LOCATING REST AREA, SHADY SPOT REST AREA

Means	Number of Vehicles Stopping	Percent of Total
Road map	58	4.6
Road signs	642	51.0
Previous visits	420	33.3
Other	116	9.2
Undetermined	24	1.9
Total	1,260	100.0

[a]Data shown for exemplary purposes only.

Suggested Report Outline

A. Introductory Pages

1. Title page
2. Preface
   a. Reason for report
   b. Purpose of study
   c. Acknowledgments
3. Table of Contents
4. List of Tables and Figures
5. Introduction

B. Conclusions

State significant conclusions that have been drawn from and are supported by findings of the study. Such conclusions might include statements regarding potential amounts of use of certain types of rest areas or facilities; the effect of rest area location, types of facilities, signing, and design on the amount or character of rest area use; the adequacy of existing rest area facilities; deductions pertaining to required rest area spacing; and the adequacy of rest area maintenance.

C. Summary of Findings

The summary of findings should include, but not be limited to, the following:

1. Statements of the average daily number of vehicles and percent of highway traffic entering the rest areas.
2. Statements of the average and peak moment accumulations of vehicles in the rest areas (number and percents).
3. Statements regarding the findings of any control conditions on the amount and types of rest area use (advance signing vs no advance signing, shoulder parking vs no parking, freeway vs expressways, etc.).
4. Statements of peak periods of rest area use (hour, day of week) and relative use during these periods.

5. Statements of the average time and distance since last stop and the percentage of rest area stops that occur within specified times and distances since last stop which are indicative of current policy on rest area spacing.
6. Statements of the amount of rest area use by vehicle type.
7. Statements of the amount of use of rest area facilities (parking, table-bench units, restrooms, drinking water, etc.).
8. Statements regarding primary purposes of rest area stops (percent of vehicle-parties stopping for various purposes).
9. Statements of the average number of persons per vehicle entering the rest area and significant differences, if any.
10. Statements of the proportions of in- and out-of-state vehicle use of rest areas (vehicle registration data).
11. Statements of the proportion of entering rest area vehicle traffic that

Shady Spot Rest Area

Week Beginning	Day of Week						
	Sun.	Mon.	Tue.	Wed.	Thur.	Fri.	Sat.
July 2	-	385	396	362	375	389	410
July 9	468	362	341	321	384	371	460
July 16	492	372	392	341	362	355	442
July 23	462	369	382	391	400	425	489
July 30	441	341	381	361	345	367	449
August 6	497	321	352	339	360	368	-

Sleepy Hollow Rest Area

Week Beginning	Sun.	Mon.	Tue.	Wed.	Thur.	Fri.	Sat.
July 2	-	275	281	306	291	317	392
July 9	367	270	291	269	268	284	381
July 16	352	286	300	277	287	289	402
July 23	371	296	269	276	274	246	410
July 30	361	293	301	300	299	266	380
August 6	349	291	268	294	285	278	-

(Data shown for exemplary purposes only)

Figure 14. Rest area traffic volume count summary.

stops in the rest area and the primary reasons for not stopping.
12. Statements regarding occupant attitudes toward rest areas and major points of satisfaction and dissatisfaction.
13. Statements regarding evaluations of operation of the rest areas as determined by observers and occupants comments.

D. Study Methodology

1. Selection and description of study sites.
2. Description of data collection.

E. Analysis

1. Traffic volumes.
2. Rest area use.

F. Case Histories

G. Appendix

1. Rest Area Interview Form.
2. Rest Area Traffic Volume Count Summary (Fig. 14).

REFERENCES

1. "Safety Rest Areas on Interstate Highways." U.S. Department of Commerce, Bureau of Public Roads, Circular Memo. (August 6, 1959).
2. "Parking Turnouts and Rest Areas." HRB Special Report 7 (1951).
3. "A Policy on Safety Rest Areas for the National System of Interstate and Defense Highways." AASHO (April, 1958).
4. "Freeway Operations." Institute of Traffic Engineers (1961).
5. "Shoulder Use Study Procedure Guide." HRB Correlation Circular 426 (Aug. 1960).
6. Ohio Department of Highways, unpublished data on rest area use (Aug. 1961).

Appendix A

STATISTICAL ANALYSIS

Sample Size Determination

The purpose in this appendix is to describe a statistical method of estimating the sample size required to provide data with sampling errors at or below a given value. In other words, what is the sample size necessary so that the proportional sampling error of certain statistics will be within a specified range?

In the instance of rest area studies, it is desirable to ascertain the sample size needed to determine the average percent of highway traffic entering the rest area in a 24-hour period and the average number of vehicles accumulated during the daily peak moment within reasonable accuracy (± 10 and ± 20 percent, respectively).

A standard sample size determination method may be applied as follows:

If C = allowable proportional error in sample mean;

P = daily sample percent of highway traffic entering rest area;

$\overline{P}$ = average of daily sample percents;

σ_P = standard deviation of sample percents;

$t_{0.05}$ = critical value of t exceeded only 5 times in 100 as obtained from t distribution for appropriate number of degrees of freedom; and

N = number of sample days;

then,

$$|C\overline{P}| = t_{0.05}\sigma_P/\sqrt{N-1} \quad (1)$$

Solving Eq. 1 for N,

$$N = \frac{1 + t^2_{0.05}\sigma_P^2}{C^2\overline{P}^2} \quad (2)$$

Eq. 2 may be expressed in raw score form for easy machine calculation as follows:

$$N = 1 + \frac{t^2_{0.05}[(N\Sigma P^2) - (\Sigma P)^2]}{C^2(\Sigma P)^2} \quad (3)$$

A percentage of traffic P in Eq. 3 would be established from each day's highway and rest area traffic recorder counts, and the derived sample percentages P would be used in calculating the required sample size. If a larger sample were indicated by the required number of days N to achieve the desired accuracy, additional counts should be taken.

The sample evaluation procedure as just described applies to the required sample size for determining the average peak-moment vehicle accumulation in the rest area. In this instance, the number of vehicles accumulated each day at the peak moment X would be substituted for P in Eq. 3,

$$N = 1 + \frac{t^2[(N\Sigma X^2) - (\Sigma X)^2]}{C^2(\Sigma X)^2} \quad (4)$$

The following is an example of the sample size computation applied to peak moment vehicle accumulation data for a 7-day sample at an Oregon rest area: Number of Vehicles accumulated at peak moment X for each day = 9, 9, 8, 7, 9, 11, and 13; $\Sigma X = 66$; $C = 0.2$; $\Sigma X^2 = 646$; $\overline{X} = \frac{\Sigma X}{N} = 9.429$; $\sigma_X = \frac{1}{N}\sqrt{N\Sigma X^2 - (\Sigma X)^2} = 1.841$; $t_{0.05} = 2.247$ (6 degrees of freedom); and $N = 7$. Substituting in Equation 4,

$$N = 1 + \frac{(2.447)^2[7(646) - (66)^2]}{(0.2)^2(66)^2} = 1 + \frac{993.977}{174.240} = 6.705$$

Thus, 7 days would be sufficient sample size to achieve the desired accuracy of ±20 percent, 95 times in 100.

Method of Evaluating Variability of Given Sample

If a sample of a given size has been obtained, it is desirable to analyze the variability of the data in terms of the relative accuracy of the major statistic derived. To determine the variability in terms of expected percent of error, Eq. 1 may be rearranged for the solution of C, the proportional error of the sample mean, as

$$C = \frac{t_{0.05}\sigma X}{\sqrt{N-1}\,(\overline{X})} \quad (5)$$

Here, all components have the same meaning as in Eq. 1 except that X is substituted for P. Applying this equation to the peak moment vehicle accumulation data used in the previous example,

$$C = \frac{2.447(1.841)}{\sqrt{6}\,(9.429)} = \frac{4.505}{23.101} = 0.195$$

This result is interpreted to mean that the sample average peak-moment vehicle accumulation is expected to be within ± 19.5 percent of the true mean, 95 times in 100.

Stating the variability of the sample in terms of the confidence interval of the mean by use of the t-distribution, where μ is the population mean;

$$\overline{X} - \frac{t\sigma}{\sqrt{N-1}} \leq \mu \leq \overline{X} + \frac{t\sigma}{\sqrt{N-1}} \qquad (6)$$

Substituting the components of the example, $\frac{t\sigma}{\sqrt{N-1}} = \frac{2.447\ (1.841)}{\sqrt{6}} = 1.839.$

Substituting in Eq. 6 and rounding to the nearest tenth, the mean of the population can be expected to lie between 7.6 and 11.3, 95 percent of the time.

Appendix B

DESCRIPTION OF REST AREA AND RELATED INFORMATION

Rest Area _____ Date _____

1. Highway No. _____, _____, _____, _____, _____.
   Milepoint, No. Lanes, Lane Width, Shoulder Width

2. General Description of Rest Area (Physical size, geographic location, physical features, topography, recreational aspects, visibility from highway).

3. Inventory of Facilities:

   (a) Restrooms (Number and type).

   (b) Table and bench units (Number and location).

   (c) Cooking facilities (Type, number, and location).

   (d) Parking facilities (Type, number of spaces, size).

   (e) Other facilities (Shelters, drinking fountains, telephones, informational signboards, electrical outlets, camp sites, et cetera—number and type).

4. Log of signs related to rest area use (rest area signs, sign for nearby State Parks or nearby public or private rest area facilities, and regulatory shoulder parking signs).

Sign	Milepoint	Comments (Direction of travel served, miles from rest area, size, condition).

5. Log of Service Stations, Parks, Cities, and other private or Public Rest Areas within 15 miles of the study Rest Area.

Name	Location	Description

6. Sketch of Rest Area (Show general plan of rest area in relation to highway, access roads, parking, facilities locations).

7. Sketch map of rest area (Scale 1" = 1 mile) and surrounding area about five miles each side of area. (Obtain from Highway Department maps).

8. Photographs of rest area. (An aerial photo is desiralbe.)