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USER GUIDE FOR AIR FORCE BASE AUTOMOTIVE TRANSPORTATION SIMULAT--ETC(U)
SEP 79 M DUFFEY-ARMSTRONG , S SWOPE F08635-76-D-0132
UNCLASSIFIED AFESC/ESL-TR-79-16-VOL-1 NL

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ESL-TR-79-16

USER GUIDE FOR THE AIR FORCE BASE AUTOMOTIVE TRANSPORTATION SIMULATION MODEL-BATS

VOLUME I: DATA COLLECTION AND REDUCTION

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DDC
JAN 11 1980
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SEPTEMBER 1979

FINAL REPORT
JUNE 1978-SEPTEMBER 1979

APPROVED FOR PUBLIC RELEASE;
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REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1 REPORT NUMBER: ESL-TR-79-16 - Vol I - 1

2. GOVT ACCESSION NO.

3 RECIPIENT'S CATALOG NUMBER

4 TITLE (and Subtitle): USER GUIDE FOR THE AIR FORCE BASE AUTOMOTIVE TRANSPORTATION SIMULATION (BATS) Volume I: Data Collection and Reduction

5 TYPE OF REPORT & PERIOD COVERED: Final Report, June 1978 — September 1979

6. PERFORMING ORG. REPORT NUMBER

7 AUTHOR(s): Marilyn Duffey-Armstrong, Susan Swope, Richard Sandys

8. CONTRACT OR GRANT NUMBER(s): F08635-76-D-0132

9. PERFORMING ORGANIZATION NAME AND ADDRESS: SRI International, 333 Ravenswood Avenue, Menlo Park, California 94025

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: 1210 1

11. CONTROLLING OFFICE NAME AND ADDRESS: Air Force Engineering & Services Center, RDVA, Tyndall Air Force Base, Florida 32403

12. REPORT DATE: September 1979

13. NUMBER OF PAGES: 167

14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)

15. SECURITY CLASS. (of this report): UNCLASSIFIED

15a. DECLASSIFICATION DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Available in DDC

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

BATS - Base Automotive Transportation Simulation
AQAM - Air Quality Assessment Model
transportation model
data base
data reduction
simulation
computer model
motor vehicle emissions
motor vehicle transportation

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This user guide describes the collection and preparation of information required by the Base Automotive Transportation Simulation (BATS) computer model. The BATS model predicts traffic volumes on an Air Force installation's roadway network using land-use, transportation and demographic data. The data collection procedure is presented in a step-by-step format with information sources clearly identified. The data collection procedure is divided into discrete tasks so that the information can be collected at different time periods. A master checklist enables a supervisor to efficiently manage the data collection tasks for the

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cont.

personnel available. The entire data reduction and encoding procedure to create a BATS input computer card deck is also explained.

PREFACE

This report contains the data collection and reduction procedures for the Base Automotive Transportation Simulation (BATS) computer program developed during the period June 1978 - September 1979 by SRI International, Menlo Park CA, under contract F08635-76-D-0132, with HQ Air Force Engineering and Services Center/RDVA, Tyndall AFB FL 32403. Lieutenant Harold A. Scott, AFESC/RDVA, managed the project.

A special thanks is given to the Davis-Monthan AFB, Tinker AFB and Williams AFB civil engineers and civil engineering personnel for their excellent support of the project's data collection phase.

Ms Patricia Simmon and Mr Russell Trudeau of SRI International, along with authors, performed the data collection for the development of this report and the BATS model.

This report has been reviewed by the Office of Information (OI) and is releasable to the National Technical Information Service (NTIS). At NTIS, it will be available to the general public, including foreign nations.

This report is approved for publication.

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SECTION I

INTRODUCTION

WHO SHOULD USE BATS AND WHY

The Base Automotive Transportation Simulation Model, referred to by its acronym, BATS, is a computer model developed for the Air Force by SRI International (formerly Stanford Research Institute). Designed to model an air base traffic network using available land-use, operations, and traffic data, the BATS model is helpful in planning new roads, locating building sites, initiating traffic control strategies, and estimating environmental and energy effects of air base motor vehicle traffic. The primary benefits of this model are that it reduces the need for costly traffic surveys and that it allows a change to the physical characteristics of the base to be assessed prior to the action, thus reducing the risk of costly mistakes.

Typical air base users identified by SRI during the development of the model include the civil engineer in charge of traffic control, the civil engineer responsible for maintaining environmental standards, the security police who sometimes must estimate traffic flow on the street network, and the base planners responsible for siting new buildings and maintaining the master plan.

The BATS model computer program runs on the CDC 6400/6600. To use the program, the user must complete the BATS data collection and computer coding forms described in this manual and submit these along with the computer program (i.e., BATS) to the computer center. The result is a simulation of the base traffic flow, which can be in the form of a computer printout (a listing of traffic volume on the base), a graphic display of the traffic flows, or a data file of vehicle flows that can be input directly to the AQAM (Air Quality Assessment Model).

The outputs of the BATS program can be used in many different ways. For example, the base traffic engineer can use the plot (map) showing traffic flow to identify streets in the network that are being utilized at or near capacity without conducting a traffic survey. The computer printout can be used to identify where vehicle trips originate and where they go, the amount of delay experienced at each intersection, and the overall effects on travel time of improvements in traffic control. In addition, the BATS results can be used to project air quality in and around the base (using the AQAM model) and to determine energy consumption related to the number and types of vehicles, vehicle occupancy, and the miles traveled by base personnel. Specific examples of the types of problems that can be addressed by using the BATS model are described below.

Improving Traffic Flow--The environmental and traffic engineers at a base wished to improve the flow of traffic on two main streets on the base. The two streets had one lane going in each direction. They were parallel streets, adjacent to each other, and met at a Y intersection near the main gate. The traffic engineer proposed making them into one-way streets with two lanes each, one traveling east and the other west. The proposed plan could relieve congestion and crossing conflicts at the Y intersection, but could result in an increase in both congestion and vehicular miles traveled on adjoining side streets.

The traffic network for the entire base was defined. The base was divided into zones based on the land-use characteristics of each block. The number of work trips, shopping trips, service-oriented trips, external trips, and military vehicle trips were determined for each zone. These data were then input to BATS and a descriptive run of base traffic from 6:00 a.m. to 6:00 p.m. was made. The BATS model was then rerun with the two main streets defined as one-way streets. The actual situation and the simulated situation were compared to see which showed fewest vehicle miles traveled, least delay, and shortest average vehicle running time. Comparing the results of the two runs made it possible to determine the likely advantages and problems of the one-way streets.

Relocating a Key Building--The traffic engineer at a base was asked by the base planners to assess the effect of moving the commissary to a new location near the BX. The existing commissary was located close to a main gate and access road; thus, traffic to the store had little conflict with cross-base traffic. The proposed location, however, would require traffic to travel on, or to cross, the main cross-base thoroughfare. The question to be resolved was whether congestion would occur due to the relocation, and if so, what kind of new control (signal) would be required to relieve the congestion.

As with most simulations, a descriptive run of the current base traffic flow was made to represent the status quo, and then a predictive run was made to simulate the congestion caused by the new location. Congestion was predicted at one two-way stop intersection. A third predictive run showed that this congestion would be alleviated by installation of a vehicle-actuated signal at the intersection.

Determining Impact of Bus Service--The civilian community near an air base proposed routing some buses to the base and wished to predict the change in air pollution and in peak hour congestion due to ridership (numbers of passengers) on the buses.

Both a descriptive and a predictive run were made of the base. The descriptive run showed some congestion during the peak rush hours. The predictive run indicated a net savings in average travel time when buses were used to carry a higher percentage of the peak hour travelers. Vehicle running time and vehicle miles traveled were less with the bus service than without it. Although AQAM was not run for the base as part of the study, it was logical to assume that vehicle emissions (particularly carbon monoxide) would be less with the buses operating

than without. The civilian community might further use the models to evaluate the cost effectiveness of the proposed bus service as compared to widening access roads or installing additional traffic controls.

Changing Shift Times--At one air base a steady increase in personnel working on the base resulted in morning and evening commute hour congestion. To determine whether a change in the shift time for some organizations would relieve the congestion, the BATS was used to model the existing situation and to portray 15-minute counts during the morning and evening rush hours. The descriptive run showed the morning and evening congestion much as it occurs on a typical work day.

The shift hours of selected organizations were then changed on the BATS input forms so that the arrivals and departures from the base would be distributed more evenly, thereby relieving congestion. The model predicted a significant decrease in congestion if the shift time were changed to spread the traffic more uniformly over each 15-minute period of the rush hour. The traffic engineer could then recommend to the Base Commander what work shifts could be changed to reduce the congestion.

Estimating Vehicle Emissions--A metropolitan community found that the carbon monoxide standard was being exceeded in the downtown area. Because the air base was close to the downtown area, the base civil engineer was asked to undertake a study in the community interest to determine the contribution from the air base to the carbon monoxide level. BATS was used in conjunction with the AQAM model to determine the contribution resulting from on-base vehicle movement. This estimate served the need of the community and saved the base from having to do actual monitoring.

OPTIONAL WAYS TO RUN BATS

The many options built into the BATS model require different amounts and types of input. A quick, generalized simulation will require far fewer specific details than a thorough analysis. Standard data were developed from the three bases studied to cover average or typical situations. These standard data are also referred to as proxy data or default parameters. The term "default parameter" simply means that unless another, base-specific number is entered into the computer, the standard number, internal to the model, is used by default.

Each analysis requires completion of Tasks 1-4, those tasks that describe the base roadway system (network) and that divide the base into zones by principal land uses. However, depending upon the problem under consideration, only some calibration tasks will need to be completed. For example, if the problem is congestion during the morning and evening commute hours, to see how best to lessen that congestion by changes in shift times, base-specific information will be needed on:

- The number of persons working in each zone
- Their shift times

- The average number of persons per vehicle used to transport employees to and from work
- The roadways they use.

However, noncommute hour trips such as midday shopping or lunch hour trips would not be a concern.

If, on the other hand, vehicular traffic generated by midday trips on the base is being studied, it would be necessary to collect base-specific data on trips to shopping, service, and recreation areas on the base, plus gate counts to indicate travel to and from areas off the base. The default parameters would be allowed to generate commute hour trips, because they are not of concern for this application of the model.

The user may, therefore, choose to use many or few of the default values provided in the model, depending upon the problems to be solved or upon time and manpower constraints.

Once BATS has been run for a particular base, future runs for that base will require the user to:

- Make only those changes to the existing data base that reflect changes that have taken place on the base since the last run
- Collect data required for the new problem being studied, which were not needed and therefore not collected for previous runs.

Thus, the user will not find it necessary to go through every step in the manual each time BATS is used. Instead, each additional use will increase the number of applications to which the model can be applied.

SECTION II

ASSEMBLING THE COMPUTER INPUT DATA

ORGANIZATION OF THE DATA ASSEMBLY GUIDE

Each task in this user guide is completed by following a series of steps. Tasks 1-4 are necessary for any application of BATS. These tasks follow a logical progression using information acquired from the preceding tasks.

Tasks 5-7 are collected only for specific applications of BATS. A table listing which tasks are necessary for various options is explained in the model documentation. Terms that may be unfamiliar are explained the first time they are used and are also included in the Glossary. Three basic types of data must be collected to complete the coding forms, which are then keypunched onto cards to be read by the computer. These basic data types used to model air base vehicular movement are outlined below:

- o Network Definition Data
  - Scaled maps of the base, including parking lots, building location, and access roads.
  - Traffic engineering characteristics of each road and intersection, such as number of lanes, traffic signals, and speed limit.
  - Link-end coordinates and link numbers.
  - Zone definition including access links and a symbol, either alphabetic or numeric, which identifies each zone.
- o Trip Generation Data
  - Demographic variables, including population, civilian employment, military employment, BX or commissary dollar sales, retired military population, and number of military vehicles assigned to organizations in each zone.
  - Time-of-day coefficients to generate person-trips using the demographic variables. Coefficients are required for each trip purpose. Most of these are provided for the user.
  - Vehicle load factor (number of persons per vehicle).

- Number of vehicles of each type -- light-duty vehicle, light-duty truck 1, light-duty truck 2, heavy-duty gas truck, heavy-duty diesel truck, and motorcycles.

o Calibration Data

- Parking lot counts of the number of vehicles entering, leaving, and parked during specified time periods for selected zones.

- Speed and delay (e.g., time spent at stop signs or traffic signals) runs on specified links.

- Major street volume counts.

- Gate counts -- number of vehicles entering and exiting all gates for specified time periods.

- Counts of through-volumes (vehicles using the road but not going to or leaving the base) on base-access roads.

DATA COLLECTION TASKS

In most cases, data collection tasks will be performed by on-base personnel from the Base Civil Engineering Office. However, if data collection is to be performed by an outside agency, Appendix B describes appropriate procedures.

Task 1: Assemble Resource Documents From Air Force Offices

Because one objective of this model is to extract as much of the necessary information as possible from existing Air Force records, the locations of a number of key documents having much of the data are identified below. These documents should be assembled and stored in one central location for continued reference by BATS users. They should be inventoried and updated annually. The following offices, all of which may be under the jurisdiction of the Base Civil Engineering Office, contain relevant information and documents:

o The Base Civil Engineering Office

- Two 1" = 400' scaled maps and two 1" = 200' scaled maps of the AFB showing all on-base buildings, roads, parking areas, intersections, external access roads, and gates to the base.

- A transportation or planning document describing traffic operation characteristics of each road on the base, including speed, number of lanes, intersection configurations and controls, parking restrictions, and road width.

- Any previous traffic engineering studies undertaken for the AFB.

- Parking lot map showing location and capacity of major parking lots on the base.

- Three printouts of facility occupant information from the BLIS Report:

  (1) A listing of all buildings on the base in order by building number

  (2) A listing of all base buildings alphabetically by the custodian's last name (Figure 1).

  (3) The same as listing number 2 (Figure 2), but double-spaced, with only one custodian (and the buildings for which he or she is responsible) on each page. This should be prepared by the computer in the format shown below.

PREPARED: (date filled in by computer)

B-L-I-S R-E-P-O-R-T
REQUEST FOR FACILITY OCCUPANT INFORMATION

CUSTODIAN:
(The computer will fill in the custodian's name here)

ORGANIZATION SYMBOL	FACILITY NUMBER	NUMBER OF PERSONNEL ASSIGNED TO BUILDING			NORMAL DUTY HOURS
		MILITARY	CIVILIAN	TOTAL	
(The computer will fill in these two columns).					

FIGURE 1. BLIS REPORT – REQUEST FOR FACILITY OCCUPANT INFORMATION

EXAMPLES: Listing Number 2 will look like this:

PREPARED 78 SEP 26 CAN #

B-L-I-S R-E-P-O-R-T

MASTER CUSTODIAN REQUEST LISTING

CUSTODIAN	ORGN SYMBOL	FACILITY NUMBER
AMES J H JR	FTD	0480
AREYTA A A	MAMM	0051
ARMSTRONG D L	ACD	0753
BAKER R L	CC	1089
BALDWIN F E	DAP	0483
BARKMAN A M	DESQ	0754

Listing Number 3 will look like this:

PREPARED 78 SEP 21

B-L-I-S R-E-P-O-R-T

REQUEST FOR FACILITY OCCUPANT INFORMATION

CUSTODIAN: WHITTLE H D

ORGANIZATION SYMBOL	FACILITY NUMBER	NUMBER OF PERSONNEL ASSIGNED TO BUILDING			NORMAL DUTY HOURS
		MILITARY	CIVILIAN	TOTAL	
TFTS	0075				

FIGURE 2. BLIS REPORT – MASTER CUSTODIAN REQUEST LISTING AND REQUEST FOR FACILITY OCCUPANT INFORMATION

- Military vehicle information, also from the BLIS report, including total number of vehicles by military organization and by type, and the total yearly mileage for each. The instructions to the computer and a sample of the printout are shown in Figure 3.

```
PREPARED:                                                    CAN #
USING FILE:        FILE CARD:

                          B-L-I-S  R-E-P-O-R-T
                             TRAFFIC SURVEY
                        INQUIRY REQUEST EDIT LIST

        RETRIEVAL REQUEST STATEMENTS
    DEFINE ASGND/ORG              TO BE AN:33:2:
    DEFINE REC/ID                 TO BE AL:1:1:
    DEFINE SITE/CODE              TO BE AN:3:1:
    DEFINE REC-C/O-DT             TO BE UN:773:5:
    DEFINE MILE/HR/CD             TO BE AL:65:1:
    DEFINE MILEAGE                TO BE UN:413:5:
    DEFINE USAF/MAN/CD            TO BE AN:21:4:
    SELECT REC/ID = "C" AND SITE/CODE = "W" AND MILE/HR/CD = "M" AND
    REC = C/O = DT  "7
    7273"
    OUTPUT INFO
    SORT ASGND/ORG                USAF/MAN/CD MODEL/YEAR
    PAGE ASGND/ORG
    TALLY ASGND/ORG               USAF/MAN/CD
    TOTAL MILEAGE
    TITLE "MILITARY VEHICLE UTILIZATION"
    PRINT SUMMARY MILEAGE
```

```
PREPARED:  (computer will fill in date)

                          B-L-I-S  R-E-P-O-R-T
                     MILITARY VEHICLE UTILIZATION
MILEAGE

TOTAL     1813
TALLY               FIELD IS USAF/MAN/CD    CONTENTS ARE B193    COUNT IS  11

TOTAL     2442
TALLY               FIELD IS USAF/MAN/CD    CONTENTS ARE B204    COUNT IS  11

Key:  In this example,
      1813 is the total yearly mileage
      ( /MAN/CD) is the organization to which the vehicle is assigned
      B193 is the type of vehicle
      11 is the number of vehicle maintenance records (number of vehicles
      would, therefore be 11/11 or 1 vehicle).
```

FIGURE 3. BLIS REPORT – TRAFFIC SURVEY INQUIRY REQUEST EDIT LIST AND MILITARY VEHICLE UTILIZATION

- A listing explaining the military vehicle codes (B193 in Figure 3 above).

o The Base Environmental Planner

- The TAB A-1 Environmental Narrative for the AFB, the base management summary, or other summary of base personnel characteristics. The information needed is capacity and occupancy rate of dormitories, including bachelor officers' quarters and transient quarters, and the amount and occupancy rate of family housing available on the base.

- The Source Emissions Inventory (list of sources of air pollution on the base) collected as inputs to the AQAM (if one exists).

- The base telephone directory.

- Base organizational chart.

o The Base Planning Office

- A land-use map, color-coded if available.

o The Base Real Estate Office

- Current listing of all buildings on base and their occupants. This may provide an alternate source if the first BLIS listing is difficult to obtain. If both are available they provide a cross check on each other. One may also serve to supplement the information on the other.

If the TAB A-1 has not been kept current since its compilation in 1975, other sources for the data will have to be located. Most bases maintain a summary of facts about the base activities and population that is updated annually. The Commander's Office, Base Information Office, and Comptroller's Office are all good places to check for such a document.

If no Source Emissions Inventory has been made, get the exact location (latitude, longitude to the nearest second) of a specific point on the base. Then obtain the UTM coordinates for that location from the U.S. Geological Survey Office at one of the following locations:

EAST of the Mississippi:	WEST of the Mississippi:
US Geological Survey Reston, VA 22090 (703) 860-6167	US Geological Survey Denver, CO 80225 (303) 837-4169

The UTM system is an x-y coordinate system with x being the east-west axis, and y being the north-south axis. Distances in the UTM system are measured in meters. When these coordinates are received, a mylar grid overlay should be prepared for the base map by the Base Civil Engineering drafting office. The grid should be scaled the same as the map, but the grid spacing should be in tenths of kilometers. However, if some other unit is used, Section III provides instructions for converting the input units to meters.

Traffic engineering studies for DOD installations can usually be obtained from the Military Traffic Management Command in Newport News, VA. If only one copy of the land-use map is available, use it to transfer land-use designations to one of the scaled maps provided.

Task 2: Specify the Network

The items required to complete this task include:

- The scaled base maps
- A ruler
- Colored pencils or felt-tipped pens
- A sheet of transparent paper large enough to cover the base area on the 1" = 400' map.

The network to be defined is the roadway system on the base, plus those off-base roads that provide access to the base roadways through the base gates. The network is made up of a number of links that are joined to provide access to buildings on the base. If the following steps are completed, the network definition data for BATS is ready to be transferred to the coding sheets in Section III.

- Step 1: Define the links on one of the 1" = 400' maps.
- Step 2: Number all links in the network.
- Step 3: Identify and record x, y coordinates.
- Step 4: Define intersections.
- Step 5: Number intersections.

Each of these steps is described below.

Step 1: Define the Links

A link is a segment of street or roadway that lies between two end points. End points can be intersections (the meeting of two or more links), or origin or destination points. A link must connect to another link or to an origin or destination point (see Figure 4). Vehicles using the network will always travel from one link to the next through an intersection.

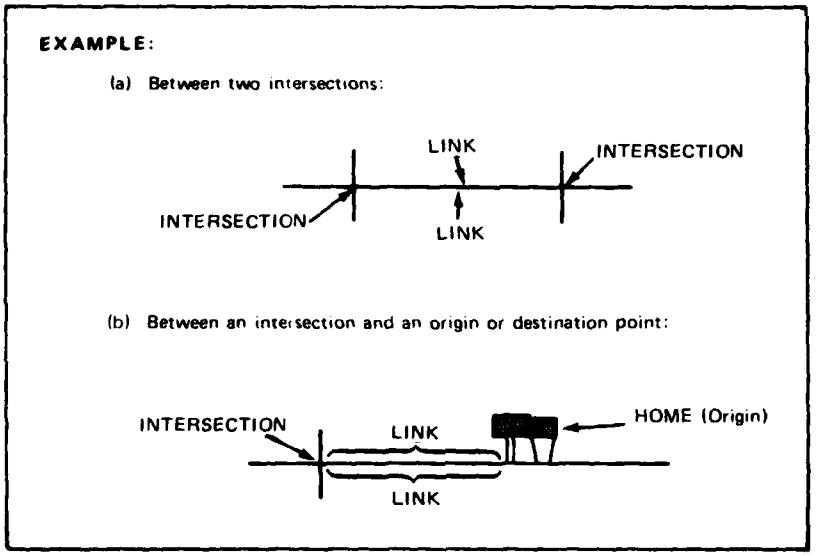


FIGURE 4. LINK DEFINITION

Using one of the 1" = 400' scaled maps and a straight-edge or ruler, draw red lines to define all roadways on the base and those which give access to the base. Next, place a transparent sheet over the base map and retrace the road network. Use this tracing to number the links as described below.

Step 2: Number the Links

Assign each link a number up to a maximum of 240, and write the number beside the link on the transparent sheet on which the roadway network was traced. A link represents one direction of flow; therefore, two-way streets must have two link numbers while one-way streets have only one. Several hints may make this task easier:

- o Begin numbering at one corner or end of the base map.
- o Make the progression of numbers as obvious as possible. Specific links are then easier to locate later on.
- o Be consistent in assigning numbers. (In Figure 5 below, links that travel west or north are assigned odd numbers and links traveling east or south are assigned even numbers.)
- o Having begun with the number 1, whenever a link number is mentioned, the link in the other direction of an odd-number link must be one number higher, and that of an even-numbered link one number lower.

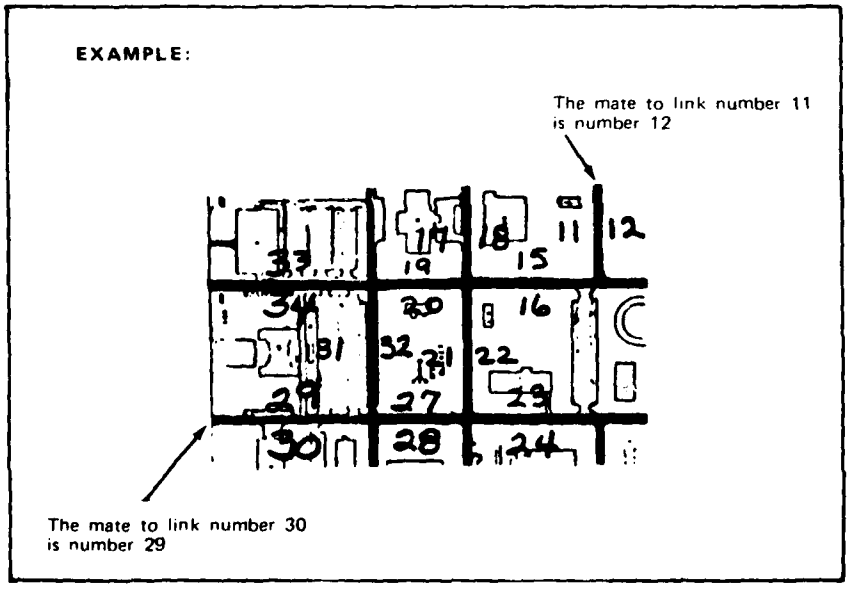


FIGURE 5. NUMBERING LINKS

- For curving roadways, create artificial links to show the curve by breaking the link into two or three links if necessary (see Figure 6).

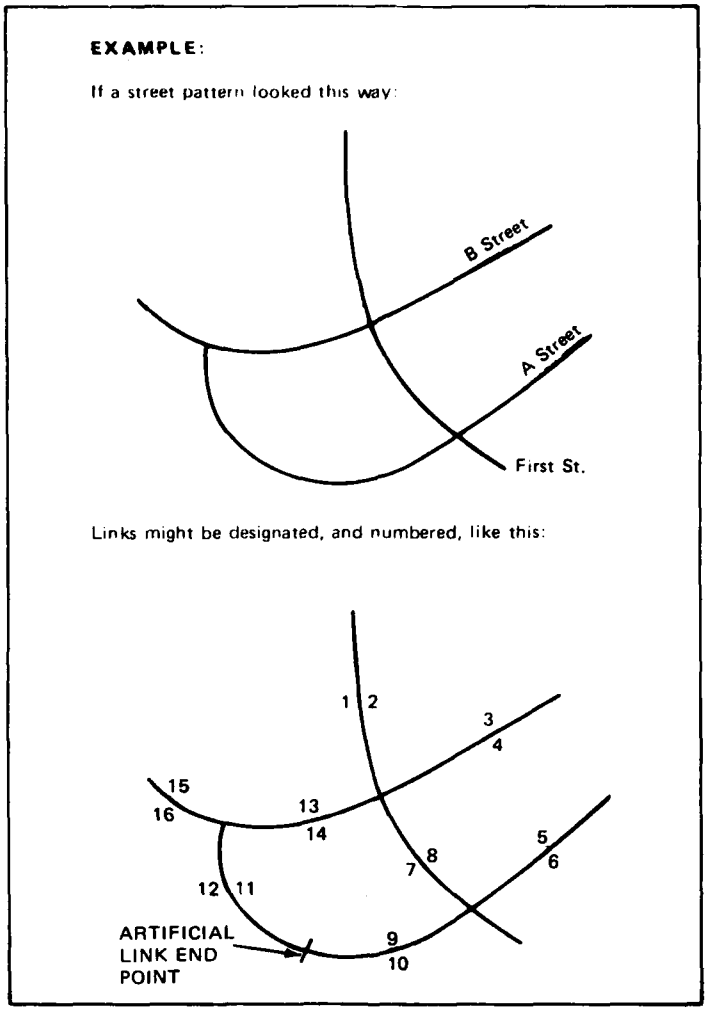


FIGURE 6. NUMBERING CURVED LINKS

- Do all link numbering at one sitting. This will help to avoid accidentally duplicating numbers.

- If there are more than 240 links, eliminate enough of the shorter, less traveled links to bring the total number of interior plus exterior links to no more than 240.

- When numbering is completed, check carefully to be certain that all well traveled links have been numbered.

- o Write the total number of links you have defined at the bottom of the map.

Step 3: Assign x, y Coordinates

Determine the x, y coordinates of the end points of each link. The coordinates of most links are available in the Source Emissions Inventory for the Air Force AQAM model. If new links have been built, or if no Source Emissions Inventory has been made for the base, use the mylar grid overlay prepared by the Base Civil Engineering drafting office for the base map.

To determine the x, y coordinates, place the mylar grid over the map. Then, read off the coordinates of each intersection. Each coordinate will be a 6- or 7-digit number preceded by a letter, such as E571,000 or N839,000 (see Figure 7).

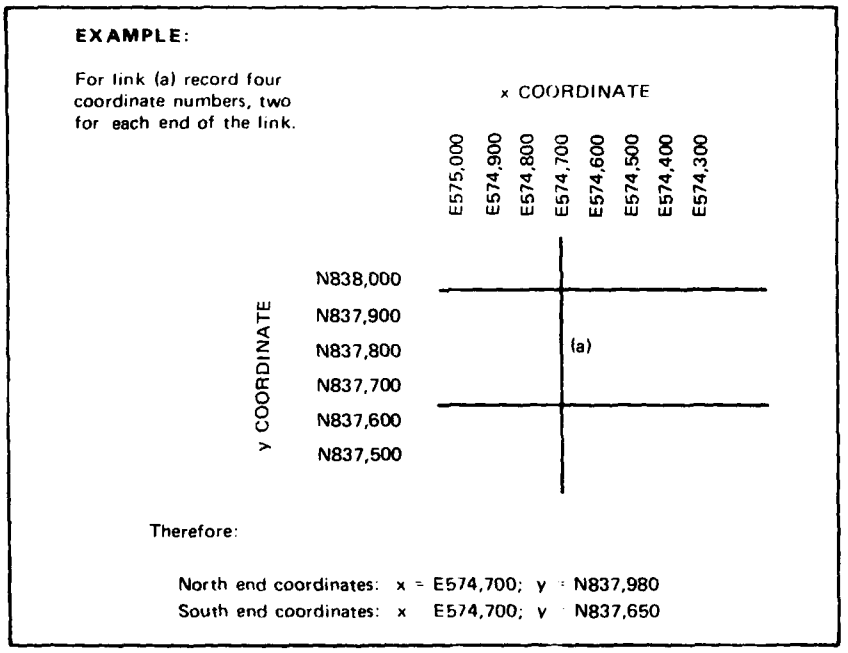


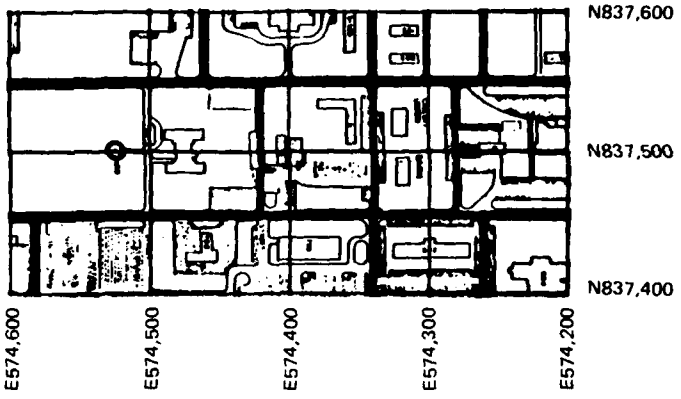
FIGURE 7. FINDING x, y COORDINATES

Write the numbers for each intersection directly on the map as shown in Figure 8. This will aid in checking for errors and can save some work, because at intersections several links share coordinates, as shown in the example.

EXAMPLE:

RECORDING x, y COORDINATES

The grid on the map segment below represents the mylar grid placed over the base map so that the x, y coordinates can be read.



Note the coordinates of each INTERSECTION on the map as shown in the example below. This is easier and more efficient than noting the coordinates of each individual link: because paired links (e.g., 5 and 6) will have identical coordinates and because wherever a number of links meet (an intersection) they will share a set of coordinates.

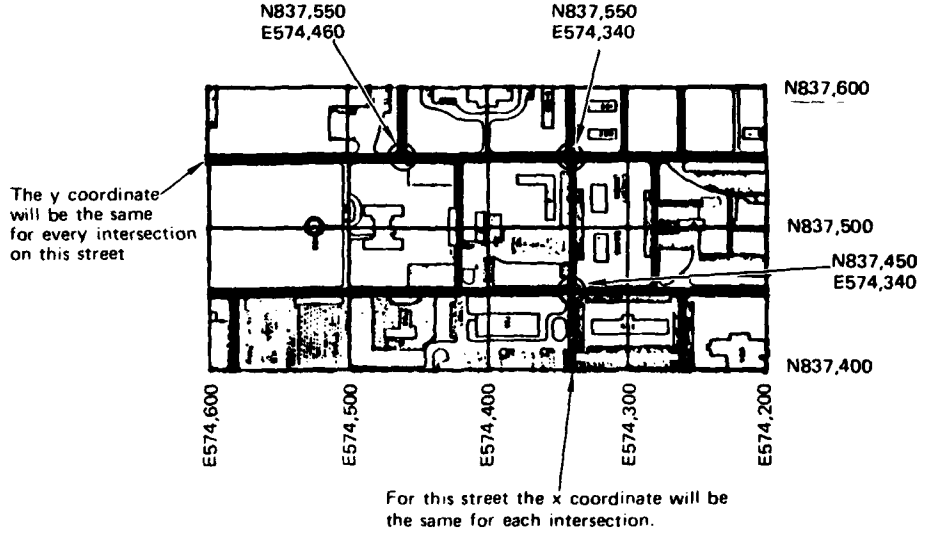


FIGURE 8. RECORDING x, y COORDINATES

Step 4: Define Intersections

Using the transportation or planning document that describes base traffic operation characteristics, mark the traffic controls at each intersection on the same transparent sheet on which the links are drawn (see Figure 9). If this information is not available from a transportation or planning document, drive over the roadway network on the base to collect it and record it on the base map. This requires two people, one to drive and one to mark the intersection controls on the map.

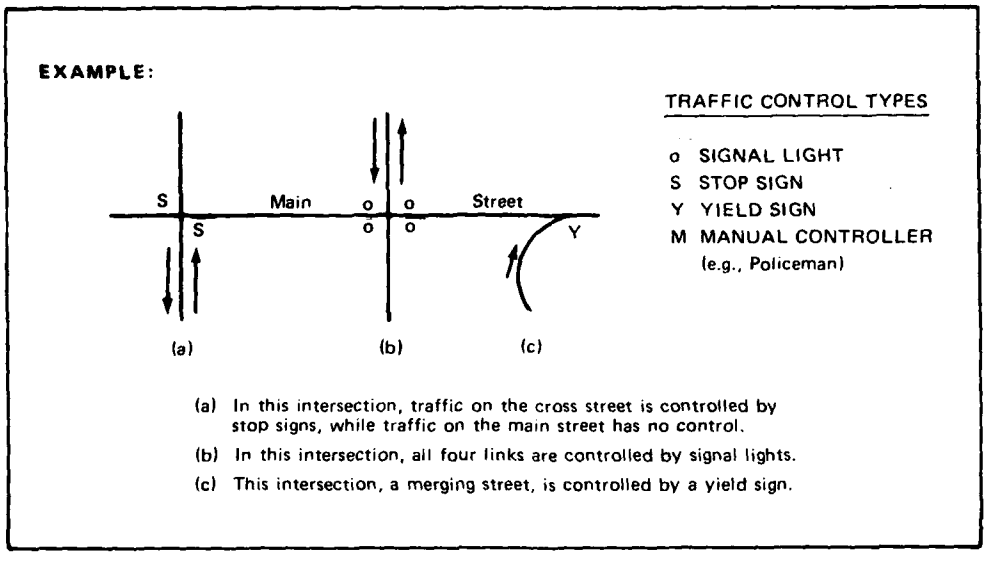


FIGURE 9. DEFINING INTERSECTIONS

At the same time, indicate the speed limits for each roadway, and whether the street is one-way. Examples of these markings are shown in Figure 10.

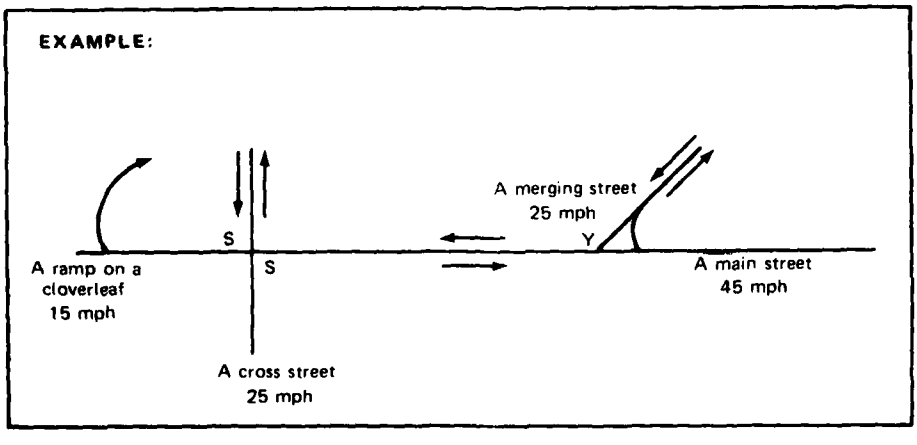


FIGURE 10. MARKING INTERSECTIONS

For each signalized intersection complete a signalized data collection sheet, as shown in Figures 11 and 12.

EXAMPLE:

SIGNALIZED INTERSECTION

Data Collection Sheet

Intersection Number 4

Fixed Time Cycle 60
Actuated Time Cycle —

1) Draw in the number of lanes for each approach
2) Indicate the turning movement permitted from each lane, using arrows
3) Phase lengths (+amber) N 30 S 30 E 30 W 30
   Left turn phase (+amber) N 15 S 15 E 0 W 0
   Amber length _____
4) Flashing operation period (if any) from _____ to _____.

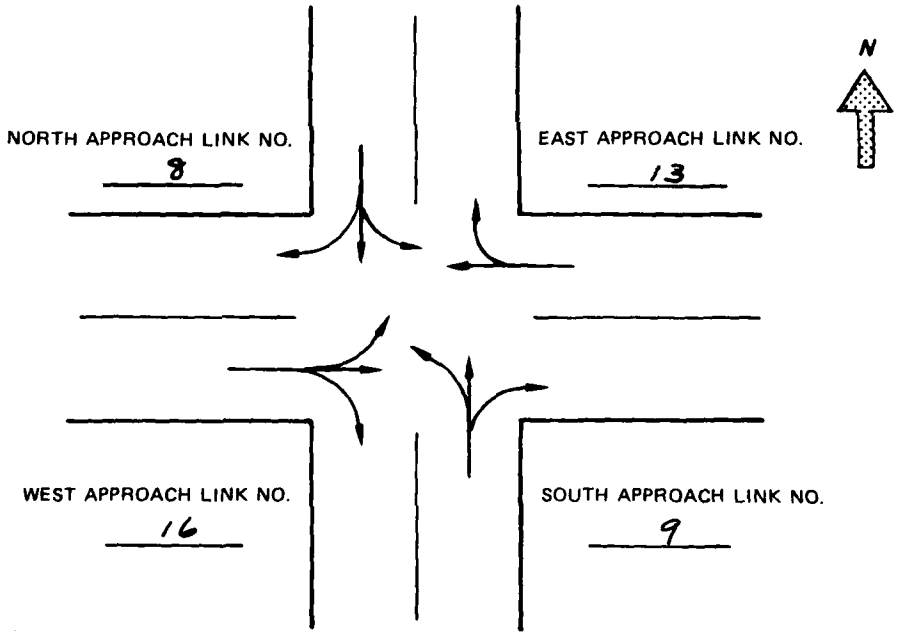


FIGURE 11. COMPLETING SIGNALIZED INTERSECTION DATA COLLECTION SHEET

The fixed time cycle is the number of seconds from the beginning of one red light to the beginning of the next. The actuated time cycle is the sum of the longest possible cycle in seconds that can be set in the control box. This information may be available from the civil engineering office or from the Construction Manager.

SIGNALIZED INTERSECTION

Data Collection Sheet

Intersection Number _____ Fixed Time Cycle _____
Actuated Time Cycle_____

1) Draw in the number of lanes for each approach
2) Indicate the turning movement permitted from each lane, using arrows
3) Phase lengths (+amber) N____ S____ E____ W____
Left turn phase (+amber) N____ S____ E____ W____
Amber length _____
4) Flashing operation period (if any) from _____ to _____.

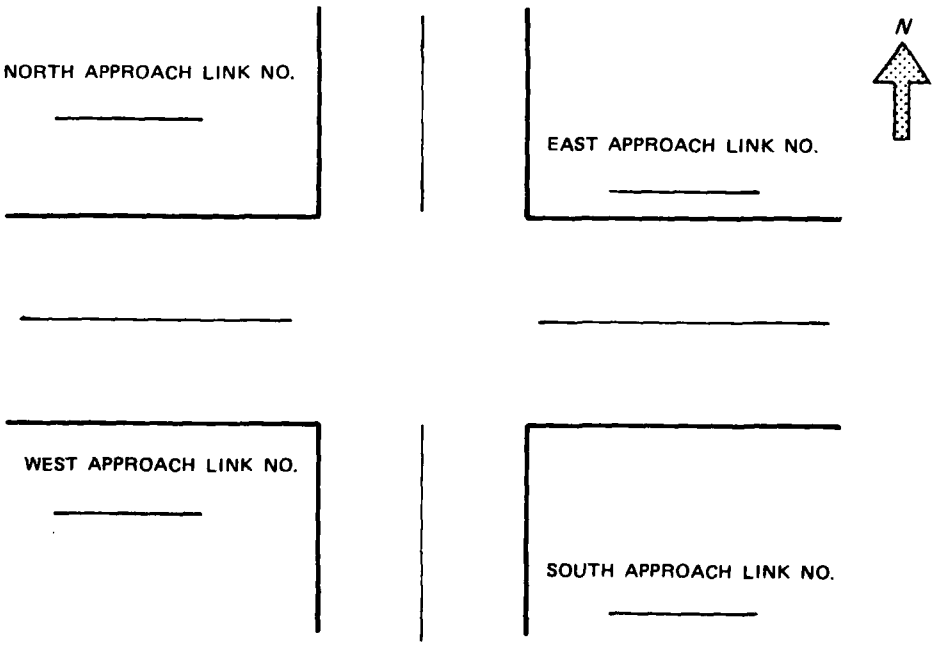


FIGURE 12. SIGNALIZED INTERSECTION DATA COLLECTION SHEET

Step 5: Number Intersections

An intersection number is assigned to the meeting of two, three, four, or more links. All major intersections must be numbered because later the user will assign some time delay caused by cross-street traffic to each numbered intersection, and no delay calculation will be made for intersections that are not numbered. Do not number the four-link intersection at an overpass because through traffic is not delayed in either direction.

Intersections either may be numbered manually, using a different colored pencil than that used for numbering the links, or this operation may be postponed until the intersection can be automatically numbered by the computer using the subprogram NETINT.

NETINT is a special-purpose program designed to number the intersections of the network and identify the approach links. Using the link data as input, NETINT automatically assigns numbers to the intersections. The results (output) of NETINT can then be checked against the map to be certain that the correct links are used to form each intersection, and to transfer the intersection numbers from the computer printout to the map.

Task 3: Define the Zones

A zone is an area with one primary land use, such as housing or recreation. Each land use has particular types of trips associated with it. For example, the area surrounding an officer's club or bowling alley would be classified as a service/recreation area. People make trips to the officer's club for meals and for socializing after work; clearly, the bowling alley attracts people for recreation.

There are two general types of zones: (1) on-base or interior zones and (2) off-base or exterior zones. The size, shape, and location of interior zones must be defined by land use on the scaled map. The six internal land uses are industrial, administrative, flight line, service/recreational, shopping, and housing. Off-base zones are defined only by the inbound and outbound pairs of links that provide access to the base.

Defining the zones correctly is extremely important to the usefulness of the model, because the model's accuracy depends on how well the user defines each zone and the type and number of trips associated with it.

Step 1: Determine the Starting Point

Much of the zone definition may have already been completed. If a traffic engineering study was completed within the last 2 years, it may have divided the base into zones by land use. If such a study

exists, proceed with Step 1a. If there is no recent traffic engineering study but the Civil Engineering Office has developed a land use map, proceed with Step 1b. If neither of these items above is available, go to Step 2.

Step 1a: Using a Traffic Engineering Study

A traffic engineering study may be used if it meets the following criteria:

- Land use was the basis for defining the zones used in the study.
- No more than one major land use is located in any one zone.
- Base land use at the time of the study was essentially the same as it is now.

If land use has changed substantially (for example, if the BX has been moved or a new hospital has been built), the zones must be adjusted to reflect that change. This redefinition might involve dividing what was once one zone into two or including new roadways in the link network.

Compare the base map used by the engineering study with the current base map and note any changes either in building location or in organization location. The base Civil Engineering Office should have personnel who can assist in this task if necessary.

The land use classifications in the traffic engineering study may be somewhat different from those used by BATS. Table 1 lists the BATS land-use classifications, examples of the activities that should be included within each classification, and equivalent terms that might have been used in previous traffic engineering studies or on the base land-use map.

Make whatever adjustments to the zones used by the study that are necessary so that they conform to the land uses in Table 1. When certain that the representation of current base land use is accurate, transfer the land-use designations to one of the 1" = 400' maps using colored pencils to shade the zones as shown in Table 1. Next, go to Step 3.

TABLE 1. LAND-USE CLASSIFICATION

Code	Color*	Classification	Activities	Equivalent Terms
1	Blue	Housing	On-base family and dorm housing (includes BOQ and VOQ)	
2	Orange	Industrial	On-base work zones other than administrative or flight line	
3	Red	Shopping	BX, commissary, thrift shop, gas station	Commercial
4	Green	Service/ Recreation	Hospital, bank, credit union, gym, pool, bowling alley, food service facilities (officer's and NCO clubs)	Community, Parks and Playground
5	No color	External	All off-base activities, whether housing, shopping, or service	
6	Yellow	Administrative	Office buildings	
7	Grey	Flight Line	Work zones connected to and adjoining the flight line	

* Use what is most convenient; these colors are merely suggestions.

Step 1b: Using an Existing Land Use Map

First, note whatever changes may be necessary to adjust the land-use classifications on the land-use map to those used by the BATS model (see Table 1). If the Civil Engineering Office has an extra copy of their land-use map available or if continuing access to their map during the course of the study is possible, and if no changes to the map are needed, proceed to Step 3 below. If most of the work must be done at some other location, use a color-coding system (see Table 1) to transfer the land-use designations from the Civil Engineering Office map to the unmarked 1" = 400' scaled map.

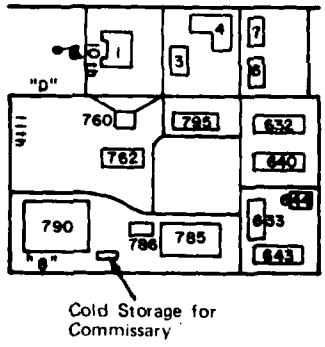
Step 2: Determine Land Use

If the land use map must be developed , use one of the larger scaled maps (1" = 200' if available) so that it is easier to read building numbers and street names. The base telephone directory will also be needed. Alternatively, the real estate section of the Civil Engineering Office may have a listing of the buildings and their occupants. Working either from this or from the base telephone directory, complete Table 2, listing the buildings in numerical order.

Looking at each segment of a base map, first identify what the primary function or activity is for each building. On the typical base, it is likely that:

- Buildings located together are close in their building numbers (e.g., in Figure 13 Buildings 3 and 4 are just across the street from Building 1)
- Generally, buildings with similar or complementary functions are close to each other.

EXAMPLE:



1 Base Commander
3 Accounting and Finance
4 Administrative Services
760 Service Station
762 Communications
785 BX
786 Run-In Chef
790 Commissary
795 Movie Theatre

The figure shows two groups of buildings:

- Buildings 1, 3, and 4 share the same land use and are close to each other.
- Although buildings 760 through 790 have several different land uses, in terms of total number of vehicle trips generated, shopping clearly predominates.

FIGURE 13. DEFINING LAND USE

TABLE 2 INDEX OF LAND USE BY BUILDING

BUILDING NUMBER	ZONE* NUMBER	ORG CODE	OCCUPANT(S)	LAND USE DESIGNATION†

* Will be completed in a later task
† Include code number and classification

These buildings and their land uses would be entered on Table 2 (see Figure 14). Now, note clusters of buildings representing the same land use on the list in Table 2 and locate these buildings on the map (use the larger scale map for reference if necessary). If, as is likely, they are located close to each other, color-code the map, using the land-use coding from Table 1. It may be helpful to outline each building with the color representing its land use as it is identified. This provides an additional visual aid to determining zones.

If a computer listing of buildings in order by number is already available, either from the BLIS report, or from the real estate office, use that to note the land use designation, and the zone number when it is assigned in Step 3.

Step 3: Define a Maximum of 50 Zones

Step 3a: Off-Base Zones

Using either Section 4.2.2.4 of the TAB A-1 or the base management summary (whichever is more recent), make a list by name or by zip code of the communities surrounding the base where more than 5% of base personnel live and shop. At Williams Air Force Base, for example, the external zones designated were Mesa, Tempe, Phoenix, Chandler, Gilbert, and other, for a total of 6 external zones. This left a maximum of 44 on-base zones.

To distinguish between on- and off-base zones, the off-base zones are given a two-letter identification; on-base zones are given numerical identifiers. At Williams AFB, for example, the following designations were used:

MS = Mesa

TM = Tempe

PH = Phoenix

On the map next to the off-base links leading to each of the off-base zones, write the name of the zone and its identifying symbol, for example, Mesa (MS).

Step 3b: On-Base Zones

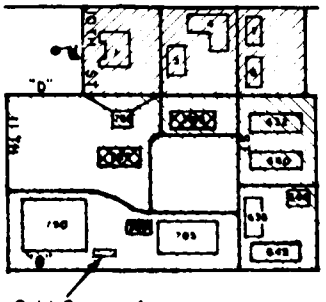
Using the unmarked 1" = 400' map and referring to the land-use map, divide the base into zones by land-use type using a pencil. Remember that there can be no more than 50 zones, including both on- and off-base zones, so there must be a way to revise zone divisions, if

EXAMPLE:

INDEX OF LAND USE BY BUILDING

BUILDING NUMBER	ZONE* NUMBER	ORG CODE	OCCUPANT(S)	LAND USE DESIGNATION†
1			BASE COMMANDER	ADMIN (1)
3			ACCOUNTING AND FINANCE	"
4			ADMINISTRATION OFFICES	"
760			SERVICE STATION	SHOPPING (3)
762			COMMUNICATION OFFICE	ADMIN (1)
781			COMMISSARY COLD STORAGE	SHOPPING (3)
783			RUN-IN CHEF	SERVICE (4)
785			BX	SHOPPING (3)
790			COMMISSARY	"
795			THEATRE	SER/REC (3)

EXAMPLE:



1	Base Commander	ADMINISTRATIVE AREAS
3	Accounting and Finance	
4	Administrative Services	
760	Service Station	SHOPPING AREAS
785	BX	
790	Commissary	
781	Cold Storage for Commissary	
762	Communications	SERVICE/ RECREATION AREAS
786	Run-In Chef	
795	Movie Theatre	

The map segment above is coded according to the land uses described in Table 1, with line hatching taking the place of colors.

FIGURE 14. RECORDING LAND USE (Sample Table 2)

necessary. If, inadvertently, more than 50 zones are designated, the on-base zones must be revised so that more than one land use occurs in some zones. However, only one land use should be dominant. In addition, those off-base zones whose residents use the same roadways to enter the base can be combined. In defining zones, remember that:

- Zones must coincide with roadway links on all but one side.
- Zones may be either large or small. It is unlikely that zones will be uniform in size.
- If a zone is exceptionally large, split it into smaller zones. For example, at Williams AFB the zone in which the BX, commissary, and service station were located might have been split into two shopping zones. Some zones are easier to define than others, as shown in Figure 15.

Step 4: Number the Zones

Number the zones the same way the links were numbered, beginning at one end of the base and moving across the base, so that the progression of numbers is easily seen as shown in Figure 16. Then, write the number of internal and external zones at the bottom of the map.

Task 4: Make a Zone Directory

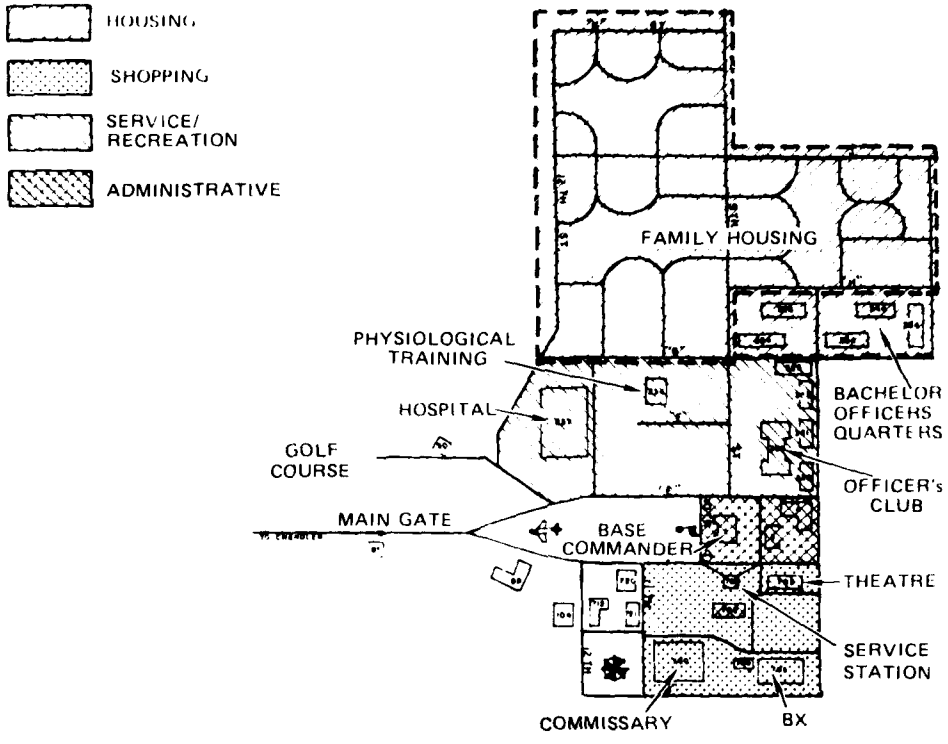
This task consists of making a cross-referenced directory of the on-base buildings for use in completing Tasks 5 and 6.

Step 1: List Buildings by Building Number

List all the buildings on the base in order by number (see Figure 17). If Step 2, Task 3 was completed, simply fill in Column 2 on Table 2. Alternatively, record the data in the format shown in Table 3, using the larger scale map or the base telephone directory. Use two or more pages to complete the listing if necessary.

Adjust the building number headings if necessary as shown in Figure 18. For example, on one model base, nearly all the numbers from 1-59 were used, whereas few buildings had numbers between 60 and 299. Likewise the headings on the table may not all represent the same numerical span. It may also be necessary to adjust column headings when overflows occur in some columns.

EXAMPLE:



In this example, some zones are easy to define:

(1) The family housing area, although not a simple rectangular shape, is well-defined.

(2) Likewise, the Bachelor Officer's Quarters occupy an easily identified area.

(3) The hospital's area extends into the one occupied by physiological training. However, the hospital clearly dominates the area, because most of the space between the two buildings and south of the physiological training building is parking for the hospital. Further, physiological training is under the jurisdiction of the hospital command.

(4) Most shopping facilities are situated together. Although the theater would be classified as service/recreation, shopping clearly dominates the area.

(5) The location of the Officers' Club is a more difficult problem. Officers' Club facilities take up most of the block, but a considerable number of administrative offices are adjacent to the Officers' Club. The deciding factor is that the Officers' Club generates most of the vehicular traffic entering and leaving that block.

(6) The Base Commander's offices and other adjacent administrative offices account for a relatively small area, but can be expected to generate a substantial amount of work-to-work vehicle traffic during the day.

FIGURE 15 DEFINING ZONES

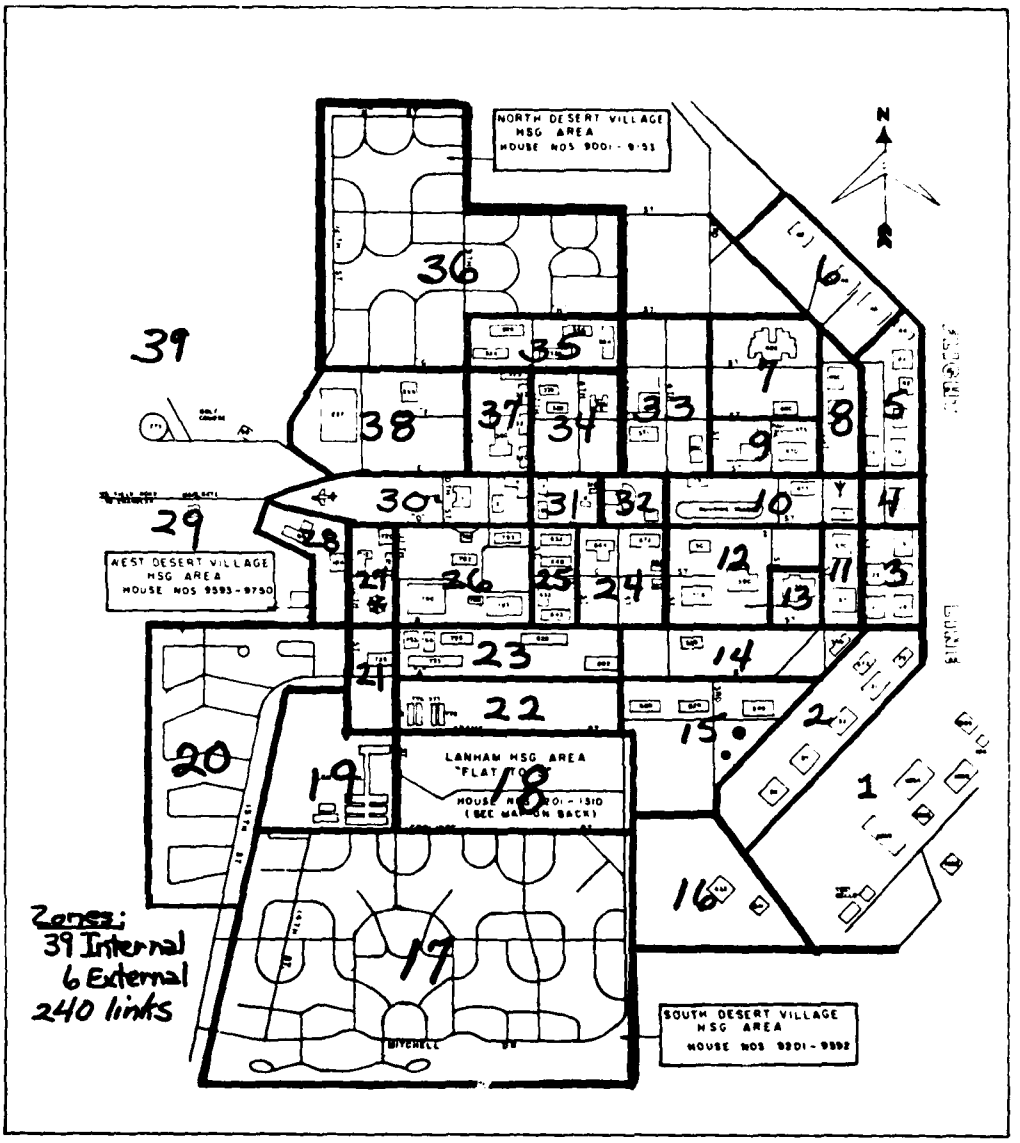


FIGURE 16. NUMBERING ZONES

TABLE 3 BUILDINGS BY BUILDING NUMBER

BUILDING NO.	ZONE	BUILDING NO.	ZONE	BUILDING NO.	ZONE	BUILDING NO.	ZONE	BUILDING NO.	ZONE

BUILDINGS BY BUILDING NUMBER

1-99		100-299		300-499		500-599		600-699	
BUILDING NO	ZONE	BUILDING NO	ZONE	BUILDING NO	ZONE	BUILDING NO	ZONE	BUILDING NO	ZONE

FIGURE 17. SETTING UP A BUILDING NUMBER FORMAT (Sample Table 3)

BUILDINGS BY BUILDING NUMBER

1-~~99~~ 58		~~100~~ 60-299		300-~~499~~ 399		~~500~~ 400-599		600-~~699~~ 758	
BUILDING NO	ZONE	BUILDING NO	ZONE	BUILDING NO	ZONE	BUILDING NO	ZONE	BUILDING NO	ZONE
1		60		300		490		600	
3		68		301		491		602	
4		71		302		492		618	
6		72		303		500		619	
7		74		310		501		628	

FIGURE 18. COMPILING A LIST OF BUILDINGS BY NUMBER (Sample Table 3a)

Step 2: Associate Each Building With Its Zone

Using the zone map prepared in Step 4, Task 3, locate each building and then write the number of the zone in which it is located next to the building number on Table 3. When this step is completed, the result is an index of base buildings by building and zone number(see Figure 19).

BUILDINGS BY BUILDING NUMBER

1 - 59 99		60 100 - 299		300 - 399 499		400 500 - 599		600 - 750 699	
BUILDING NO	ZONE	BUILDING NO	ZONE	BUILDING NO	ZONE	BUILDING NO	ZONE	BUILDING NO	ZONE
1	25	60	17	300	27	490	7	600	21
3	25	68	24	301	27	491	7	602	20
4	25	71	3	302	27	492	7	618	20
6	23	72	5	303	23	500	18	619	20
7	23	74	5	310	27	501	18	628	20

FIGURE 19. ASSOCIATING EACH BUILDING WITH A ZONE (Sample Table 3b)

Step 3: Compile a List of Buildings by Zone

Using the index of on-base buildings by building number, convert the information to an index of buildings by zone. List each zone in order starting with zone 1, and within each zone list each building located within it in order by number (see Figure 20). For example, looking at the completed Table 3, the lowest building number located in zone 1 might be number 32, and the second through fourth numbers 37, 38, and 39. Continue to check the list, column by column, for all buildings in zone 1. Then recheck the list for each of the remaining zones. A small check by each building number on Table 3 as it is transferred to Table 4 will ensure that all buildings are recorded.

ZONE	BUILDING NO	ZONE	BUILDING NO.	ZONE	BUILDING NO.	ZONE	BUILDING NO	ZONE	BUILDING NO.
1	32	6	44	19	514	23	6	28	122
	37		45		516		7		329
	38		46		517		8		330
	39		48		519		310		331
	53		49		524				332
	55		50		525	24	68		333
	58		1353		526		516		334
	511		1354		527		1080		336
			1359		528		1081		349
2	29		1365		529		1082		360
	30		490		538		1083		363
	31						1084		

FIGURE 20. COMPILING A LIST OF BUILDINGS BY ZONE (Sample Table 4)

TABLE 4 BUILDINGS BY ZONE

ZONE	BUILDING NO.	ZONE	BUILDING NO.	ZONE	BUILDING NO.	ZONE	BUILDING NO.	ZONE	BUILDING NO.

Task 5: Compile Work Trip Information

This task is likely to prove to be the most time consuming of the data collection tasks. If the BLIS report printout described in Task 1 can be acquired, begin with Step 1a below. If not, begin with Step 1b.

Step 1: Collect and Record Building Occupancy Data

Step 1a: Send BLIS Reports to Custodians

A cover memorandum explaining what information is needed, its purpose, how the BLIS form produced as a computer printout should be filled out, and the deadline for receiving the information should be sent to each custodian. The memo should be signed by someone in authority on the base, such as the Base Civil Engineer (see example, Figure 21). As custodians return the completed BLIS forms, check them off on the single-spaced master list. If all responses are received by the deadline, proceed to Step 3; if not, begin telephoning the custodians who have not responded, getting the information on their buildings over the phone, if necessary. When the information is complete, proceed to Step 2.

Step 1b: Collect Information by Phone

Using the base organization chart as a master list, call each organization to request the building numbers of the facilities they occupy, the number of personnel assigned to each building (military, civilian, and total number), and the normal duty hours. Collect the information on Table 5 in the format shown in Figure 22 below.

Step 2: Record Zone Numbers

Using the index of building by building number completed in Step 3, Task 4, record the number of the zone in which each of the buildings is located in the last margin on the returned BLIS Report forms or on the forms filled out in Step 1b. Then arrange the work trip data in order by zone.

EXAMPLE:

Reply to
Attn of: (Return Address -- person's name, ext.) (Date)

Subject: Base Traffic Model Survey

To: (Custodian's Name)

1. _____ AFB is implementing a new transportation/land use computer model.

2. Your cooperation is requested in the collection of some of the required data. Please enter the total number of people on each shift in each numbered building on the attached machine run listing.

Example:

Organization Symbol	Facility Number	Number of People in Building			Normal Duty Hours
		Military	Civilian	Total	

3. Please return the completed machine run listing to 82 ABG/DEE, Stop 6, by 30 March 1979.

(Name)
Base Civil Engineer

1 Atch
Machine Run Listing

1st Ind,

TO: (Return Address)

Completed machine run listing is returned as requested.

1 Atch n/c

FIGURE 21. SAMPLE MEMORANDUM FOR CUSTODIANS

TABLE 5 FACILITY PERSONNEL ASSIGNMENTS

ZONE NO.	ORGANIZATION SYMBOL	FACILITY NUMBER	NUMBER OF PERSONNEL ASSIGNED			NORMAL DUTY HOURS
			MILITARY	CIVILIAN	TOTAL	

EXAMPLE:

FACILITY PERSONNEL ASSIGNMENTS

ZONE NO.	ORGANIZATION SYMBOL	FACILITY NUMBER	NUMBER OF PERSONNEL ASSIGNED			NORMAL DUTY HOURS
			MILITARY	CIVILIAN	TOTAL	
17	SVE	8	2		2	0845 - 1000
	"		6		6	1000 - 1900
	"	60		5	5	0800 - 1630
	"	310	NO	PERSONNEL		
	"	760		4	4	0700 - 1000
	"	786		9	9	1000 - 1800

FIGURE 22. FACILITY PERSONNEL ASSIGNMENTS (Sample Table 5)

Step 3: Complete Work Trip Data Collection Forms

Photocopy enough Work Trip Data Collection Forms (Table 6) so that there are two forms for each on-base zone. If some zones have many buildings in them, more than two forms may be needed. From the index of buildings by zone compiled in Step 3, Task 4, fill in the zone number, and the numbers of the buildings in that zone in the space provided at the top of the Work Trip Data Collection Forms.

Fill out a minimum of two Work Trip Data Collection Forms for each on-base zone, one for arrivals in the zone at the beginning of duty hours and one for departures from the zone at the end of the duty hours, as shown in Table 6. Cross out the word "departures" on the form to be used for arrivals and vice versa.

Across the tops of the columns on the "arrivals" form, enter any hour that personnel arrive in the zones, in order, from earliest to latest. Under "building number," enter the numbers of the buildings in order. For each arrival time, enter the number of military personnel first, then a slash and the number of civilian personnel. If duty times are different on different days, enter a line for each day that shift times are different. Put the number of weekend personnel in parentheses. When entering the 24-hour total, include only those personnel on duty Monday through Friday. Figure 23 shows a completed "arrivals" sheet. Repeat the process to record departures as shown in Figure 24.

TABLE 6 WORKTRIP DATA COLLECTION FORM

(Use to fill out card types 5, 6, and 11)

A minimum of two of these forms for each zone on the base will be needed.

Zone _____

Building Numbers _____
(Enter in order from zone index)

ARRIVALS/DEPARTURES
(Cross out the one that is inappropriate)

BUILDING NO.	TIMES* (Enter times applicable in order from 0100 to 2400)										24-HOUR TOTAL†	HOURS OF OPERATION
	MIL/CIV	MIL/CIV	MIL/CIV	MIL/CIV	MIL CIV	MIL/CIV	MIL/CIV	MIL/CIV	MIL/CIV	MIL CIV		FROM TO
TOTALS†												

* For each shift time, enter the number of military and the number of civilian personnel due at that time. If no civilians are due at a particular time, but 20 military personnel are, enter 20/0. If 20 civilians are due, but no military personnel enter 0 20.

† Put weekend staff in ( ) parentheses and omit them when totalling.

EXAMPLE:

WORKTRIP DATA COLLECTION FORM

(Use to fill out card types 5, 6, and 11)

Zone 27

Building Numbers 300, 301, 302, 303, 320, 321, 322, 323
(Enter in order from zone index)

ARRIVALS/~~DEPARTURES~~
(Cross out the one that is inappropriate)

BUILDING NO.	TIMES* (Enter times applicable in order from 0100 to 2400)										24-HOUR TOTAL†	HOURS OF OPERATION
	0600	0630	0645	0745	0800	1030	1630	2400				FROM TO
	MIL/CIV	MIL/CIV	MIL/CIV	MIL/CIV	MIL/CIV	MIL/CIV	MIL/CIV	MIL/CIV	MIL/CIV	MIL/CIV		
300	0/3	–	–	–	2/7	0/5	6/4	–			8/19	0630 - 2300
301	NO PERSONNEL											
302												
303												
320	–	4/10	–	2/3	–	–	–	–			6/13	0635 - 630
321	–	–	–	8/4	–	–	1/0	1/0			10/4	24 Hrs
322	–	–	1/0	8/5	–	–	–	–			9/5	0645 - 630
323	2/0	–	–	21/15	–	–	–	–			23/15	0600 - 1630
TOTALS†	2/3	4/0	1/0	39/27	2/7	0/5	7/4	1/0			56/46	

* For each shift time, enter the number of military and the number of civilian personnel due at that time. If no civilians are due at a particular time, but 20 military personnel are, enter 20/0. If 20 civilians are due, but no military personnel enter 0/20.

† Put weekend staff in ( ) parentheses and omit them when totalling.

FIGURE 23. COMPLETING WORK TRIP ARRIVALS FORM (Sample Table 6)

EXAMPLE:

WORKTRIP DATA COLLECTION FORM

(Use to fill out card types 5, 6, and 11)

Zone 27

Building Numbers 300, 301, 302, 303, 320, 321, 322, 323
(Enter in order from zone index)

~~ARRIVALS~~/DEPARTURES
(Cross out the one that is inappropriate)

BUILDING NO	TIMES* (Enter times applicable in order from 0100 to 2400)										24-HOUR TOTAL†	HOURS OF OPERATION
	0800	1430	1445	1530	1630	2300	2400					FROM TO
	MIL/CIV	MIL/CIV	MIL/CIV	MIL/CIV	MIL/CIV	MIL/CIV	MIL/CIV	MIL/CIV	MIL/CIV	MIL/CIV		
300		0/5			2/10	6/4					8/19	0630 2300
301	}											
302	} No PERSONNEL											
303	}											
320				4/0	2/3						6/3	0630 1630
321	1/0				8/4		1/0				10/4	24 Hrs
322				1/0	0/5						9/5	0645 1630
323			2/10		21/15						23/15	0600 1630
TOTALS†	1/10	0/5	2/0	5/0	41/37	6/4	1/0				56/46	

* For each shift time, enter the number of military and the number of civilian personnel due at that time. If no civilians are due at a particular time, but 20 military personnel are, enter 20/0. If 20 civilians are due, but no military personnel enter 0/20.

† Put weekend staff in ( ) parentheses and omit them when totalling.

FIGURE 24. COMPLETING WORK TRIP DEPARTURES FORM (Sample Table 6a)

Task 6: Compile Nonwork Trip Information

This somewhat time-consuming task may not be necessary depending upon the problem being studied. If the data are needed, interview, either in person or by telephone, the persons associated with nonwork activities on the base to get average and peak participation rates in service activities, such as the hospital, food services, bank, and credit union; shopping activities, such as the BX and commissary; and recreational activities such as the gym, bowling alley, and swimming pool. In the interview, ask appropriate personnel for the information requested in Table 7. Then complete Table 7 for each zone as shown in Figure 25.

Nonwork activities on air bases commonly include those associated with the following facilities:

- Hospital
  - Clinics
  - Dispensary
- Commissary
- Base Exchange
  - Main Store
  - Beauty and barber shops
  - Gas station
- Credit Union
- Bank
- NCO and officers clubs
- Recreation facilities
  - Gym
  - Pool
  - Bowling alley
  - Golf course
  - Hobby shops
  - Picnic areas
  - Recreation center
- Library
- Child care center
- Base personnel office
- Movie theatre

TABLE 7 NONWORK TRIP DATA COLLECTION FORM

NAME OF ACTIVITY	BUILDING NO	ZONE	AVERAGE DAY VOLUME (No. of People)	PEAK		PEAK HOUR		NO. OF EMPLOYEES	HOURS OF OPERATION
				DAYS	VOLUME	HOUR	VOLUME* No. or %		

* Numbers or percent of a day's business done during the peak hour.

EXAMPLE:

NONWORK TRIP DATA COLLECTION FORM

NAME OF ACTIVITY	BUILDING NO.	ZONE	AVERAGE DAY VOLUME (No. of People)	PEAK		PEAK HOUR		NO. OF EMPLOYEES	HOURS OF OPERATION
				DAYS	VOLUME	HOUR	VOLUME* No. or %		
HOSPITAL	237	26	500	NONE		NONE		212	0815-1630- CLOSED 1200-1300
COMMISSARY	790	43	1000	FRI.	1200	10-12	45%	102	0800-1800 (T-W-F)
				PAY DAY					0800-1900 (Th)
									0800-1500 (SAT)
									CLOSED SUN. & M
MAIN BX	785	43	2000	"	300	11-1600	300/hr	87	"
SERVICE STATION	760	43	700	"		10-14	35-40%	9	0730-1730 (M-F) 0900-1500 (SAT)
									CLOSED SUN
BEAUTY SHOP	785	43	15	FRI/SAT	30-35	0800-1200	12/hr	3	SAME AS BX
PERSONNEL	60	17	12 per WK	TU-W		1300-1600	100%		TUE-WED 1300-1600 ONLY
CREDIT UNION	7	23	2000	4 DAYS AROUND PAY DAY	3000	1100-1400	33⅓%	15	0800-1600 (M-F)
BANK	6	23	2500	"	3000	1130-1230	40%	6	0800-1600 (M-F)
ETC.									

* Numbers or percent of day's business done during the peak hour.

FIGURE 25. COMPLETING NONWORK TRIP DATA (Sample Table 7)

Task 7: Collect Calibration Data

Unless these data are already available through the base military police or the Civil Engineering Office, actual counts of vehicle movements must be made to determine the following types of calibration data if recent counts are not already available:

- Gate counts
- Speed and delay
- Parking lot counts
- Street counts
- Military vehicle counts.

However, only the gate counts are required for all applications of the model.

Task 7a: Gate Counts

Gate counts are the most important calibration data to be collected. They may be available from the base traffic engineer or from the base military police. If they are not, and if there are major intersections just outside the gates to the base, check with the local city, county, or state Department of Transportation. The hourly volume of traffic into and out of each base gate is needed for all applications. To model peak rush hour traffic, the number of vehicles entering and exiting the base for each 15-minute period during the morning and evening rush hours must be determined.

Where no counts are available, or where the number of employees on the base has changed, new gate counts must be made. These should be conducted under the direction of the base traffic engineer or the security police.

Task 7b: Speed and Delay

Speed and delay runs are optional tools that may be used to test the accuracy of the model once the status quo information for previous tasks has been fed into the computer. If used, speed and delay runs should be collected on major routes. Examples of major routes include those from the main gate to the major employment centers, and from residential areas to shopping, officers, and NCO clubs.

The first step is collecting data on speed runs during the morning, evening, and noon rush hours on payday and the day before. It is most efficient if the project team collects the data whenever they travel by automobile on the base during these times. Table 8 specifies the information to be collected. If time permits, it is useful to make speed runs over the same routes every day for a week. This provides an average as well as best and worst case.

Filled in, Table 8 might resemble Figure 26. Note that in recording the time, 26 minutes and 50 seconds past 7 a.m. is entered by breaking up the military notation 0726 into 07/26/50.

Next, convert the information collected to speed and delay as shown in Figure 27. The speed on a street is the distance from the starting cross street to the finishing cross street divided by the travel time and multiplied by 60. Delay is the distance traveled, divided by the speed limit, minus the calculated speed. In Step 4, of Task 2, speed limits on all base roadways were recorded.

EXAMPLE:

SPEED AND DELAY DATA

DATE 9/28

DAY Thurs. AM RUSH

	STREET	STARTING CROSS STREET	FINISHING CROSS STREET	STARTING TIME (hr/min/sec)	FINISHING TIME (hr/min/sec)	STARTING ODOMETER	FINISHING ODOMETER
(a)	D	WILLIAMS FIELD RD.	1 ST	06/38/42	06/41/47	60,591.4	60,592.4
(b)	E	7th	3rd	06/40/00	06/40/45	43,411.6	43,411.9
(c)	5th	MITCHELL	D	07/26/50	07/30/00	30,983.5	30,984.8
(d)	7th	G	B	07/50/36	07/52/10	12,610.1	12,610.4

(a) The route from the main gate to offices along the flightline.

(b) The route from the officers' club where base personnel have breakfast to the turn off for a building with substantial base employment.

(c) The route from on-base family housing to an employment area

(d) The route from the BOQ to an employment area

FIGURE 26. COMPUTING SPEED AND DELAY (Sample Table 8)

TABLE 8 SPEED AND DELAY DATA

DATE _____

DAY _____

STREET	STARTING CROSS STREET	FINISHING CROSS STREET	STARTING TIME (hr/min/sec/	FINISHING TIME (hr/min/sec)	STARTING ODOMETER	FINISHING ODOMETER

EXAMPLE:

To compute speed for trip (a) on Sample Table 8:

1. Finishing odometer - Starting odometer = Distance traveled

   60,592.4 - 60,591.4 = 1 mile

2. Finishing time - Starting time = Travel time

   06/41/47 - 06/38/42 = 3 minutes and 05 seconds = 3.08 minutes
   (05÷60=.08)

3. $\frac{\text{Distance traveled (miles)}}{\text{Travel time (minutes)}} \times \frac{60 \text{ minutes}}{1 \text{ hour}} = \text{Speed (miles per hour)}$

   $\frac{1}{3.08} \times 60 = 19.48$ mph

   To compute delay for the same trip:

   $\frac{\text{Distance traveled}}{\text{Calculated speed}} - \frac{\text{Distance traveled}}{\text{Speed limit}} = \text{delay (hr)}$

   $\frac{1}{19.48} - \frac{1}{25} = .01$

FIGURE 27. COMPUTING SPEED AND DELAY

Task 7c: Time-of-Day Parking Lot Counts

Parking lot counts should be undertaken when information is needed to determine cycles of vehicle patterns, numbers of trips, and length of stay at specific facilities on the base.

To establish a cycle, counts must be made and recorded hourly. Use the format shown in Table 9.

A completed Table 9 might look like Figure 28. This shows most personnel arriving at work between 0700 and 0800, with a few using their automobiles to make work-to-work trips during the morning hours. On the whole, the parking lot population remains fairly constant throughout the workday.

EXAMPLE:

PARKING LOT COUNTS

DATE 9/28/78
FACILITY BLDG 40
LOT CAPACITY 64

TIME	TYPE OF VEHICLE*						
	LDV	LDT1	LDT2	HDT	HDD	MOT	BIC
0600	2	0	0	0	0	0	0
0700	24	12	2	0	0	5	10
0800	31	14	8	0	0	7	11
0900	28	14	8	0	0	7	11
1000	23	14	8	0	0	8	11

* Type of vehicle: LDV = light duty vehicles, e.g., cars
LDT1 = light duty trucks (under 6,000 lb)
LDT2 = light duty trucks (6,000–8,500 lb)
HDT = heavy duty truck
HDD = heavy duty diesel truck
MOT = motorcycle
BIC = bicycle
Trucks with automobile-sized wheels can usually be assumed to be LDT1, those with oversized wheels are usually LDT2.

FIGURE 28. RECORDING PARKING LOT COUNTS (Sample Table 9)

TABLE 9 PARKING LOT COUNTS

DATE _____

FACILITY _____

LOT CAPACITY _____

	TYPE OF VEHICLE						
	LDV	LDT1	LDT2	HDT	HDD	MOT	BIC

For other applications, make a rough map of the parking lot being studied showing all parking stalls. Then, record all occupied parking stalls in the lot at the start of the time period being studied. During that specified time period, observe the parking lot and as each vehicle enters or leaves a stall, place an I (for in or enter) or an O (for out or exit) for that stall. At the end of the time period, the length of stay can be determined for each vehicle. This type of data would be useful during the noontime rush hours, or during peak shopping hours (if these are different). It would not be useful for morning and evening rush hours.

Task 7d: Street Counts

As a check against the traffic volume predictions made by BATS and based on data collected in earlier tasks, counts may be made of the number of vehicles traveling on some major links on the air base during a specified time period as shown in Table 10. The actual data may then be compared with the traffic volumes predicted by the model to verify the accuracy of the model. Collect the data in the format shown in Figure 29.

EXAMPLE:

STREET COUNTS

DATE 9/26/78
STREET E
CROSS STREETS 7th and 9th

TIME	NUMBER OF PASSENGERS PER VEHICLE*	INBOUND								OUTBOUND							
		LDV	LDT1	LDT2	HDT	HDD	MIL	MOT	BIC	LDV	LDT1	LDT2	HDT	HDD	MIL	MOT	BIC
1100	2234	𝍸	𝍸	𝍸	𝍸	III	𝍸	𝍸	IIII	𝍸	𝍸	𝍸	III		𝍸	𝍸	𝍸
	3222	𝍸	𝍸	I	𝍸		𝍸	𝍸		𝍸	𝍸	III			𝍸	𝍸	𝍸
	2442	𝍸	𝍸		I		III	𝍸		𝍸	𝍸				𝍸	𝍸	II
	5222	𝍸	IIII					II		𝍸	𝍸				III	𝍸	
	3342	𝍸								II	II						
	27	25	19	6	11	3	13	17	4	22	22	8	3	0	18	20	12
1115	3222	𝍸	𝍸	𝍸	𝍸	I	𝍸	𝍸	II	𝍸	𝍸	𝍸	IIII	II	𝍸	𝍸	𝍸
	2434	𝍸	𝍸	𝍸	II		𝍸	I		𝍸	𝍸	𝍸			𝍸		𝍸
	6233									𝍸	𝍸				II		

* The driver is not included as it is understood that every vehicle counted has a driver. If there are no passengers do not make any entry for that vehicle (in this column). The total number of vehicles plus the total number of passengers equals the total number of persons in all vehicles.

FIGURE 29. COLLECTING STREET COUNTS (Sample Table 10)

TABLE 10 STREET COUNTS

DATE _____

STREET _____

CROSS STREETS _____

TIME	NUMBER OF PASSENGERS PER VEHICLE*	INBOUND								OUTBOUND							
		LDV	LDT1	LDT2	HDT	HDD	MIL	MOT	BIC	LDV	LDT1	LDT2	HDT	HDD	MIL	MOT	BIC

Task 7e: Military Vehicles

Use the BLIS Report of Military Vehicle Utilization, Section K of the Vehicle Control Officers' Field Data Manual (which explains the military vehicle codes used in the report), and the base telephone directory (if necessary to identify the buildings in which each organization is located).

First, next to the military vehicle codes on the BLIS Report, enter the vehicle type codes used for BATS, i.e., LDV for light duty vehicle, LDT1, LDT2, and so on. Second, using a list of vehicle control officers, or the telephone directory, associate each organization with a building or buildings. Third, tally the total number of vehicle miles for each organization. If an organization is in more than one zone, split the "total mileage per year" among those zones. Then, using the Directory of Buildings by Building Number (Table 3), associate each organization with its zone.

Compile the information in Table 11 as shown in Figure 30. In Figure 30, organization LGSS, located in zone 1 has one heavy duty truck (HDT) and two heavy duty diesel trucks, or a total of three vehicles which travelled 1375 miles in one year. It may be useful to enter the number of the building in which the organization is located. Space is provided for this in the organization column.

List all the zones in which mililtary vehicles have been assigned in order by number until the list is complete. When several organizations with military vehicles assigned to them are in the same zone, add the mileages for each to get the "total mileage per year" for each zone.

EXAMPLE:

MILITARY VEHICLE UTILIZATION

ZONE	ORGANIZATION	VEHICLE TYPE	NUMBER OF VEHICLES	TOTAL MILEAGE PER YEAR
1	LGSS	HDT	1	
		HDD	2	1375
2	DAPF	LDV	5	
		LDT1	5	
		LDT2	1	8149
6	CC	LDV	1	167

FIGURE 30. COMPILING MILITARY VEHICLE UTILIZATION

TABLE 11 MILITARY VEHICLE UTILIZATION

ZONE	ORGANIZATION	VEHICLE TYPE	NUMBER OF VEHICLES	TOTAL MILEAGE PER YEAR

SECTION III

DATA REDUCTION

INTRODUCTION

Put simply, data reduction is the process used to rearrange information gathered in the data collection tasks in Section II so that it can be keypunched and fed into the computer for analysis. The informational maps and the intermediate data forms from the data collection tasks in Section II are used to complete coding forms that organize the information in a format that can be read by the computer.

Seventeen different types of computer cards may be utilized by the BATS model. The content of each of these card types is explained in this section, first briefly, to provide an overview, and then in detail, card by card. In the detailed descriptions, the intermediate data forms and maps needed to complete the card types required for a special model application are referenced.

It is not necessary to complete all 17 card types for most model applications. As with the data collection tasks, the project supervisor will indicate which card types are necessary to analyze the problem under consideration.

From 1 to 24 hours may be simulated during any computer run. Fill out a Header Card and a Card Type 1 (Run Description Card) for each hour to be simulated during a run. The information on some cards remains the same regardless of the time of day. For example, the link descriptions (Card Type 2) would need to be entered only once, as would the descriptions of nonsignalized intersections (Card Type 3). However, signalized intersections may have different signal cycles at different times of the day. If a time period has different characteristics from the time period preceding it, a new card must be submitted. New cards of a particular type are submitted only if the data have changed from the previous hour.

Note that every card, except the title, or header card, uses the first two columns of the computer card for the Card Types Number 01-16. Enter all numbers on the cards so that they are right justified; that is, if the entry has fewer digits than the number of columns provided, the blank columns should be on the left of the field (a field is a column or columns set aside to contain a particular piece of data). Whenever the value to be entered is zero, either enter a 0 or leave the field blank.

Card Type #	Card Description
	Header Card identifies the date and title of each computer run or simulation.
1	Run Description Card gives the number of Card Types 02-16 that must be read for a particular computer run or simulation.
2	Link Description Card gives the characteristics of each section of roadway on the base, including location, number of lanes, capacity, speed limit, connections (maximum 240).
3	Intersection Description Card describes the characteristics of each intersection, including the links it connects, traffic controls, and if signalized, the signal's cycle, phase time, and phase capacity.
4	Zone Description Card divides the base into as many as 50 zones both on-base and bordering the base.
5	Demographic Variable Card gives the trip-producing characteristics of each zone defined on Card Type 4, including number of military and civilian employees, number of houses, dormitory rooms, and parking lot capacity.
6	Trip Purpose Card assigns a percentage of the total trips arriving in or leaving a zone during a specified time period to a particular purpose based on the demographic variable entered on Card Type 5. The user may choose to omit the percentages called for on Card Type 6 and rely on the PLUALU array given in Card Type 14 or on the default PLUALU array in the computer program.
7	Gate Description Card gives the location and characteristics of up to 10 gates, including links, vehicle counts, and capacity.
8	Vehicle Count Card describes the traffic load on a particular road or at a particular intersection.
9	Load Factor Card gives the average number of persons riding in each type of vehicle.
10	Truck Route Card describes any routes assigned to trucks from an entry gate to their destination on-base, and from that destination to an exit gate.
11	Work Shift Count Card describes the arrival and departure times of military and civilian employees on the base.

12 Plot Option Card describes the plot (diagram of base roadway with or without specified roadway traffic conditions) to be produced, if the user wishes to specify a different scale or other characteristic than one contained in the model.

13 Calibration Factor Card is used to change the number of vehicle trip productions and attractions for all zones, to conform to whatever actual base data are available.

14 PLUALU (Production Land Use - Attraction Land Use) Array Card is used when the PLUALU array contained in the computer program is considered inappropriate to the base being studied, or when the simulation being used is particularly sensitive to land use.

15 Demographic Variable Name Card is used to change the demographic variables assumed by the model.

16 Name List Data Card is used to convert yearly vehicle miles and vehicle running times to hourly vehicle miles and running times.

Header Card (no card type number)

The header card is simply a title card that identifies the computer run being made. One header card is needed for each computer run. The first six spaces on the coding sheet give the date of the data being run. For example, if the data were collected on September 29, 1978 that date would be entered as 780929, with the last two digits of the year first, then the number of the month, and finally the day. The remaining spaces may consist of any alphabetical or numerical characters as shown in the following examples:

780929 Williams AFB, Peak (Payday) PM Rush 1600-1700

780929 Williams AFB, Peak (Payday) PM Rush 1600-1700 D&E Sts, 1-way

780929 Williams AFB, Twelve-Hour Summary Run

79036 Tyndall AFB, Non Peak Day AM Rush 0600-0800

Card Type 1 - Run Description Card

For every time period to be modeled, complete one Card Type 1. This card tells the computer how many of each card type it must read in order to perform a particular task. Because it is necessary to determine how many of each of the other cards will be needed, complete Card Types 02-16 before filling in the header card and Card Type 1. If the data for a particular card type do not change for subsequent time periods in that computer run, that card type's columns should be left blank on subsequent Cards Type 1.

Coding Instructions - Card Type 1

Column Space(s)	Description	Possible No. of Cards
1-2	Card type number	01
3-6	Number of Cards Type 2 - Link Description Cards. One Card Type 2 must be completed for each link in the network, up to a maximum of 240 links. Therefore, the user may have as many as, but no more than, 240 Cards Type 2.	Up to 240
7-10	Number of Cards Type 3 - Intersection Description Cards: One Card Type 3 must be completed for each intersection in the network, up to a maximum of 70.	1-70
11-14	Number of Cards Type 4 - Zone Description Cards. One Card Type 4 must be completed for each zone. The program can accommodate up to, but no more than 50 zones.	1-50
15-18	Number of Cards Type 5 - Demographic Variables: One Card Type 5 should be completed to describe the demographic variables for each of the zones for which a Card Type 4 was completed.	1-50
19-22	Number of Cards Type 6 - Trip Purpose Coefficients: One card is completed for each trip purpose. For a list of these, see the instructions for Card Type 6.	1-15

Column Space(s)	Description	Possible No. of Cards
23-26	Number of Cards Type 7 - Gate Description card: One Card Type 7 is completed for each gate through which vehicles can enter or leave the base. No more than 10 gates may be included in the computer analysis, so the number of cards equals the number of gates for a maximum of 10 cards.	1-10
27-30	Number of Cards Type 8 - Vehicle Count Card: This is an optional card, which may or may not be used for a particular computer run. When used, one card is needed for every four links describing an intersection.	up to 70
31-34	Number of Cards Type 9 - Load Factor Card: There can be one load factor card for each hour that will be simulated. There must be a Card Type 9 for the first hour the user wishes to simulate.	at least 1
35-38	Number of Cards Type 10 - Truck Route Card: From two to four cards may be used to describe a truck route.	0-4
39-42	Number of Cards Type 11 - Work Shift Count Card: These cards describe employee arrivals and departures during the morning and evening rush hours. Each card can cover either arrivals or departures during one 15-minute period for up to 18 zones. If there are more than 18 and fewer than 37 zones on and bordering the base, two cards will be needed for each 15-minute time period (8 cards). If there are more than 36 zones, three cards will be needed for each time segment (a maximum of 12 cards for arrivals and 12 cards for departures).	4-24
43	If the user wishes to have the computer read a Plot Options Card (Card Type 12), a 1 should be entered in this column; if no plot is desired, a 0 is entered or the column is left blank.	0-1
44	If the user wishes to use the calibration option and enter a Card Type 13, a 1 is entered in this column. If not, a 0 is entered.	0-1
45	The number of PLUALU array cards (Card Type 14) to be read: Seven cards are required to enter a PLUALU array.	0,7

Column Space(s)	Description	Possible No. of Cards
46	Number of Demographic Variable Name Cards (Card Type 15) to be read.	0-1
47	Number of Name List Data Cards (Card Type 16) to be read.	0-9
48-51	The hour of the day being simulated: Use military notation, e.g., 8 a.m. is 0800, noon is 1200, 5:00 p.m. is 1700, 10:00 p.m. is 2200, etc.	1-2400
52-54	Day of the week being simulated: 1 is Sunday, 2 is Monday, etc.	1-7
55-59	The duration of the time period being simulated, in seconds.	900-86,400

Time (TP) in Seconds

Hours	Minutes	=	Seconds
0	15		900
0	30		1,800
0	45		2,700
1	--		3,600
3	--		10,800
8	--		28,800
12	--		43,200
24	--		86,400

60-64	The total number of person-trips generated on the base during the specified time period: These include trips made by persons between zones on the base and trips made by persons moving from an on-base to an off-base zone. If no number is entered in these columns, the trip purpose coefficients are used to generate the number of person-trips. The computer symbol is TOTGEN for total generations.	0-99,999
65-69	The total number of persons attracted to on-base zones during the specified time period, either from another zone on-base or from an off-base zone to an on-base zone. Again, if these columns are left blank, the trip purpose coefficients are used to generate person-trips. The computer symbol is TOTATT for total attractions. Note that the number of trips made entirely on-base is the difference between gate counts (in persons) and TOTATT or TOTGEN.	0-99,999

Column(s)	Description	Possible Values
70	The exponent of internal travel time.	1, 2, 3
71	The exponent of travel time.	1, 2
72	Enter the number representing the minimum level of service (congestion level) on links to be hatch-marked on the plot; for example:	0-6

Enter	For Level of Service	
0		All levels of traffic
1	A	Free flow of traffic - low volume and high speed, little or no delay.
2	B	Stable flow of traffic - reasonable speed reduction and few traffic restrictions.
3	C	Stable flow of traffic - a relatively satisfactory operating speed is still obtained.
4	D	Unstable flow of traffic - only tolerable operating speeds.
5	E	Unstable flow of traffic - low operating speeds, and street volumes at or near the capacity.
6	F	Forced flow of traffic - speeds reduced substantially and stoppages occurring.

73	Plot options.	0-4

Enter	Type of Plot
0	no plot
1	hourly plot
2	summary plot
3	summary plus hourly plot
4	accumulate summary plot data

74	Smoothing Option: Only one smoothing option may be entered for any one run. The smoothing function is defined and described in the program documentation of subroutine SMOOTH	0-3

Enter	Smoothing Operation
0	No smoothing
1	Smooth trips toward gate counts (or use calibration factors if they have been read in)
2	Smooth toward external trip summaries
3	Smooth toward internal trip summaries

75	Tells the computer whether the user wants 15-minute or hourly iterations:	0-3

Column(s)	Description	Possible Values
	Enter 0 Hourly iterations (or leave blank) 1 15-minute iterations 2 15-minute shift counts without gate counts 3 Both 15-minute shift counts and gate counts	
76	Minimum run time flag: This gives the user the option to make the program run faster by omitting some computations. Enter 0 for all vehicles to be routed between specified origin and destination zones (this gives the most accurate results). 1 for any trip demand with fewer than 0.1 vehicle routed to a higher demand zone (faster, but less accurate). 9 for routing all trip demand of less than 0.9 vehicle to a higher demand zone (fastest, least accurate).	0, 1, 9
77-80	Output options.	
77	AQAM output option, which causes a file to be written for later input to the AQAM model (extrapolates hourly data to a year's emissions) Enter 0 No file 1 Summary file 2 Summary of all runs	0-2
78	Printout of a trip purpose table: Enter 0 No table 1 Printout of person trip purpose table 2 Person trip purpose table adjusted by shift and gate count	0-2
79	Printout origin-destination (O-D) table.	0-7

Enter

0	No table
1	Person O-D table
2	Persons riding in civilian vehicles O-D table
3	Combination of 1 and 2
4	Persons riding in military vehicles O-D table.
5	Combination of 1 and 4
6	Combination of 2 and 4
7	Combination of 1, 2 and 4

Column(s)	Description	Possible Values
80	Printout of counts of vehicles by type on all links	0-7

Enter

0	No printout
1	Origin to gate and gate to destination trips + modal split load factors
2	Origin to gate and gate to destination trips calibrated
3	1 + 2
4	Assignment counts and times
5	1 + 4
6	2 + 4
7	1 + 2 + 4

An example of the Type 1 cards that might be prepared for a morning rush hour is shown in Figure 31. Figure 32 is the coding form to be used in collecting data on Card Type 1.

EXAMPLE:

If the user planned to simulate the traffic flow during the morning rush hour 0600-0900 on a Friday, three run description cards would be needed.

BATS INPUT CODING FORM CARD TYPE 1 RUN DESCRIPTION

CARD TYPE	NUMBER OF CARD OF TYPE 2	3	4	5	6	7	8	9	10	11	HOUR OF DAY	DAY OF WEEK	TIME PERIOD (Duration)	TOTAL INTERNAL PRODUCTIONS	TOTAL INTERNAL ATTRACTIONS	PLOT OPTIONS	SMOOTHING OPTION	ITERATION TIME FLAG	MINIMUM RUN TIME FLAG	ADAM FILE PRINTOUT	PRINT TRIP PURPOSE TABLE	PRINT O-D TABLE	PRINT VEHICLE BY TYPE
01	240	62	510	510	9	1	0	1	2	3	0700	6	3600			3	3	1	1	0	2	7	3
01					9					3	0700	6	3600			3	3	1					
01					9					3	0800	6	3600			3	3	1					

All three would be labeled Card Type 1 in the first two columns, and the same outputs would be requested for each hour. Only four fields change: the hour of the day and the 3 fields for Card Types 6, 7, and 11. Because different numbers of personnel arrive at different buildings between 0700 and 0800 and between 0800 and 0900 as arrived between 0600 and 0700, three new Cards Type 11 must be read into the computer for each of those hours, and the hour itself must be indicated in columns 48-51.

FIGURE 31. EXAMPLE – CARD TYPE 1: RUN DESCRIPTION

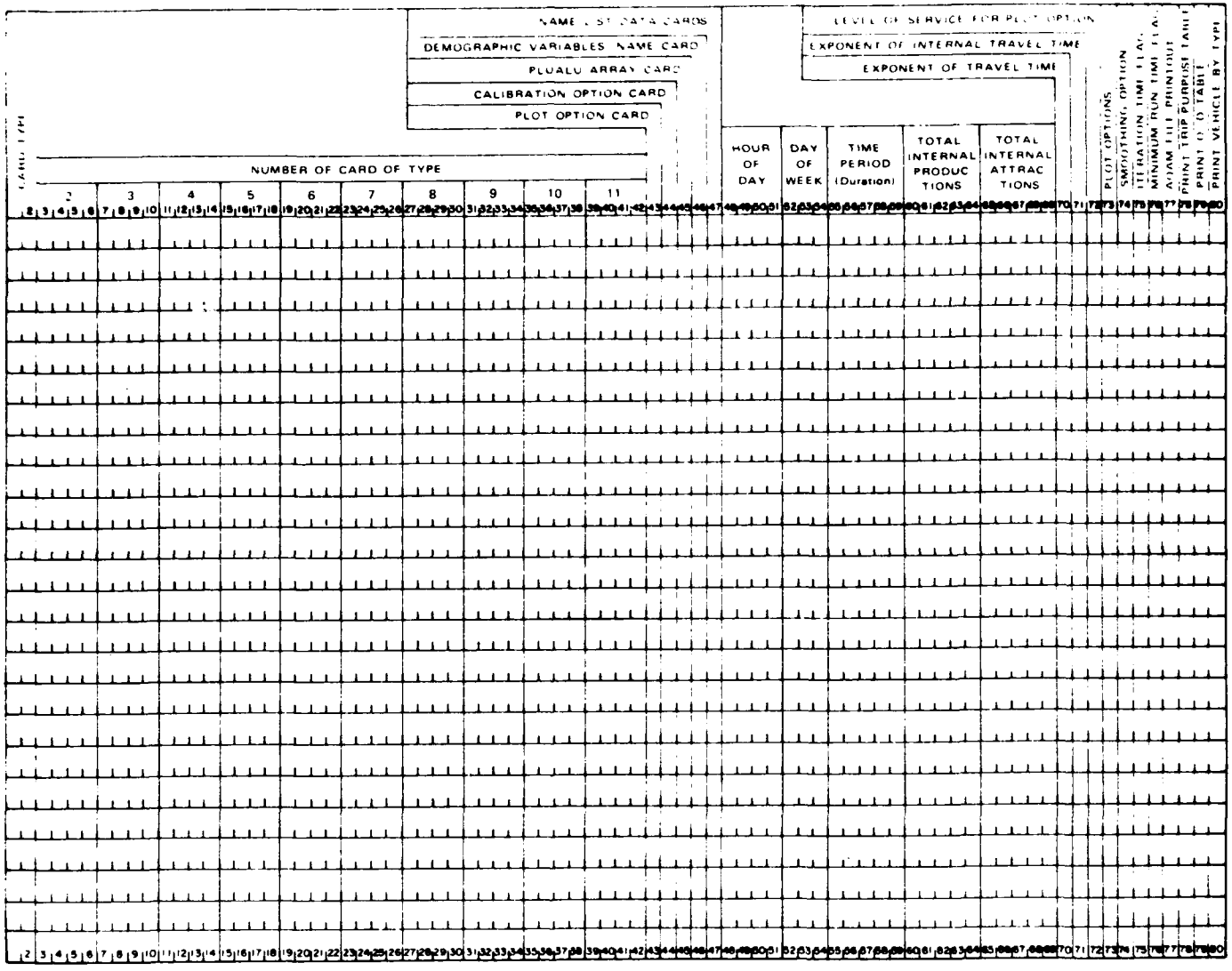


FIGURE 32. BATS INPUT CODING FORM – CARD TYPE 1: RUN DESCRIPTION

Card Type 2 - Link Description Card

Each Card Type 2 describes one link in the traffic network on the base. No more than 240 links can be so described. If the base being modeled has more than 240 links, some of the minor, less-traveled roadways should have been omitted from the link system as directed in Task 2, Section II.

To complete the coding sheet for Card Type 2 as shown in Figure 33, use Map #1, which was completed in Task 2 of Section II and on which link numbers; x, y coordinates; traffic controls; and speed limits were noted.

EXAMPLE:

If there are one-way streets on the base, or if for some other reason a link number was omitted, a dummy card for that link must be filled out as shown here.

BATS INPUT CODING FORM – CARD TYPE 2: LINK DESCRIPTION

CARD TYPE	LINK NO	NO OF LANES	X COORD	Y COORD	X COORD	Y COORD	CAPACITY	SPEED	LINK CONNECTIONS			EMISSION HEIGHT	SCALE OF X,Y COORDINATES	INCREMENTS TO THE X,Y COORDINATES	
									STRAIGHT	RIGHT	LEFT			X COORD	Y COORD
02	10	1	74703	37987	74703	37750	1200	25	6	7	2	0			
02	11	1	74703	37987	74703	37750	0	25	0	0	0	0			

FIGURE 33. EXAMPLE – CARD TYPE 2: LINK DESCRIPTION

Coding Instructions for Card Type 2

Column(s)	Description	Possible Values
1-2	Card type number.	02
3-5	Link Number (1-240): Number in order from link number 1 to the total number of links defined on the scaled map. Do not skip any link numbers. Numbers must be consecutive as shown in Figure 33.	1-240
6-10	Number of lanes in the link: This will be used to compute link capacity if no capacity is specified on this card.	1-8

For an explanation of x and y coordinates, see Task 2.

Column(s)	Description	Possible Values
11-15	The last five digits of the x-coordinate of northernmost or easternmost end point of the link.	
16-20	The last five digits of the y-coordinate of northernmost or easternmost end point of the link.	
21-25	The last five digits of the x-coordinate of southernmost or westernmost end point of the link.	
26-30	The last five digits of the y-coordinate of southernmost or westernmost end point of the link.	
31-35	Link or intersection capacity is the maximum number of vehicles that can flow through a street or intersection in an hour. The base civil engineer may provide estimates of capacity. (If these columns are left blank, default values of 1,200 vehicles/lane for speeds less than 50 mph and 1,800 vehicles/lane for speeds greater than 50 mph will be used).	1,200-
36-40	Speed limit in miles per hour.	5-55
41-45	The number of the link to which this link is connected at the northern x-y coordinate, going straight ahead. Figure 34 illustrates how to fill in columns 41-55.	1-240

EXAMPLES:

If the link number entered in columns 3–5 is 40,
columns 41–45 would be 36
columns 46–50 would be 38
columns 51–55 would be 41

If the link number entered in columns 3–5 is 37,
columns 41–45 would be 41
columns 46–50 would be 36
columns 51–55 would be 39

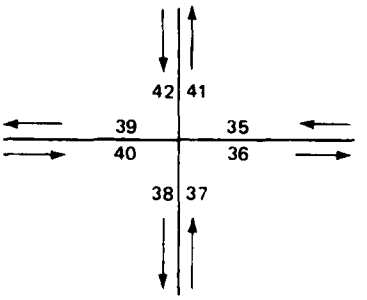


FIGURE 34. RECORDING LINK CONNECTIONS

Column(s)	Description	Possible Values
46-50	The number of the link to which this link is connected at the northern x-y coordinate, turning right.	1-240
51-55	The number of the link to which this link is connected at the northern x-y coordinate, turning left. Note: If one of the links in Columns 41-55 does not exist, those columns are simply left blank, or a zero would be entered as shown in Figure 35. For example, if the link ends in a T intersection, there would be no connecting link allowing a vehicle to continue straight ahead, and so Columns 41-45 would be left blank.	1-240
56-60	Emission height: This must be specified for elevated links. If the link is on relatively flat terrain, a height of zero is normally used.	0
61-70	Scale of x-y coordinates: This converts the x-y coordinates of the link end points from map units to meters.	

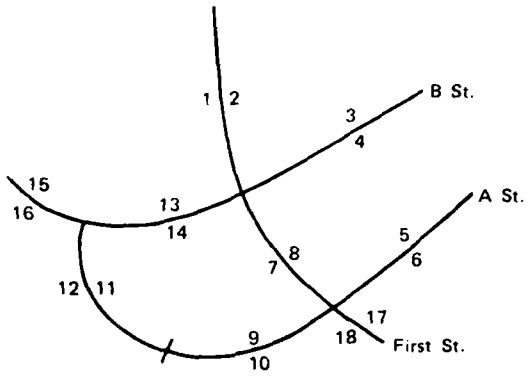
Enter	If map was read to:
Nothing	In meters
0.1	To nearest 10 meters
0.30478	In feet
121.912	In inches and was scaled so that one inch equalled 400 feet (1" = 400').

71-80	Increments to the x-y coordinates in kilometers. An optional additive factor used to convert coordinates to UTM coordinates.	

When the Cards Type 2 (see Figure 36) have been completed, the user runs the NETINT subprogram. NETINT instructions are in the model documentation. NETINT numbers all of the intersections and lists the road links that define them. At this point, the user should compare the computer printout with the scaled map of the base to check its accuracy. Any errors should be corrected on Cards Type 2 and the NETINT program rerun before Cards Type 3 are completed.

EXAMPLE:

If an artificial link was created to represent a curved or angled road as that shown here, the artificial links should entered on Card Type 2 like this:



BATS INPUT CODING FORM – CARD TYPE 2: LINK DESCRIPTION

CARD TYPE	LINK NO	NO OF LANES	X COORD	Y COORD	X COORD	Y COORD	CAPACITY	SPEED	LINK CONNECTIONS STRAIGHT	RIGHT	LEFT	EMISSION HEIGHT	SCALE OF X Y COORDINATES	INCREMENTS TO THE X Y COORDINATES X COORD	Y COORD
02	9	1						25	1	0	0				
02	12	1						25	1	0	0				
02	19	1						25	6	18	8				
02	11	1						25	0	14	15				

These cards will result in a computer produced plot that resembles this sketch:

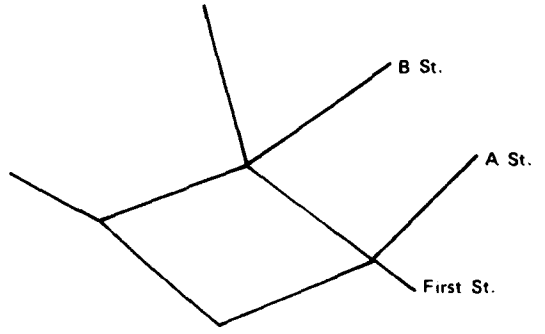


FIGURE 35. RECORDING LINKS FOR CURVED OR ANGLED ROAD

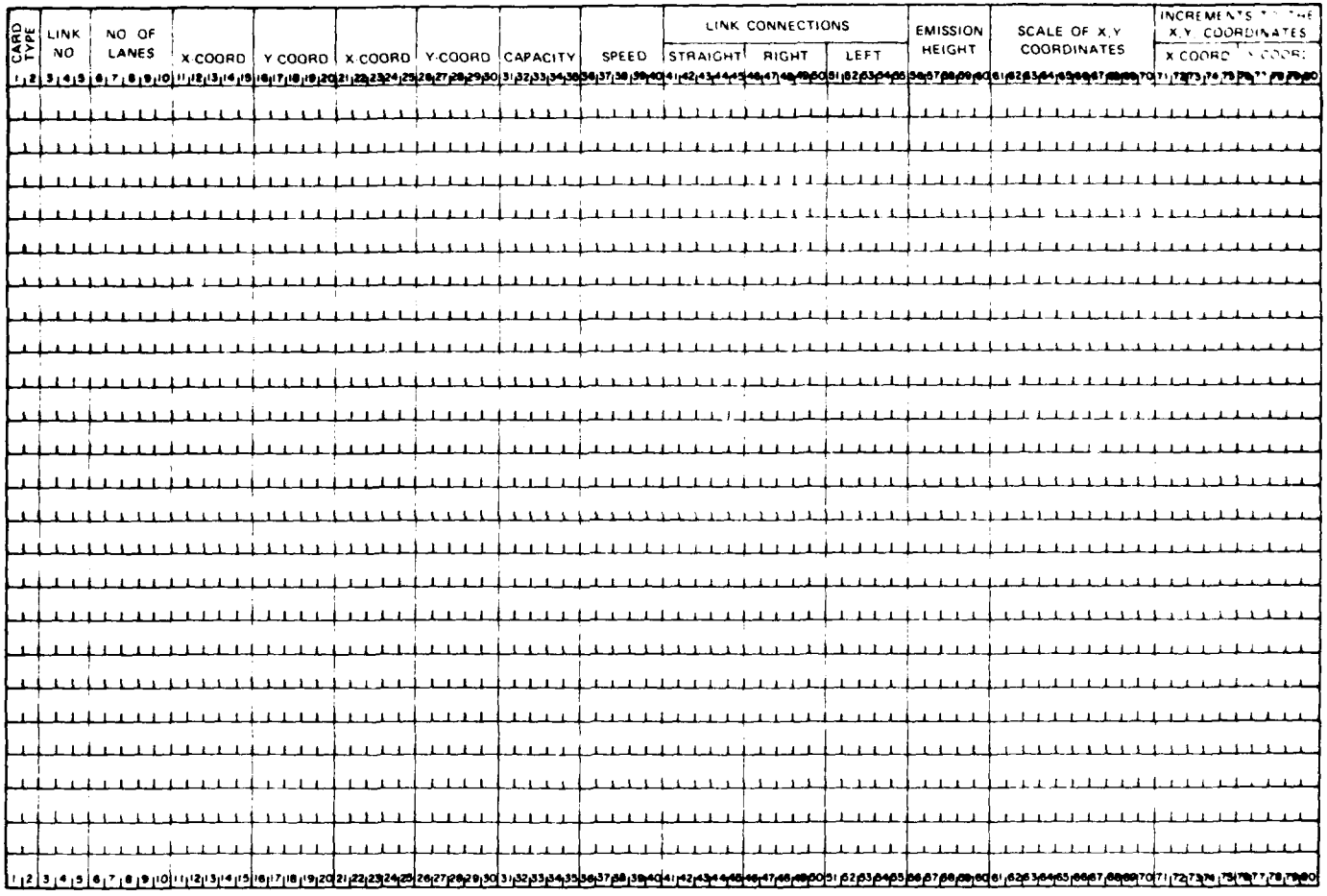


FIGURE 36. BATS INPUT CODING FORM – CARD TYPE 2: LINK DESCRIPTION

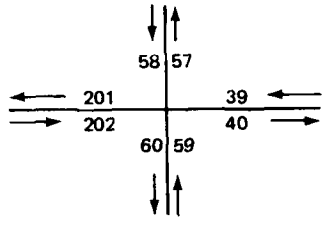
Card Type 3 - Intersection Description Card

Each Card Type 3 describes an intersection. Intersections are numbered consecutively from 1 to 70 following the link-numbering sequence. Each intersection is defined by the links that meet at that intersection, that is, by the approach link numbers rather than the exit link numbers (see Figure 37).

EXAMPLES:

(1) This intersection would be defined as follows:

North approach link = 58
East approach link = 39
South approach link = 59
West approach link = 202

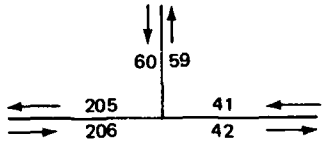


(2) If the intersection consisted of fewer than four links, like this T intersection:

it would be defined:

North approach link = 60
East approach link = 41
South approach link = 0
West approach link = 206

with zero designating the nonexistent link.



(3) If there is a Y intersection like this one where two of the links are neither directly north and south or east and west, the intersection could be defined as follows:

North approach link = 0
East approach link = 1
South approach link = 6
West approach link = 4

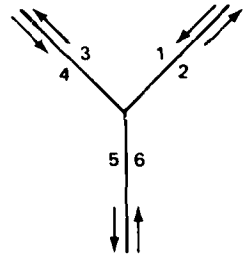


FIGURE 37. DEFINING INTERSECTIONS

Note that the links are always listed in clockwise order beginning with the northern link, and that the defining link is the one taken by vehicles going toward the intersection being described, rather than away from it.

For each intersection, the type of traffic control being used must be entered on Card Type 3 (see Figure 38). The codes for each type of traffic control are listed and defined in Table 12. The intersection and link numbers, and the type of traffic control at each are noted on map number one. For nonsignalized intersections, complete columns 1-30. The information needed to complete columns 31-75 for signalized intersections was recorded on Signalized Intersection Data Collection Sheets in Task 2, Step 4.

Coding Instructions for Card Type 3

Column(s)	Description	Possible Values
For all intersections:		
1-2	Card type number.	03
3-5	Intersection Number from 1 to a maximum of 70: Enter from NETINT listing or from map if intersections were numbered manually.	1-70
6-10	North approach link number from NETINT listing or map.	1-240
11-15	East approach link number from NETINT listing or map.	1-240
16-20	South approach link number from NETINT listing or map.	1-240
21-25	West approach link number from NETINT listing or map.	1-240
26-30	Type of traffic control at the intersection. Codes are explained in Table 12.	-2-+5

TABLE 12. INTERSECTION TRAFFIC CONTROLS

Symbol On Map	Code	Definition
S or Y	-2	4-way stop signs--All four links have stop signs.
S or Y	-2	3-way stop signs--A T-intersection, all three links have stop signs.
S or Y	-1	2-way stop signs--The street with the larger volume has no traffic control for its two links, while the cross street's links are controlled by stop signs.
S or Y	-1	1-way stop--One link, probably in a T-intersection, is controlled by a stop sign.
None	0	No traffic controls on any of the approach links.
0	1	Fixed-time traffic signal controls traffic in both directions.
0	2	Vehicle-actuated (VA) signal control and possibly separate left-turn phase.
0	3	VA signal control with separate phases, for example north approach traffic may be able to go left as well as straight without crossing south approach traffic because south approach traffic would have a red light.
0	4	Combination of signal controls 2 and 3 above--type 2 control on the north-south road, type 3 control on the east-west road.
0	5	Combination of signal controls 2 and 3 above, but reversed from Code 4, with type 3 control on the north-south road and type 2 control on the east-west road.

Column(s)	Description	Possible Values
For Signalized Intersections Only:		
31-35	If the intersection is signalized, enter the cycle time in seconds (the total time from one green light to the next green light on that same approach). The timing should be available from the Civil Engineering Office.	20-200
36-39	The minimum phase time (length of green light), in seconds on the north-south roadway. If there is a type 3 control approach, enter the minimum phase time of the north approach.	10-180
40-43	The minimum phase time in seconds on the east-west roadway. If there is a type 3 control approach, enter the minimum phase time of the west approach.	10-180
44-47	Left turn minimum signal time in seconds on the north-south roadway, if any. If there is no left turn signal and left turns are made through opposing traffic during Phase I, enter a zero. If a type 3 control approach enter the minimum phase time of the south approach.	10-180
48-51	Left turn minimum signal time in seconds on the east-west roadway, if any. If there is no left turn signal and left turns are made through opposing traffic during Phase I, enter a zero. If this is a type 3 control approach, enter the minimum phase time for the west approach.	10-180
52-55	Amount of amber time. This can either be ascertained in the field, or be supplied by the traffic engineer with jurisdiction over signaling.	3-5
56-75	For a signalized intersection, these columns may be used to specify the capacity of each of the four approaches to the intersection (the number of vehicles that can move through the intersection during 1 hour of green signal time). If these are left blank, the computer program will determine the capacity, provided a signal type was entered in columns 26-30 on this card.	

PROJECT ______________ DATE ______________ PAGE ______________

CARD TYPE	INTERSECTION NO	APPROACH LINK NUMBERS				CONTROL TYPE	CYCLE	PHASE TIME				AMBER TIME	PHASE CAPACITY				
		NORTH	EAST	SOUTH	WEST			I	II	III	IV		I	II	III	IV	
1 2	3 4 5	6 7 8 9 10	11 12 13 14 15	16 17 18 19 20	21 22 23 24 25	26 27 28 29 30	31 32 33 34 35	36 37 38 39	40 41 42 43	44 45 46 47	48 49 50 51	52 53 54 55	56 57 58 59	60 61 62 63	64 65 66 67	68 69 70 71	72 73 74 75 76 77 78 79 80

FIGURE 38. BATS INPUT CODING FORM – CARD TYPE 3: INTERSECTION DESCRIPTION

Card Type 4 - Zone Description

Complete this card type using the map on which zones were outlined and numbered. Street or parking lot counts (see Tasks 7c and 7d, Tables 9 and 10), together with Military Vehicle Counts made for Task 7e, can be used as the basis for computing the percentages of each type of vehicle to be associated with a zone. Be sure to include heavy duty truck counts in zones that generate heavy duty truck traffic, such as the BX and commissary. For the exterior zones, use the average of the total number of vehicles of each type recorded on the base.

Coding Instructions - Card Type 4

Column(s)	Description	Possible Values
1-2	Card type number.	04
3-4	Zone designation: Zones exterior to the base must be listed first, and are represented by two letters. For example, PH could be used to designate Phoenix, ME for Mesa, CH for Chandler, and so on. Zones interior to the base are listed in numerical order. The total number of zones, interior plus exterior, cannot exceed 50.	1-50 or AA-ZZ
5-16	Percentage of civilian vehicles of each type parked in the zone using parking lot counts from Task 7c.	0-99

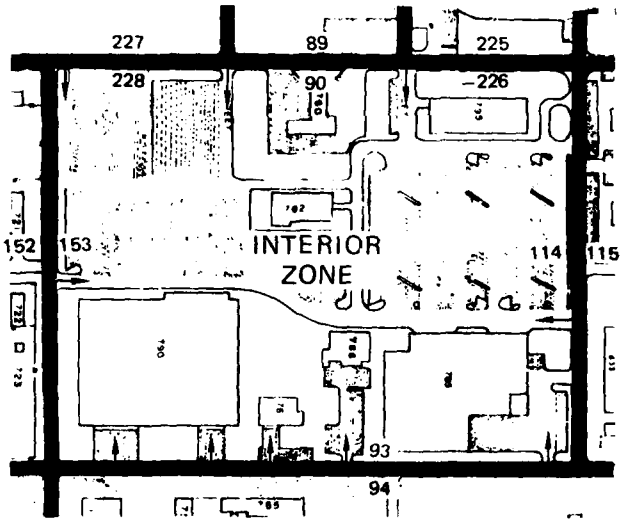
Column	
5-6	LDV (light-duty vehicles, cars)
7-8	LDT1 (light-duty trucks, under 6,000 lb)
9-10	LDT2 (light-duty trucks, 6,000-8,500 lb)
11-12	HDT (heavy-duty trucks)
13-14	HDD (heavy-duty diesels)
15-16	MOT (motorcycles)

These percentages should add to approximately 100%. (If there are bicycles parked in the zone, the percentages will add to less than 100.) Leave these spaces and 17-28 blank on the exterior zone cards until the interior zones are completed. For exterior zones, add up all the vehicles of each type for all zones, figure the percentage of each, and use that average for all external zones

Column(s)	Description	Possible Values
17-28	Percentages of military vehicles of each type located in each zone, from the BLIS Report (see Tasks 1 and 7e). Column 17-18 LDV (light-duty vehicles, cars) 19-20 LDT1 (light-duty trucks, under 6,000 lb) 21-22 LDT2 (light-duty trucks, 6,000-8,500 lb) 23-24 HDT (heavy-duty trucks) 25-26 HDD (heavy-duty diesels) 27-28 MOT (motorcycles)	0-99
29-30	Number of buses arriving in or leaving the zone during a time period, if any.	0-99
31-32	The number of links that define each zone. There may be as many as 12. This number should be filled in after completing columns 33-80.	3-12
33-80	The identifying numbers of the links related to a zone (see Figure 39): For internal zones: The first link numbers entered should be those that outline the zone. Each of these links should be followed by the link to which it is connected. The last of these outlining links should be connected to the first link entered. For external zones: The links on which vehicles travel from an external zone to enter the base should be entered first, followed by the links by which vehicles leave the base to travel to an external zone. Negative link numbers: If a link borders a zone, but does not provide access to it (into a parking lot, alley, or driveway, for example), it is entered as a negative link number. If additional space remains in the field after the zone is outlined, enter the numbers of any other bordering links from which vehicles can enter (access) the zone. If the number of bordering links is more than 12, links should be entered on the coding form (Figure 40) in this order: o Bordering links that define the zone. o Interior links (links inside the zone, if any). o Other links that both border and allow access to the zone.	1-240

EXAMPLE:

In this example, 225 is not entered because that section bordering the zone was already identified as −226, and 225 does not have a vehicle access to the interior of the zone.



BATS INPUT CODING FORM CARD TYPE 4 ZONE DESCRIPTION

CARD TYPE	ZONE ID	PERCENT OF CIVILIAN VEHICLES TYPE 1	2	3	4	5	6	PERCENT OF MILITARY VEHICLES TYPE 1	2	3	4	5	6	BUS	NO. OF BORDERING LINKS	BORDERING LINK NUMBERS 1	2	3	4	5	6	7	8	9	10	11	12
04	226													0	6	153	228	90	-226	114	93	152	227	89	115	94	

FIGURE 39. ZONE DESCRIPTION EXAMPLE

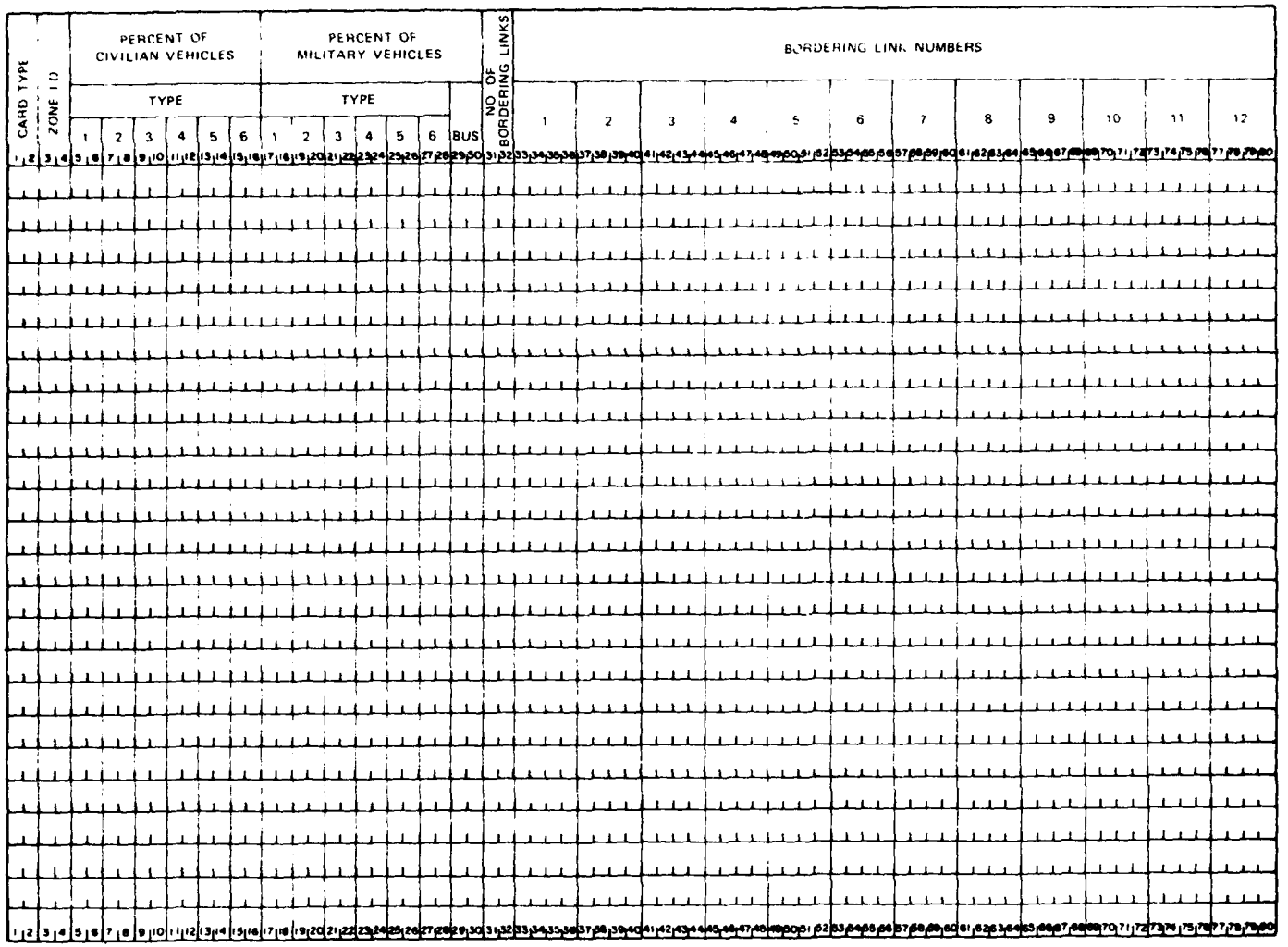


FIGURE 40. BATS INPUT CODING FORM – CARD TYPE 4: ZONE DESCRIPTION

Card Type 5 - Demographic Variables

Demographic variables characterize a zone's population. They indicate vehicle trips beginning or ending in a zone in which they occur. Some examples of useful demographic variables are the number of houses, number of employees, retail sales data, parking lot capacity, or number of seats in a theater. Such variables can produce 15 general types of vehicle trips going from one type of activity to another (e.g., example, from home to work (HOME-WORK). During a given time period, a zone can produce one, several, or none of the possible trip types.

One card type 5 is required for each Card Type 4.

Coding Instructions - Card Type 5

Column(s)	Description	Possible Values
1-2	Card type number.	05
3-4	Zone identification number.	1-50
5	Zone's principal land use. Obtain code number from the land-use map.	1-7
	1 = Housing 2 = Industrial 3 = Shopping 4 = Service/Recreation 5 = All external zones 6 = Administrative 7 = Flight line	
6-9	External zone: travel time in seconds to or from the zone to the first bordering link that was assigned a link number.	up to 9,999
	Internal zone: parking capacity (number of parking stalls from parking lot maps).	0-9,999
10-13	External zone: alternate travel time in seconds to or from all bordering links other than the time entered in columns 6-9.	up to -9,999
	Internal zone: number of parked vehicles in the zone at the start of the time period being simulated (from parking lot counts)	0-9,999

Column(s)	Description	Possible Values
14-80	Demographic Variable Values: Using Table 6, Work Trip Data Collection Form (Task 5), and Table 7, Nonwork Trip Data Collection Form (Task 6), from Section II, enter the number of employees, housing units, trips, or vehicles located in each zone in the appropriate column on Card Type 5 (see Figure 41). If none exist in a particular zone, leave the columns blank.	0-99,999

Column(s)	Index		Demographic Variable
14-20	1	=	Military employees
21-27	2	=	Civilian employees
28-34	3	=	Total number of houses occupied by AFB employees
35-41	4	=	Dormitory rooms occupied by AFB employees
42-48	5	=	Food service employees
49-55	6	=	Commercial employees
56-62	7	=	Hospital employees
63-69	8	=	Service/recreation employees
70-73	9	=	Number of military vehicles
74-80	10	=	Military vehicles miles per year

If the BX and the commissary are located in the same zone, do not enter the total number of employees for both. Deduct the number of workers from the store with the smaller total number of employees from the total for the zone.

Information on number of military vehicles and their yearly mileage is found in the BLIS Report "Military Vehicle Utilization." (See Task 1, Section II.) If this is not available, columns 70-80 may be left blank.

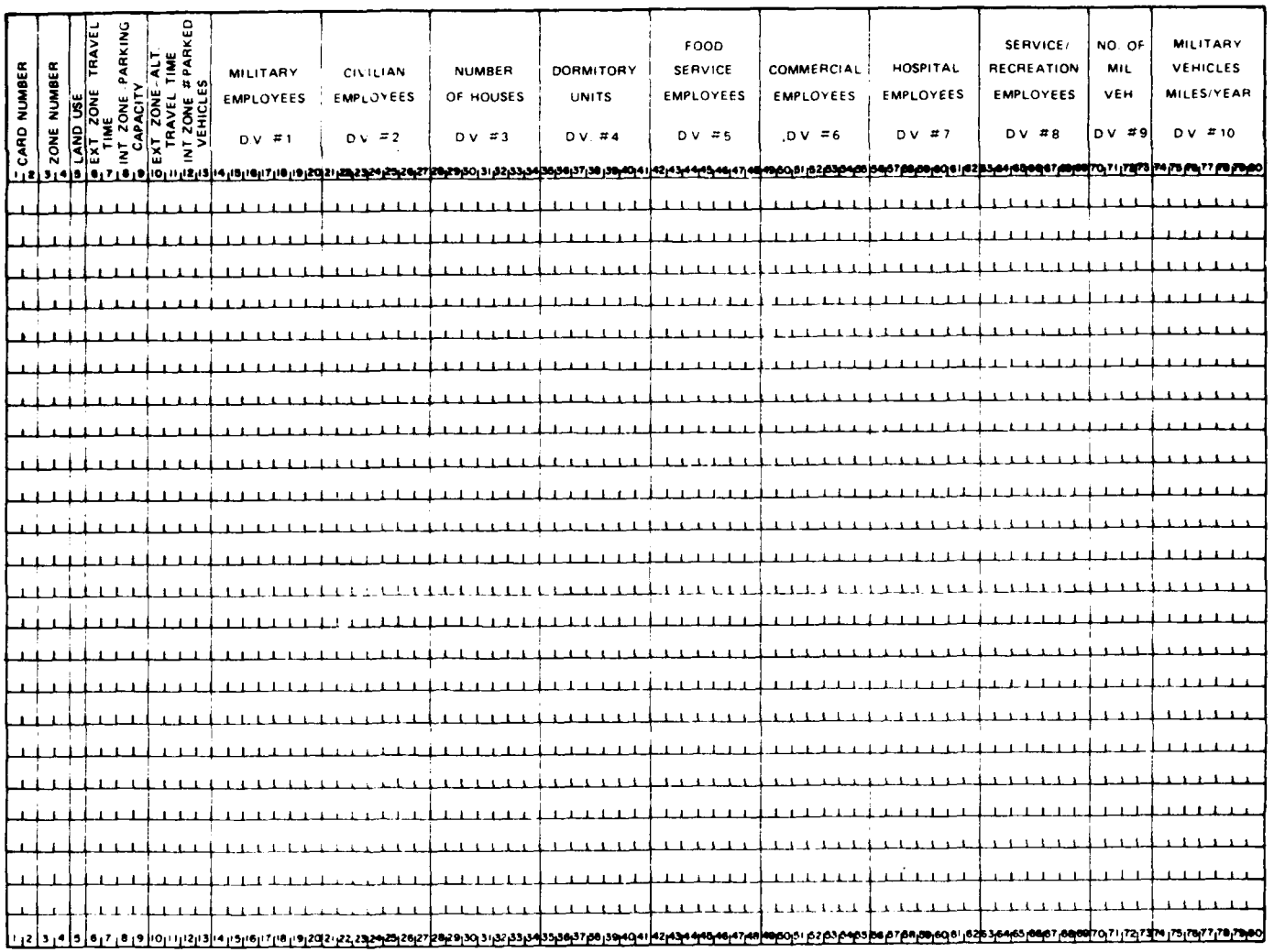


FIGURE 41. BATS INPUT CODING FORM – CARD TYPE 5: DEMOGRAPHIC VARIABLES

Card Type 6 - Trip Purpose Card

The trip purpose card indicates those trips generated to or from all zones for each trip purpose. The user may specify as many as 15 trip purposes on Card Type 6 (see Figure 42), as follows:

- Both ends of trips may be generated by entering at least two demographic variable indices from Card Type 5 and production and attraction coefficients for them. If the first land use entered is 0, all land uses will be used to generate trips for any demographic variables entered on Card Type 6.
- To generate one end of the trip using Card Type 6 while the other end is generated by default, at least one land use, one demographic variable index from Card Type 5, and one set of production and attraction coefficients must be entered on Card Type 6. The other end of each trip will then be generated by default.
- If both trip ends are to be generated by default, a Card Type 6 must be prepared which has a land use entered in column 16. However, in this case, the columns indicating demographic variables and coefficients are left blank.

Coding Instructions - Card Type 6

Column(s)	Description	Possible Values
1-2	Card type number.	06
3-12	Alphabetic trip purpose name, e.g., HOME-WORK: Note that the first trip purpose is always HOME-WORK or WORK-HOME even if there are no trips generated. It is not necessary to enter both the origin and destination land uses of a trip except in the case of HOME-WORK. This field should be left justified, i.e., any blank columns in the field should be on the right end of the field.	
13-14	Percent of cold-start vehicles in external zones, from the following tabulation.	0-99

Origin of Trip	Land Use Number	Percent of Cold Starts
HOME	1	99
INDUSTRIAL	2	50
SHOP	3	10
SERVICE/REC	4	10
EXTERNAL	5	01
ADMIN	6	50
FLT LINE	7	50

Column(s)	Description	Possible Values
15-16	Percent of cold-start vehicles for internal zones, as shown above.	0-99
17	Land use code number for generating (producing or attracting) trips, by code number. 0 = All land uses 1 = Housing 2 = Industrial 3 = Shopping 4 = Service/Recreation 5 = External 6 = Administrative 7 = Flight line	1-7
18-19	Demographic Variable number from Cards Type 5. This number will be multiplied by the production and attraction coefficients (columns 20-31) to generate trips.	1-10
20-25	Production coefficient--this value, multiplied by its demographic variable, equals the number of trip productions from all land-use zones of this type for the time period being simulated. If other data are insufficient to derive coefficients for a particular base, the following table which summarizes the trips made to and from activities on a typical base, may be used for both the production and the attraction coefficients.	

PRODUCTION/ATTRACTION COEFFICIENTS

Time Period	Food Service Employees	Shopping Employees	Hospital Employees	Service/Recreation Employees
0000-0024	15	21	2.76	37
0600	0.89	--	--	0.1
0700	1.137	0.5	0.24	0.64
0800	0.73	0.93	0.34	2.21
0900	0.87	1.27	0.28	2.19
1000	1.09	2.13	0.28	2.39
1100	1.68	2.23	0.1	4.9
1200	2.04	2.96	0.08	5.13
1300	0.74	2.83	0.34	3.49
1400	0.66	2.06	0.34	5.07
1500	1.19	2.02	0.28	4.6
1600	0.98	2.47	0.23	2.07
1700	0.72	1.15	0.09	1.92

This table summarizes the trips made to and from activities on the bases studied during the development of the BATS model.

26-31 Attractions coefficient--this value, multiplied by its demographic variable, equals the number of trips attracted to all land-use zones of this type for the time period being simulated.

Note: The same types of information (land use, demographic variable, production and attraction coefficients) required in columns 17 through 31 occur three times on each Card Type 6 (Figure 42):

Columns			Description
32	47	62	Land use*
33-34	48-49	63-64	Demographic variable+
35-40	50-55	65-70	Production coefficients
41-46	56-61	71-76	Attraction coefficients

*If more than one land use is specified on Card Type 6, only those zones with those land uses will have any trips produced or attracted. If only one land use is specified, the other end of each trip will be assigned by default.

+If no demographic variable index from Card Type 5 is entered, both ends of trips will be generated by default.

AD-A079 326 SRI INTERNATIONAL MENLO PARK CA F/G 15/5
USER GUIDE FOR AIR FORCE BASE AUTOMOTIVE TRANSPORTATION SIMULAT--ETC(U)
SEP 79 M DUFFEY-ARMSTRONG , S SWOPE F08635-76-D-0132
UNCLASSIFIED AFESC/ESL-TR-79-16-VOL-1 NL

2 OF 2
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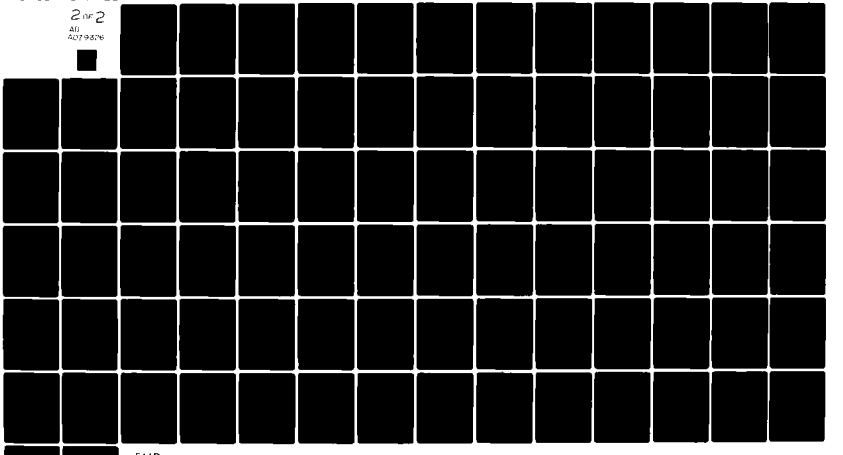

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2-80
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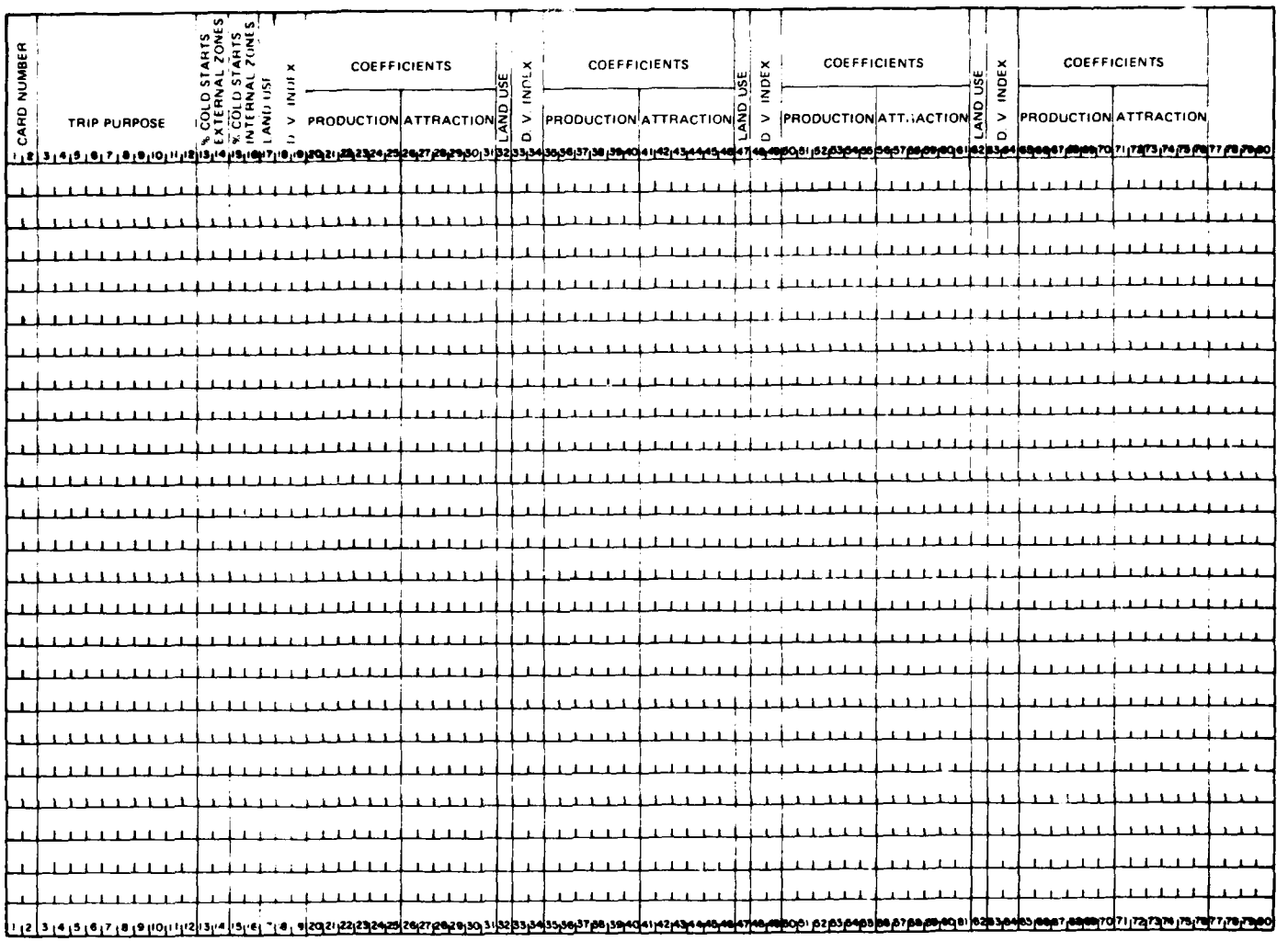


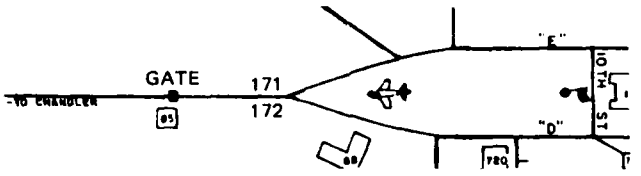
FIGURE 42. BATS INPUT CODING FORM – CARD TYPE 6: TRIP PURPOSE CARD

Card Type 7 - Gate Description

Each gate providing entrance to or exit from a facility must be described on a Card Type 7. Using the scaled map, number the gates consecutively from 1 to 10. If a base has more than ten gates, omit those gates that have the smallest volume of traffic; refer to gate counts if necessary (Task 7a). Each gate is defined by the link(s) that pass through it (see Figure 43). If a gate is one-way entering the base, the link number would be entered in columns 11-15, while columns 6-10 would be left blank. If the gate is one-way exiting the base, the link number would be entered in columns 6-10, while 11-15 would be left blank. Figure 44 is the coding form to be used in collecting data for Card Type 7.

EXAMPLE:

The only gate on one of the sample bases looks like this:



Thus, the gate would be numbered Gate # 1, and be defined by its exit link, 171 and its entrance link 172,

BATS INPUT CODING FORM - CARD TYPE 7 GATE DESCRIPTION

CARD NUMBER	GATE NUMBER	EXIT LINK NUMBER	ENTRY LINK NUMBER	TOTAL NUMBER OF VEHICLES		15-MINUTE EXITING GATE COUNTS				15-MINUTE ENTERING GATE COUNTS				TIME OF DAY	HOURLY EXIT CAPACITY	HOURLY ENTRY CAPACITY
				EXITING	ENTERING	00-15	15-30	30-45	45-60	00-15	15-30	30-45	45-60			
07	1	171	172	371	366									0600		

FIGURE 43. GATE DESCRIPTION EXAMPLE

Twelve cards of Type 7 are needed for each gate, one card for every hour from 0600 to 1700.

Coding Instructions - Card Type 7

Column(s)	Description	Possible Values
1-2	Card type number.	07
3-5	Gate number (ten-gate maximum).	1-10
6-10	Exit link number (from scaled map).	1-240
11-15	Entrance link number (from scaled map).	1-240
16-20	Total number of vehicles exiting through the gate during the hour (from Task 7a).	0-99,999
21-25	Total number of vehicles entering through the gate during the hour (from Task 7a).	0-99,999
26-45	Fifteen-minute exiting gate counts if available. If not leave these columns blank.	0-99,999
	Vehicles exiting through gate during:	
26-30	First 15-minute period, such as 0800-0815	
31-35	Second 15-minute period, such as 0815-0830	
36-40	Third 15-minute period, such as 0830-0845	
41-45	Fourth 15-minute period, such as 0845-0900	
46-65	The same information for entering vehicles as given for exiting vehicles in columns 26-45.	0-99,999
66-70	The time of the day based on a 24-hour clock. For most uses of the model, one card should be completed for each gate for each of 12 hours from 0600 to 1700.	0100-2400

Hour of Day (HOD)		Hour of Day (HOD)	
Civilian	Military	Civilian	Military
1 am	0100	1 pm	1300
2 am	0200	2 pm	1400
3 am	0300	3 pm	1500
4 am	0400	4 pm	1600
5 am	0500	5 pm	1700
6 am	0600	6 pm	1800
7 am	0700	7 pm	1900
8 am	0800	8 pm	2000
9 am	0900	9 pm	2100
10am	1000	10pm	2200
11am	1100	11pm	2300
12am	1200	12pm	2400

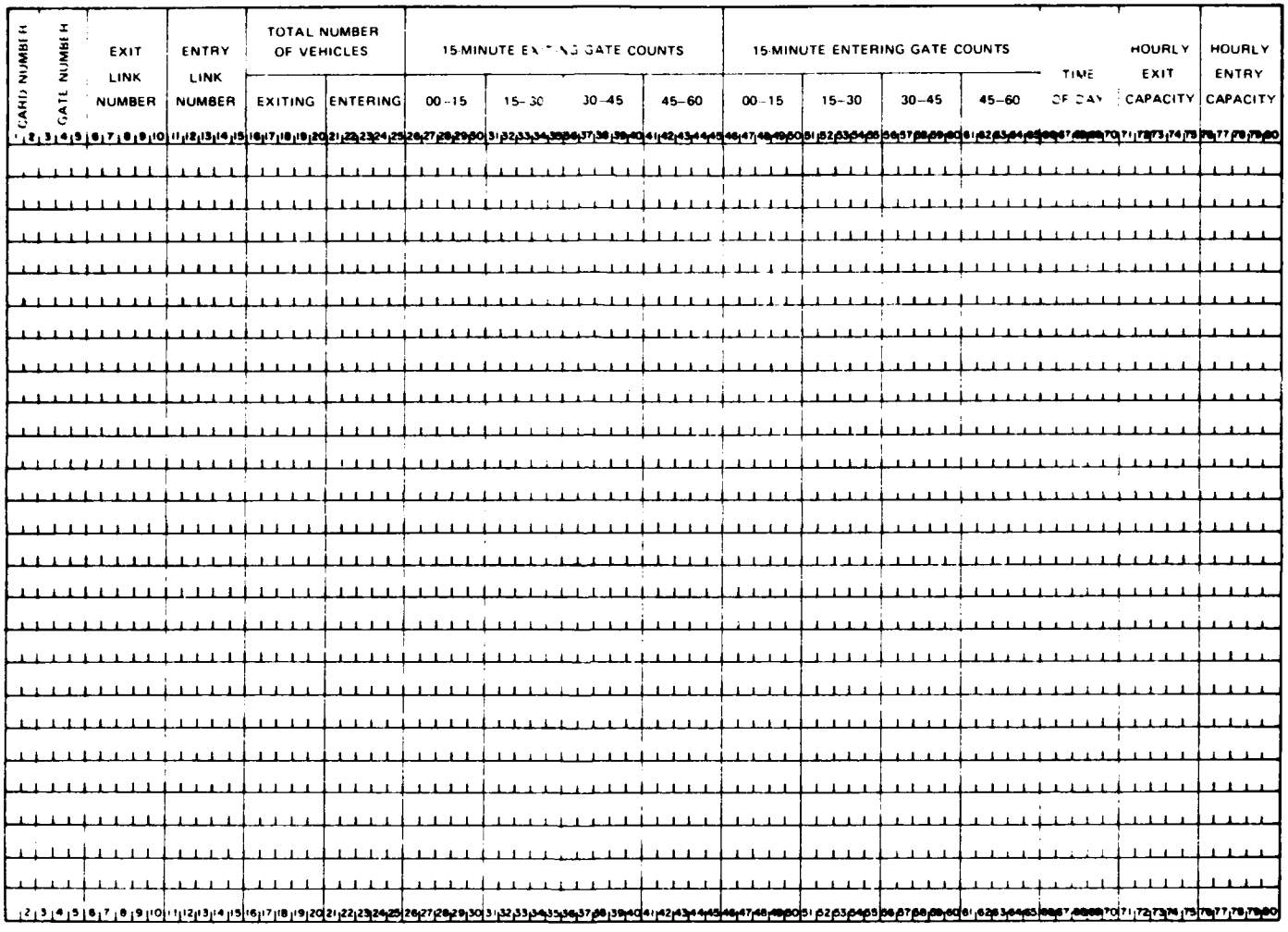


FIGURE 44. BATS INPUT CODING FORM – CARD TYPE 7: GATE DESCRIPTION

71-75	The maximum hourly exit capacity of the gate, if known, should be entered on the first of the 12 cards for the gate, the 0600 card. If these columns are left blank, capacity restriction will not be modelled.	0-99,999
76-80	The maximum number of vehicles that can enter through the gate in one hour, if known. If these columns are left blank capacity restriction will not be modelled.	0-99,999

Card Type 8 - Vehicle Counts (Optional Card)

This card, simulates movement of traffic through off-base intersections. It is used to specify nonbase-destined vehicles on the off-base street network to account for traffic passing through the major off-base intersections to aid in predicting congestion outside base entrances. It is also required if BATS is to produce input to AQAM. Each card can be used to describe one intersection of up to four links.

Street counts performed by the city, county, or state department of transportation, should be used in conjunction with gate counts. Use whatever actual count data is available and then, based on logical assumptions, estimate the missing data as shown in Figure 45.

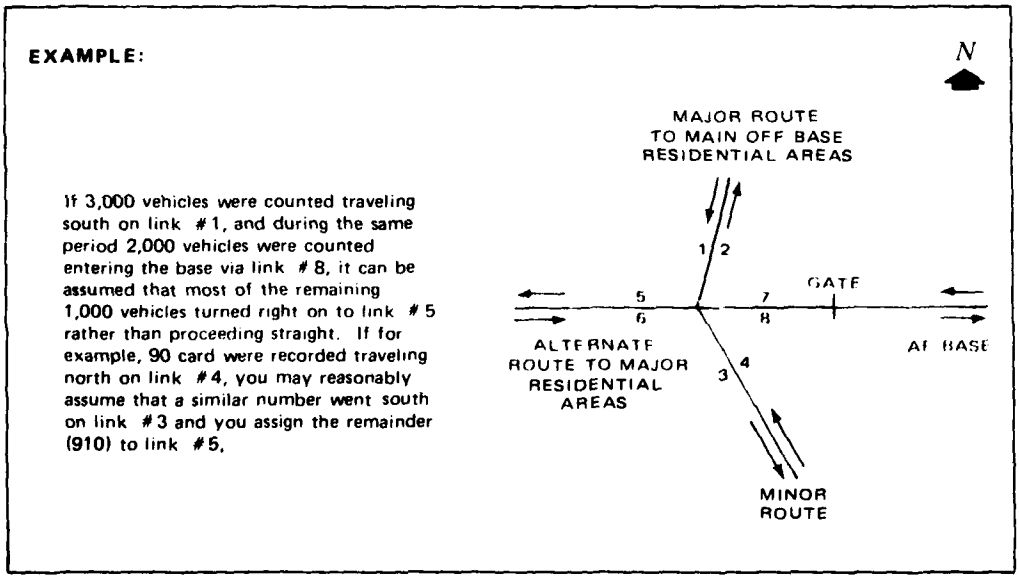


FIGURE 45. ESTIMATING VEHICLE COUNTS

Coding Instructions - Card Type 8

Column(s)	Description	Possible Values
1-2	Card Type number.	08
3-5	The north approach link number.	1-240
6-10	Number of vehicles travelling south on the north approach to the intersection.	0-99,999
11-15	Number of vehicles turning right (west) on the north approach.	0-99,999
16-20	Number of vehicles turning left (east) on the north approach.	0-99,999
21-25	The east approach link number.	1-240
26-30	Number of east approach vehicles travelling straight (west).	0-99,999
31-35	Number of east approach vehicles turning right (north).	0-99,999
36-40	Number of east approach vehicles turning left (south).	0-99,999
41-45	South approach link number.	1-240
46-50	Number of south approach vehicles travelling straight (north).	0-99,999
51-55	Number of south approach vehicles turning right (east).	0-99,999
56-60	Number of south approach vehicles turning left (west).	0-99,999
61-65	West approach link number.	1-240
66-70	Number of west approach vehicles travelling straight.	0-99,999
71-75	Number of west approach vehicles turning right (south).	0-99,999
76-80	Number of west approach vehicles turning left (north).	0-99,999

Data should be collected in the format shown in Figure 46.

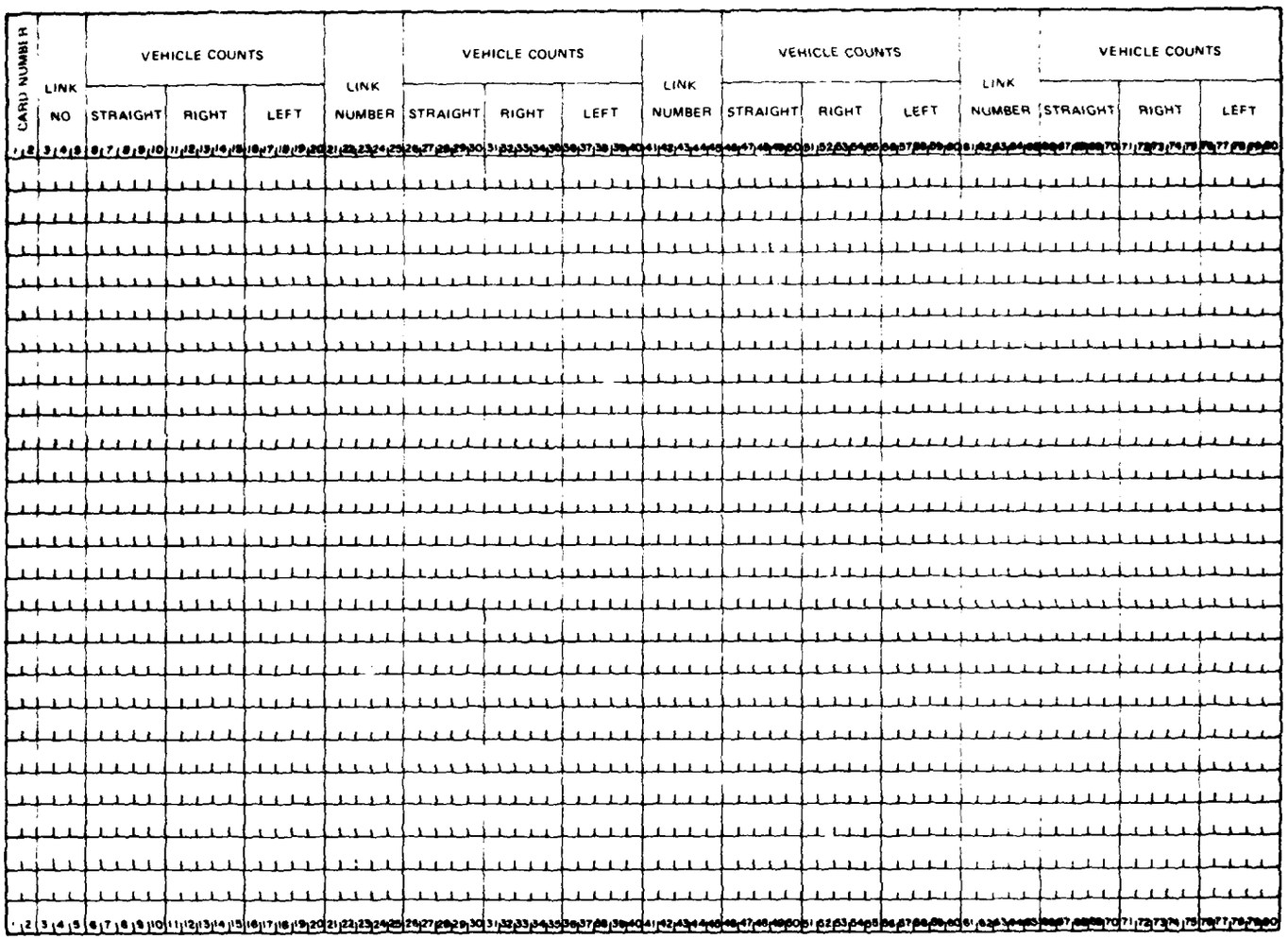


FIGURE 46. BATS INPUT CODING FORM – CARD TYPE 8: VEHICLE COUNTS

Card Type 9 - Load Factors

Load factors (the automobile occupancy rate) are simply the average number of persons riding in the various types of vehicles operating on a base. The load factor should be determined and entered for each type of military and civilian vehicle traveling on-base. It could remain constant for all vehicles throughout the day. However, passenger car occupancy is likely to be higher during the lunchtime period from approximately 1130 to 1330.

Vehicle load factors can be determined by making head counts at the same time gate or roadway counts are made. Divide the total number of vehicle occupants by the total number of vehicles to give the load factor.

The work shift rush hour load factor can be determined by taking the number of persons working on the base, subtracting the number of persons who work on-base and live on-base, and then dividing by the number of vehicles that enter the base each day during the morning rush hour.

EXAMPLE:

6,000 work on-base
-1,500 work and live on-base

4,500 work on-base, live off-base; 3,700 vehicles arrive on-base during morning rush hour

Load Factor - 4,500 ÷ 3,700 = 1.2

At a sample base, 2,848 employees arrive at work between 0600 and 0900. The "Community Pac o' Facs," published by the base, indicates that 31% of base employees or 883 live on base (2,848 x 0.31 = 883). Therefore, 2,848 - 883 = 1,965 employees arrive at work from off-base between 0600 and 0900. Gate counts showed 1,607 vehicles arriving during that time. Thus, the average occupancy or load factor is 1.22 persons (1,965 divided by 1,607 = 1.22) per car during the morning rush hour.

A head and vehicle count from 1100 to 1300 resulted in 4,170 persons and 3,252 vehicles, or a 1.28 (4,170 divided by 3,252 = 1.28) occupancy rate (load factor) during the noon hours. All bicycles, and most motorcycles and heavy duty trucks will tend to have one occupant per vehicle or a load factor of 1.0. Bus load factors indicate the

average ridership on any bus service. If this space is left blank on the computer card, the BATS model will compute the bus ridership based on the time required (including average wait) to get from one zone to another. Figure 47 shows how load factor cards for 1100 and 0600 might be completed. Figure 48 is the blank coding form on which the data may be collected.

EXAMPLE:

BATS INPUT CODING FORM CARD TYPE 9 LOAD FACTORS

CARD NUMBER	CIVILIAN VEHICLE LOAD FACTORS						MILITARY VEHICLE LOAD FACTORS						BUS LOAD FACTOR	TIME OF DAY	
	LDV	LDT1	LDT2	HDT	HDD	MOT	LDV	LDT1	LDT2	HDT	HDD	MOT			
09	1.2	1.2	1.2	1.0	1.0	1.0	1.2	1.2	1.2	1.0	1.0	1.0	5.0	1100	
09	2.2	2.2	2.2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0600	

FIGURE 47. COMPLETING THE LOAD FACTORS CODING FORM

Coding Instructions - Card Type 9

Column(s)	Description	Possible Values
1-2	Card type number.	09
3-32	Civilian Vehicle Load Factors	1.0-99.0
3-7	Passenger vehicles (LDV).	
8-12	Light-duty truck, 0-6,000 lb (LDT1).	

Column(s)	Description	Possible Values
13-17	Light-duty truck, 6,000-8,500 lb (LDT2).	
18-22	Heavy-duty truck (HDT).	
23-27	Heavy duty diesel truck (HDD).	
28-32	Motorcycle (MOT).	
33-62	Military Vehicle Load Factors	1.0-99.0
33-37	Light-duty passenger vehicles (LDV).	
38-42	Light-duty trucks, 0-6,000 lb (LDT1).	
43-47	Light-duty trucks, 6,000-8,500 lb (LDT2).	
48-52	Heavy-duty trucks (HDT).	
53-57	Heavy-duty diesel trucks (HDD).	
58-62	Bus load factor.	
68-72	Time of day in military time.	

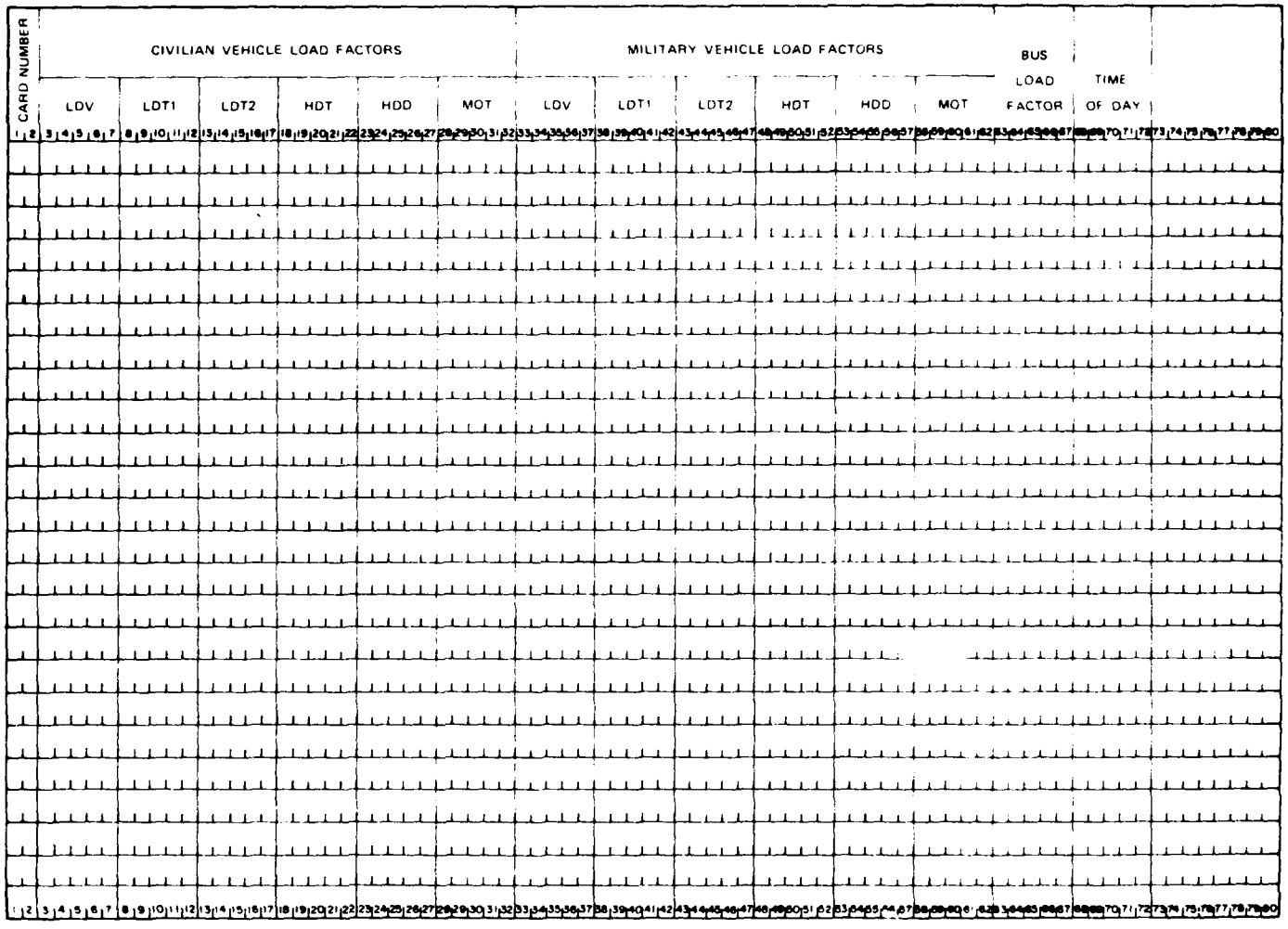


FIGURE 48. BATS INPUT CODING FORM – CARD TYPE 9: LOAD FACTORS

Card Type 10 - Truck Route(s)

This card describes the base truck routes. On the sample base, there is only one gate and only one truck route going from the gate to the loading docks. The BX and commissary are along the same route. The Civil Engineering Office should be able to identify assigned truck routes.

Using the map on which the road links have been numbered, use the first Card Type 10, Columns 8-80, to specify a truck route from the gate to the destination, beginning with the gate entrance link (in Figure 49 below, 172) and ending with the loading dock link (44).

The route from the dock to the gate is described by giving the entrance gate link first (i.e., 171), and the loading dock link last (here it would be 43).

As many as 48 links may be specified for each truck route. If there are fewer than 24 links (the sample route has ten links), only one card is needed to describe the route in each direction (a total of two cards for the route). If there are 25-48 links, two cards will be needed for each direction, or a total of four cards for each truck route.

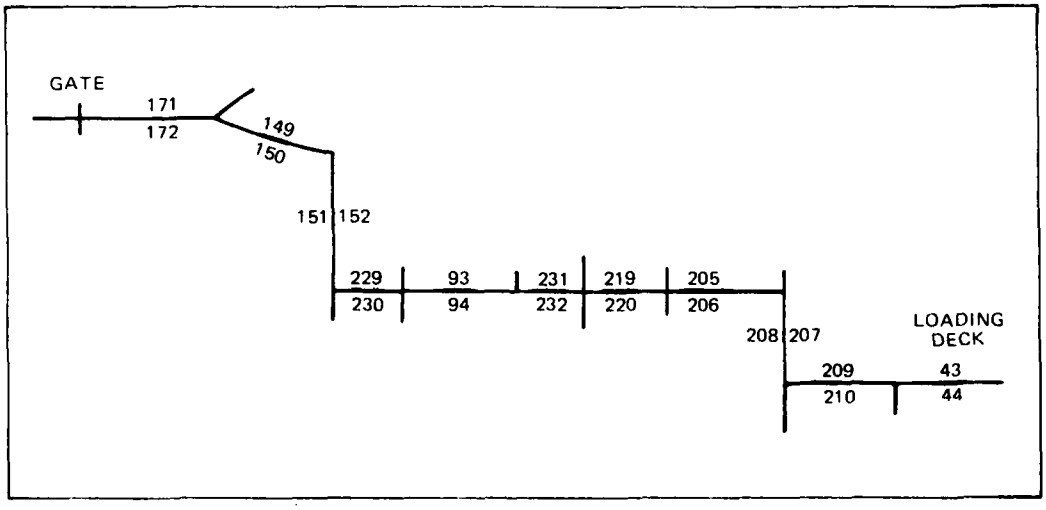


FIGURE 49. TRUCK ROUTE EXAMPLE

Coding Instructions - Card Type 10

Column(s)	Description	Possible Values
1-2	Card type number.	10
3-4	Entry or exit gate number.	1-10
5-7	Vehicle types using the truck route, usually both heavy-duty trucks and heavy-duty diesels. The entry here will usually be 4-5, indicating that both heavy-duty trucks and heavy-duty diesel trucks use the route (see code below). Abbreviations are explained in the instructions for Card Type 9. 1 = LDV 2 = LDT1 3 = LDT2 4 = HDT 5 = HDD 6 = MOT	1-1, 1-6
8-79	Route link numbers in order, from the entry gate to the loading dock on the first card and from the loading dock to the exit gate on the second card. On both cards, the gate link is listed first and the dock link, last. As was mentioned above, up to two cards may be used to specify as many as 36 links for the route. Figure 50 shows a filled in card type 10 for the sample base truck route.	1-240

A blank Card Type 10 is provided as Figure 51.

EXAMPLE:

BATS INPUT CODING FORM CARD TYPE 10 TRUCK ROUTES

LINK NUMBERS																								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

CARD NUMBER	GATE NUMBER	VEHICLE TYPES	LINK NUMBERS																					
10	4-5	1,2	150	152	230	94	232	220	206	208	210	44												
10	4-5	1,2	149	151	229	93	231	219	205	207	209	43												

FIGURE 50. COMPLETING THE TRUCK ROUTE CODING FORM

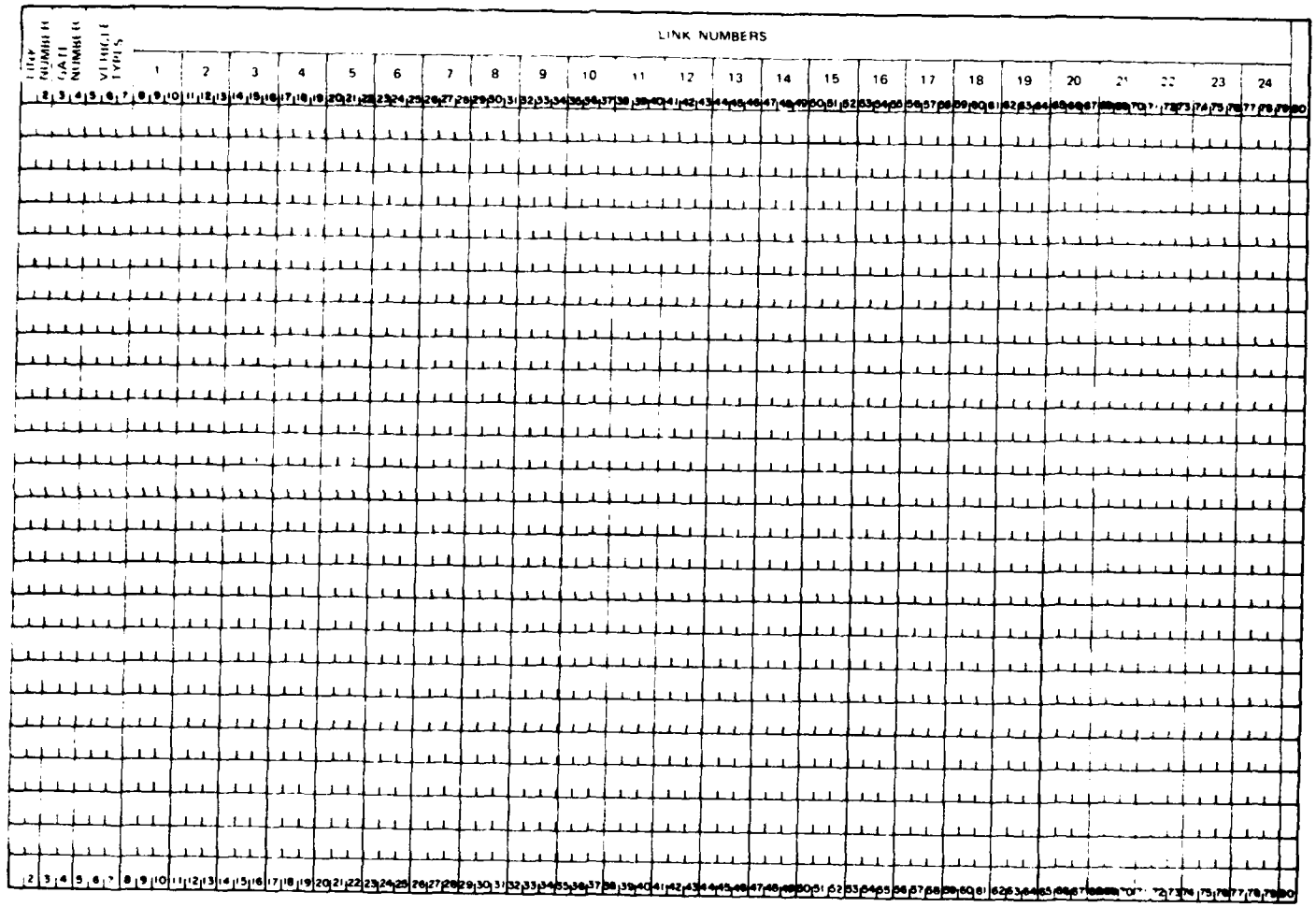


FIGURE 51. BATS INPUT CODING FORM – CARD TYPE 10: TRUCK ROUTES

Card Type 11 - Work Shift Counts

This card describes the number of persons arriving on or leaving the base for purposes of work during the morning and evening rush hours. From two to six cards will be needed for each 15-minute time period during the peak morning and evening rush hours, depending on the number of zones that have been defined for the base. (The peak rush hours run from 0600 to 0900, and from 1500 to 1800.) If the base has 18 or fewer interior zones, two Type 11 cards will be needed for each 15-minute time period. One card will record persons arriving (attractions) in each zone, and the other will record persons leaving the zone (productions) for a total of eight cards for each hour.

If there are more than 18 but fewer than 37 zones on the base, four Type 11 cards will be needed for each 15-minute time period, two for arrivals, two for departures, a total of 16 cards for each hour.

The number of persons to be entered for each zone in each time period can be found on the Table 6, Work Trip Data Collection Form completed for that zone. In Figure 52 below, four people arrive at work in Zone 4 between 0600 and 0615; 15 people arrive in Zone 1, 17 in Zone 2, 30 in Zone 3, and 50 in Zone 5 between 0630 and 0645. Figure 53 is the coding form to be used in collecting data on Card Type 11.

EXAMPLE:

BATS INPUT CODING FORM – CARD TYPE 11 WORK SHIFT COUNTS

CARD NO	PROD ATT	TIME	CARD SEQ	ZONE NUMBERS																			
			3 2 1	37 19 1	38 20 2	39 21 3	40 22 4	41 23 5	42 24 6	43 25 7	44 26 8	45 27 9	46 28 10	47 29 11	48 30 12	49 31 13	50 32 14	33 15	34 16	35 17	36 18
1	2	0615	1				4														
1	2	0645	1		15	17	30		50												

FIGURE 52. COMPLETING THE WORK SHIFT CODING FORM

Coding Instructions - Card Type 11

Column(s)	Description	Possible Values
1-2	Card type number.	11
3	Indicates whether personnel are arriving at work or leaving. 1 = departures from zones (productions) 2 = arrivals in zones (attractions)	1, 2
4-6	Fill in time period, according the the following code numbers: 061 = 0600-0615 062 = 0615-0630 063 = 0630-0645 064 = 0645-0700 071 = 0700-0715 072 = 0715-0730 073 = 0730-0745 074 = 0745-0800 081 = 0800-0815 082 = 0815-0830 083 = 0830-0845 084 = 0845-0900 031 = 1500-1515 (3-3:15 p.m.) 032 = 1515-1530 033 = 1530-1545 034 = 1545-1600 041 = 1600-1615 042 = 1615-1630 043 = 1630-1645 044 = 1645-1700 051 = 1700-1715 052 = 1715-1730 053 = 1730-1745 054 = 1745-1800	
7	Card sequence: A 1 in this column indicates that the data applies to Zones 1-18; a 2 = Zones 19-36; a 3 = Zones 37-50. No card may be omitted. If, for example, no personnel were beginning a shift in zones 19-36 on a base with 41 zones, the second card should be filled out for columns 1-7, and columns 8-79 should be left blank or filled in with zeroes.	1-3
8-79	Four spaces are allotted for each of up to 18 zones per card. For example, columns 8-11 would be arrivals in Zone 1; columns 12-15 arrivals in Zone 2, etc. The numbers of persons to be entered for each time period should be taken from Table 6. Note that persons due at work at 0645 would probably arrive between 0630 and 0645. If there are 12 people due at work at 0645, that number should be entered on the arrivals card for the 15-minute period preceding their work start time, i.e., 0630-0645. In the case of departures, persons finishing work at 1630 would leave between 1630 and 1645 and should be entered on the 43 line, i.e., 1630-1645.	0-9,999

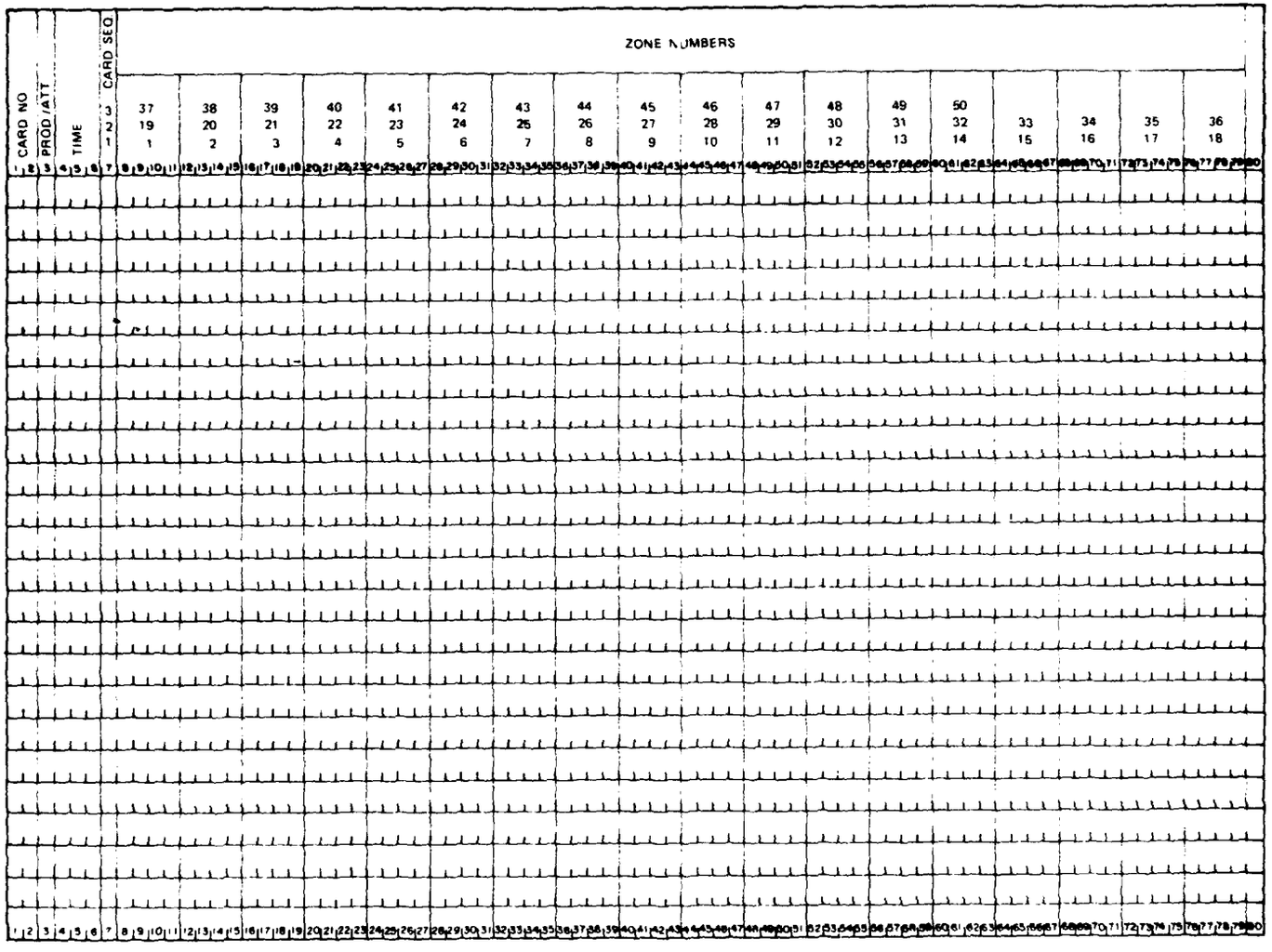


FIGURE 53. BATS INPUT CODING FORM – CARD TYPE 11: WORK SHIFT COUNTS

Card Type 12 - Plot Parameters Card

If the user wishes to change the specifications for mapping that are already in the model (e.g., scale, characteristics of the markings to indicate volume, labels), Card Type 12 is used to specify those map parameters that are to be changed (see Figure 54).

If no Card Type 12 is input for a computer run, and a plot is requested in column 73 of the Card Type 1 used for that run, the plot produced will be a complete link and zone map. It will be scaled so that one inch equals 400 feet (1" = 400'). Lines representing traffic volumes will be drawn as if there were 10 feet between them (the scale factor converts the 10 feet of real roadway to 0.25 inch on the plot). The tick marks used to indicate links where the traffic flow is critical or congested will be 20 feet long (i.e., 0.05 inch on the plot). The numbers showing the actual traffic volume on links will be printed 120 feet in height (i.e., 0.3 inch on the plot).

Coding Instructions - Card Type 12

Column(s)	Description
1-2	Card Type number is 12.
3-7	The lower left x coordinate of the map in UTM coordinates if the entire map is not to be plotted. If the entire map should be plotted, leave these columns blank.
8-12	The lower left y coordinate of the map in UTM coordinates if the entire map is not to be plotted. If the entire map should be plotted, leave these columns blank.
13-18	The scale factor for the map (e.g., entering 400 here results in a map scale of 1" = 400').
19-23	The distance between lines indicating traffic volume (e.g., entering a 10 will resultd in 0.25 inch between links on the plot from the scale factor of 1" = 400').
24-28	Tick mark length used to indicate links on the base network on which the traffic flow is critical. (e.g., a 20 here results in 0.05 inch between lines on the plot).
29-33	Distance between tick marks used to mark links with critical flow (e.g., a 60 entered here results in .15 inch between lines on the plot.

CARD NO.	LOWER LEFT x COORDINATE	LOWER LEFT y COORDINATE	SCALE FACTOR	TRAFFIC VOLUME LINES	TICK MARK LENGTH	TICK MARK SPACING	HEIGHT OF TRAFFIC VOLUME LETTERS	MAXIMUM NO OF VOLUME LINES	INITIAL PLOT TYPE
1 2	3 4 5 6 7	8 9 10 11 12	13 14 15 16 17 18	19 20 21 22 23	24 25 26 27 28	29 30 31 32 33	34 35 36 37 38	39 40 41 42 43	44 45 46 47 48

FIGURE 54. BATS INPUT CODING FORM – CARD TYPE 12: PLOT OPTION CARD

Column(s)	Description
34-38	Height of letters used to print traffic volumes on the map. Typically, a 120 would be entered here, resulting in 0.3-inch letters on the plot.
39-43	Maximum number of volume lines to be drawn next to links on the map.
44-48	Enter 1 for a plot of all links with link and zone numbers. Enter 2 for the same plot without the zone numbers.

Card Type 13 - Calibration Factor Card (Optional)

This card is used for predictive runs to simulate changes to the current base roadway network, or traffic flow, or both. If, for example, a building were moved, traffic flow would change; but the move would not necessarily close existing links nor add new links to the roadway network. On the other hand, opening or closing a gate would likely result in adding new links or closing existing links.

The calibration factors entered on this card are usually those produced as one output of the descriptive run of the model (Report F.1, Calibration Factors in Documentation for the Air Force Base Automotive Transportation Model--BATS). If only hourly counts were available for input to the descriptive run, Report F.1 will have only hourly factors. In this case, enter the hourly factor in the columns for the first 15-minute period (Columns 3-6, 19-22, 35-38, and 51-54) as shown in Figure 55 below. A blank coding form is provided as Figure 56.

BATS INPUT CODING FORM – CARD TYPE 13. CALIBRATION

CARD NO	FEXGEN				FEXATT				FINGEN				FINATT				
	00-15	15-30	30-45	45-60	00-15	15-30	30-45	45-60	00-15	15-30	30-45	45-60	00-15	15-30	30-45	45-60	
1 3	.771				.991				.950					.923			

FIGURE 55. COMPLETING THE CALIBRATION CODING FORM

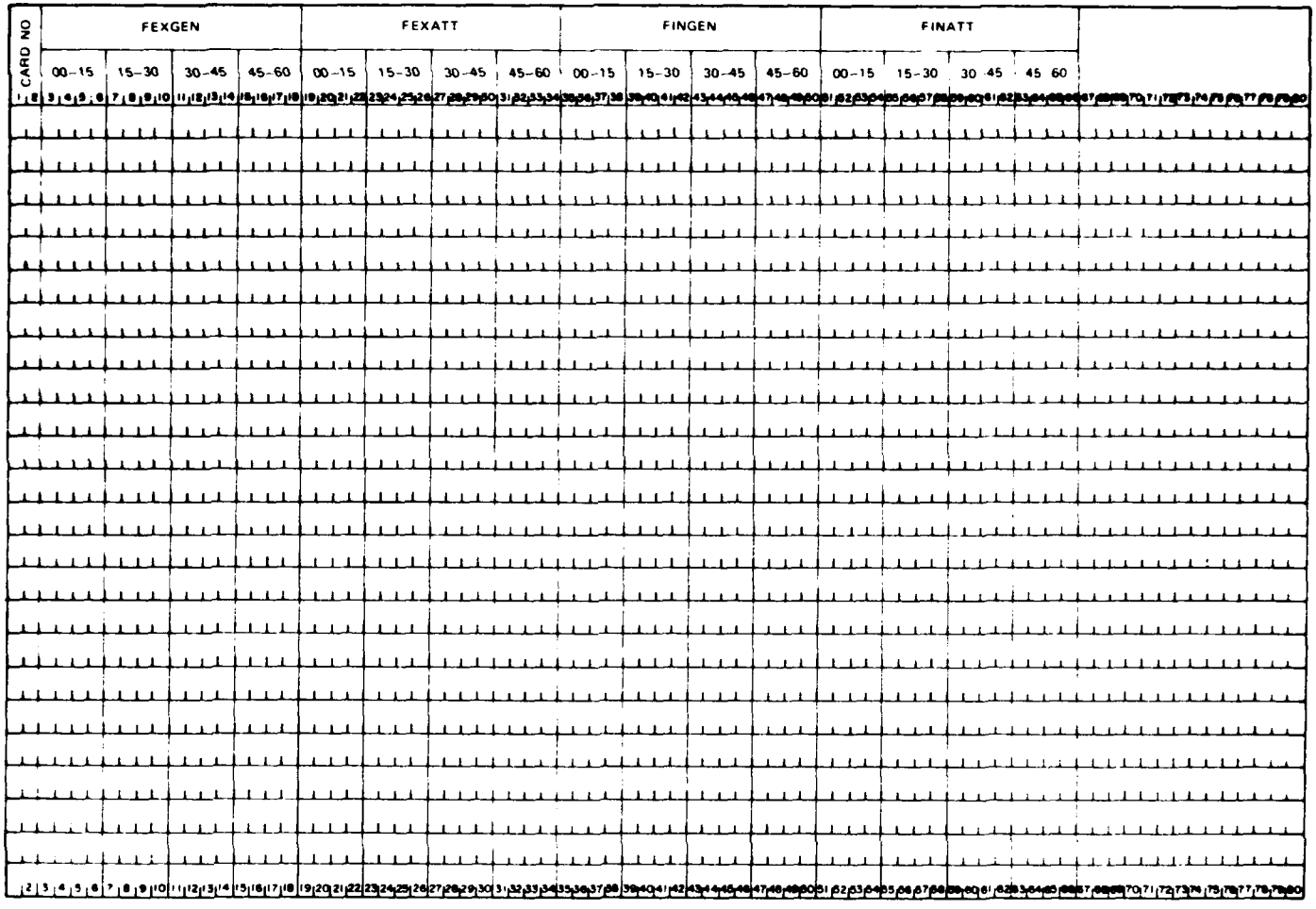


FIGURE 56. BATS INPUT CODING FORM – CARD TYPE 13: CALIBRATION

Coding Instructions for Card Type 13

Column(s)	Description	
1-2	Card type number is 13.	
3-6	FEXGEN (1)	Calibration factor to be multiplied times external generations in the first 15-minute time period
7-10	FEXGEN (2)	Calibration factor to be multiplied times external generations in the second 15-minute time period
11-14	FEXGEN (3)	Calibration factor to be multiplied times external generations in the third 15-minute time period
15-18	FEXGEN (4)	Calibration factor to be multiplied times external generations in the fourth 15-minute time period
19-22	FEXATT (1)	Calibration factor to be multiplied by external attractions for the first 15-minute period
23-26	FEXATT (2)	Calibration factor to be multiplied by external attractions for the second 15-minute period
27-30	FEXATT (3)	Calibration factor to be multiplied by external attractions for the third 15-minute period
31-34	FEXATT (4)	Calibration factor to be multiplied by external attractions for the fourth 15-minute period
35-38	FINGEN (1)	Calibration factor for internal generations in the first 15-minute period.
39-42	FINGEN (2)	Calibration factor for internal generations in the second 15-minute period.

Column(s)	Description	
43-46	FINGEN (3)	Calibration factor for internal generations in the third 15-minute period.
47-50	FINGEN (4)	Calibration factor for internal generations in the fourth 15-minute period.
51-54	FINATT (1)	Calibration factor for internal attractions for the first 15-minute period.
55-58	FINATT (2)	Calibration factor for internal attractions for the second 15-minute period.
59-62	FINATT (3)	Calibration factor for internal attractions for the third 15-minute period.
63-66	FINATT (4)	Calibration factor for internal attractions for the third 15-minute period.

Card Type 14 - PLUALU Array Card (optional)

The production land use-attraction land use (PLUALU) array is used to provide default values for all land use trip generations and attractions, except home-work trips made during the morning and evening rush hours. These rush hour trips are reflected in the actual shift counts entered on Card Type 11.

Included in the model is a set of default PLUALU values, derived from the data for the three sample bases--Williams, Tinker, and Davis-Monthan (see Table 13). Card Type 14 is used only to change any value on Table 13 to more exactly reflect the base being modelled. The more the PLUALU reflects the actual number of trips, the more accurate the model simulations will be. One possible PLUALU array is shown in Figure 57 below. Figure 58 is a blank PLUALU array coding form.

Seven cards are needed for an array, one for each of the seven land uses. Each card shows the number of trips produced by zones with a specific land use and attracted to each of the other six land use zone types. The first card shows trips produced by housing zones, the second shows trips produced by industrial zones, and so on, as shown in the following tabulation:

Card	Land Use
1	Housing
2	Industrial
3	Shopping
4	Service/Recreation
5	External
6	Administrative
7	Flight line

EXAMPLE:

BATS INPUT CODING FORM - CARD TYPE 14 PLUALU ARRAY

CARD NO	NUMBER OF TRIPS ATTRACTED TO ZONES							LAND USE GENERATING TRIPS	
	HOUSING	INDUSTRIAL	SHOPPING	SERVICE	EXTERNAL	ADMINISTRATIVE	FLIGHT LINE		
14	587.	0.	416.	324.	415.	0.	171.	HOME	
14	410.	0.	54.	76.	0.	26.	87.	INDUSTRY	
14	353.	37.	207.	177.	242.	149.	373.	SHOPPING	
14	385.	73.	138.	265.	102.	64.	27.	SERVICE	
14	423.	0.	243.	272.	0.	0.	0.	EXTERIOR	
14	87.	0.	67.	129.	0.	0.	131.	ADMINISTRATION	
14	433.	0.	274.	220.	0.	112.	0.	FLIGHT LINE	

FIGURE 57. COMPLETING THE PLUALU ARRAY CODING FORM

TABLE 13. PLUALU ARRAYS

	Home	Industry	Shopping	Service	External	Administrative	Flight Line
A.M. Trips by Land Use							
Home	587.	0.	418.	324.	415.	0.	171.
Industry	40.	0.	54.	76.	0.	26.	87.
Shopping	253.	37.	207.	177.	242.	149.	373.
Service	385.	73.	138.	265.	102.	64.	27.
External	423.	0.	243.	272.	0.	0.	0.
Administrative	87.	0.	67.	129.	0.	0.	131.
Flight Line	433.	0.	274.	220.	0.	112.	0.
Noon Trips by Land Use							
Home	1174.	51.	671.	1593.	838.	87.	604.
Industry	51.	17.	91.	334.	28.	26.	87.
Shopping	671.	91.	414.	708.	485.	216.	647.
Service	1593.	334.	708.	1109.	840.	434.	555.
External	838.	28.	485.	840.	0.	51.	133.
Administrative	87.	26.	216.	434.	51.	10.	243.
Flight Line	604.	87.	647.	555.	133.	243.	89.
P. M. Trips by Land Use							
Home	587.	40.	253.	385.	423.	87.	433.
Industry	0.	0.	37.	73.	0.	0.	0.
Shopping	418.	54.	207.	138.	243.	67.	274.
Service	324.	76.	177.	265.	272.	129.	220.
External	415.	0.	242.	102.	0.	0.	0.
Administrative	0.	26.	149.	64.	0.	0.	112.
Flight Line	171.	87.	373.	27.	0.	131.	0.

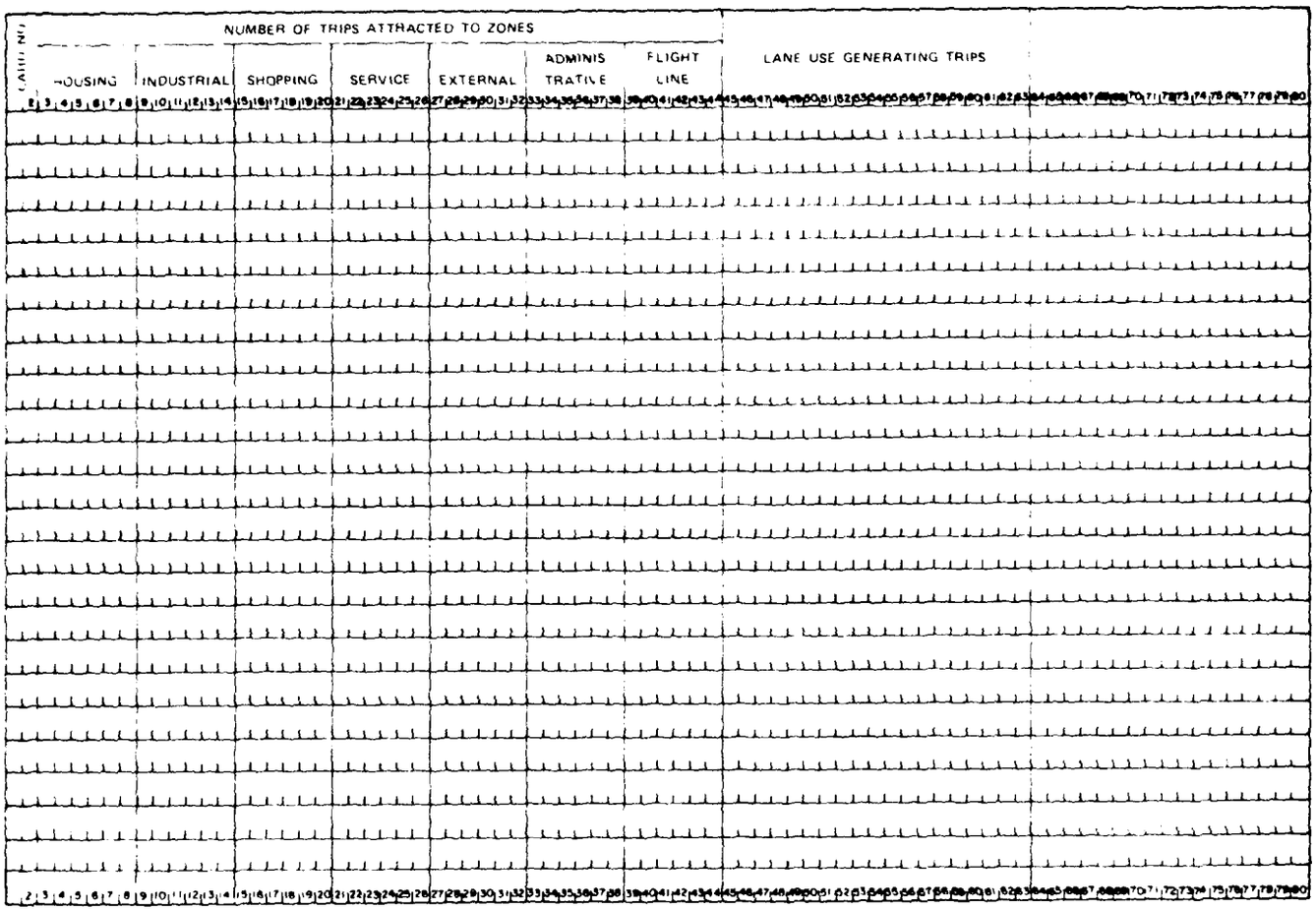


FIGURE 58. BATS INPUT CODING FORM – CARD TYPE 14: PLUALU ARRAY

Coding Instructions for Card Type 14

Column(s)	Description	Possible Values
1-2	Card type number.	14
3-8	Number of trips attracted to housing zones.	0-99,999
9-14	Number of trips attracted to industrial zones.	0-99,999
15-20	Number of trips attracted to shopping zones.	0-99,999
21-26	Number of trips attracted to service/ recreation zones.	0-99,999
27-32	Number of trips attracted to external zones.	0-99,999
33-38	Number of trips attracted to administrative zones.	0-99,999
39-44	Number of trips attracted to flight line zones.	0-99,999
45-63	Land use name, e.g., housing.	

Card Type 15 - Demographic Variable Names

This card indicates the names of the demographic variables used to generate non-work trips on Card Type 5, so that the user will have an index to the computer output. If the demographic variables as shown in the instructions for Card Type 5 were entered, Card Type 15 should be filled out as shown in Figure 59 below. If different demographic variables were used, identify them with appropriate symbols. Space is provided for up to eight letters to describe eight of the ten demographic variables on Card Type 15 (see Figure 60). Seven spaces are provided for the second and tenth variables.

EXAMPLE:

SYMBOL	MEANING
MIL EMP	Military employees
CIV EMP	Civilian employees
NO. HOMES	Number of houses
NO. DORMS	Number of dormitory units
FOOD EMP	Food employees
COM EMP	Commercial employees

BATS INPUT CODING FORM – CARD TYPE 15 DEMOGRAPHIC VARIABLE NAMES

DEMOGRAPHIC VARIABLE NAMES

1	2	3	4	5	6	7	8	9	10
15	MIL-EMP	CIV-EMP	NO.HOMES	NO.DORMS	FOOD-EMP	COM-EMP	HOSP-EMP	SER-REC	MP.MILV.	MILV-MIL

FIGURE 59. COMPLETING THE DEMOGRAPHIC VARIABLE NAMES CARD

Coding Instructions - Card Type 15

Column(s)	Description
1-2	Card Type number is 15.
3-10	Alphabetic name of first demographic variable.
11-17	Alphabetic name of second demographic variable.
18-25	Alphabetic name of third demographic variable.
26-33	Alphabetic name of fourth demographic variable.
34-41	Alphabetic name of fifth demographic variable.
42-49	Alphabetic name of sixth demographic variable.

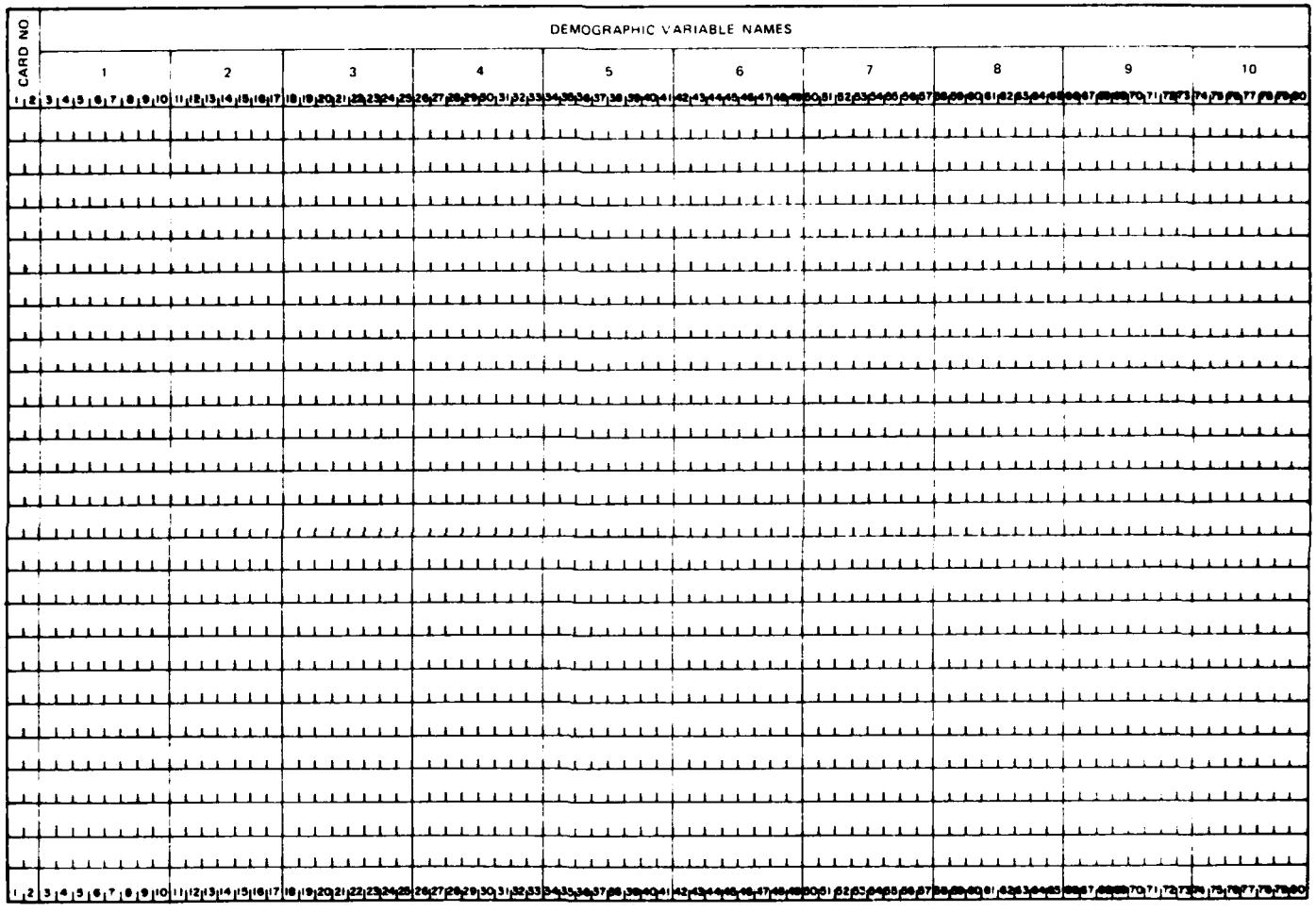


FIGURE 60. BATS INPUT CODING FORM – CARD TYPE 15: DEMOGRAPHIC VARIABLE NAMES

Column(s	Description
50-57	Alphabetic name of seventh demographic variable.
58-65	Alphabetic name of eighth demographic variable.
66-73	Alphabetic name of ninth demographic variable.
74-80	Alphabetic name of tenth demographic variable.

Card Type 16 - Namelist Data Card (to be read by AQAM)

This card is needed only if the results of BATS are going to be used for AQAM. The person responsible for running the AQAM model should be the one to complete this card. This computer language may be found in the FORTRAN IV User Manual.

The data on this card enables the computer model, either BATS or AQAM, to change hourly, half-day, or daily volumes into yearly volumes. If the default values stored in the computer are to be used, this card need not be completed. Each variable needed to complete this card is described below, with the default value specified in parenthesis. A sample Card Type 16 is shown in Figure 61. Figure 62 is the coding form to be used for Card Type 16.

Coding Instructions for Card Type 16

The values must be entered in the same order as they are listed below. Two cards are needed.

Entry	Description
$VHLMO_i$	Fraction of military vehicle mileage historically generated in the i^{th} month (0.08333).
$VHMLDY_i$	Fraction of weekly military vehicle miles occurring daily during the midweek (i = 1), on the weekend (i = 2) (0.1429).
$VHMLHR_i$	Fraction of daily military vehicle miles occurring during the i^{th} hour of the day (0.08333).
$CVAEMO_i$	Fraction of civilian vehicle mileage historically generated in i^{th} month (0.08333).

$CVABDY_i$ Fraction of civilian vehicle mileage historically generated each day during the midweek (i = 1), or each day on the weekend (i = 2) (0.1429).

$CVABHR_i$ Fraction of civilian vehicle mileage historically generated in the i^{th} hour of the day (0.08333).

EXAMPLE:

BATS INPUT CODING FORM - CARD TYPE 16 NAME LIST DATA

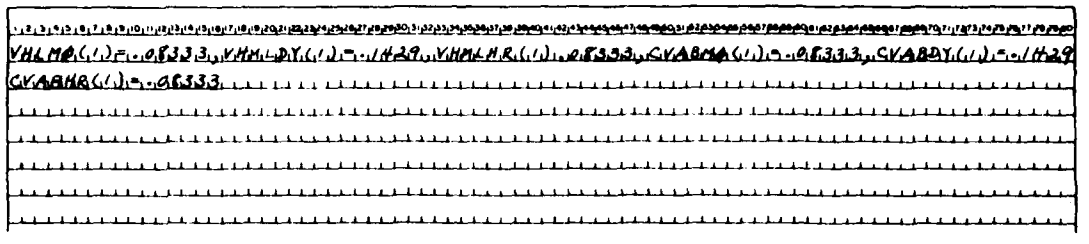


FIGURE 61. COMPLETING NAME LIST DATA CODING FORM

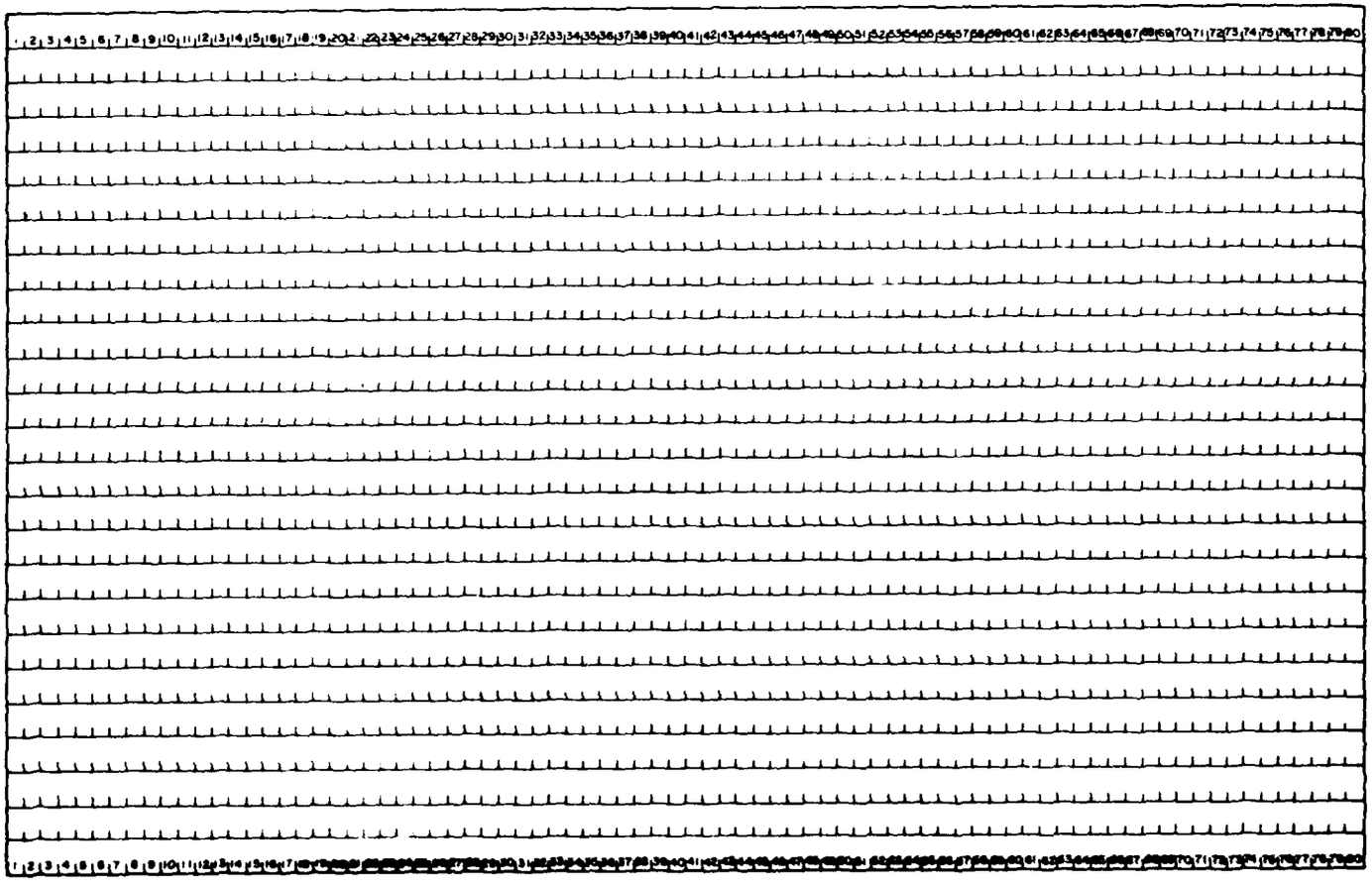


FIGURE 62. BATS INPUT CODING FORM – CARD TYPE 16: NAME LIST DATA

SECTION IV

BATS OUTPUT--HOW TO INTERPRET THE INFORMATION GENERATED

INTRODUCTION

Three basic types of information are generated by BATS: (1) a tabulated computer printout, (2) an Air Quality Assessment Model (AQAM) data file, and (3) a PLOT routine of the base's street network showing traffic volume. Using information from these outputs, the base civil engineer and other Air Force planners can estimate hourly traffic flow, plan new roads, locate building sites, and simulate a variety of traffic controls to reduce travel time, congestion, and environmental impacts.

PRINTED OUTPUT

The BATS model generates a maximum of 22 tables. Depending on the user's requirements, not all tables are printed for each simulated time period. Each table is described below so that output can be meaningfully interpreted and any input errors noted.

The cover pages of the printout identify the Air Force base, the date, and the type of computer run. The Table of Contents (Figure 63) lists each tabulated report printed in the computer run according to an alphanumeric designation and title, and shows the nine major functional parts of the computer program: input data, initialization, trip generation, trip distribution, modal split, calibration, assignment, traffic flow analysis, and summary. The input listing on the next several pages of the printout list the formatted input data from Card Types 1 - 16. The tabulated reports, each beginning on a new page, follow the input listing. Table 14 shows the primary and secondary card types that were used as input to each report.

Report A.1: Input Listing (Figure 64)

This report lists all data cards that were read by the computer for this iteration of the model. Because the data have been manipulated before being printed out, they do not exactly match the input card format. For example, the data have been separated into three parts on Card Type 0 (the Header Card) and the scale factor and additive factor have been applied to the x, y coordinates on Card Type 2. An * appearing in the listing indicates that the field is not big enough to print the input item.

The report records all input data in a convenient way, allowing for quick reference to check for input errors. The first column identifies the card type number. Other columns represent data entries according to instructions given in Section III. If a data item is keypunched in the

TABLE OF CONTENTS

A. INPUT DATA

1. INPUT LISTING

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C. TRIP GENERATION

1. ARRAY OF LAND USE PRODUCTIONS AND ATTRACTIONS (IPFLG(1)=1)

2. TRIP PRODUCTIONS (PERSONS) (IPFLG(1)=1)

3. TRIP ATTRACTIONS (PERSONS) (IPFLG(1)=1)

4. MATRIX ASSOCIATING ZONES WITH GATES(IPFLG(1)=1)

5. TRIP PRODUCTIONS MODIFIED BY GATE COUNTS AND SHIFT COUNTS (PERSONS)

6. TRIP ATTRACTIONS MODIFIED BY GATE COUNTS AND SHIFT COUNTS (PERSONS)

D. TRIP DISTRIBUTION

1. ORIGIN TO GATE AND GATE TO DESTINATION TRIPS (IPFLG(2)>=1)

2. ORIGIN-DESTINATION ARRAY (IPFLG(2)=1)

3. ORIGIN-DESTINATION ARRAY FOR CIVILIAN VEHICLE TRIPS (IPFLG(2)=2)

4. ORIGIN-DESTINATION ARRAY FOR MILITARY VEHICLE TRIPS (IPFLG(2)=4)

E. MODAL SPLIT

1. MODAL SPLIT VEHICLE LOAD FACTORS (IPFLG(3)=1)

2. ORIGIN TO GATE AND GATE TO DESTINATION TRIPS (IPFLG(3)=1)

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1. CALIBRATION FACTORS

2. ORIGIN TO GATE AND GATE TO DESTINATION TRIPS (IPFLG(3)=2)

G. ASSIGNMENT

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2. VEHICLE COUNT, TYPE AND HOT/COLD STARTS (IPFLG(3)>0)

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1. LINK COUNTS (IPFLG(3)=0)

2. INTERSECTION DELAYS AND QUEUEING

3. PARKING LOT TRAVEL TIMES AND DELAYS

4. LINK TO LINK TRAVEL TIMES

I. SUMMARY

1. NETWORK SUMMARY PARAMETERS PER TIME PERIOD

POSSIBLE REPETITION OF A THROUGH I FOR EACH TIME PERIOD.

FIGURE 63. PRINTOUT OF TABLE OF CONTENTS

Table 14 CARD TYPES USED AS INPUT TO PRINTED OUTPUT
(Card Type Number)

Report Number & Title		Input	
		Primary	Secondary
A.1	Input Listing	All cards	-
B.1	Zone Parking Capacities and Trip Lengths	4,5	2
C.1	Array of Land Use Productions and Attractions	6	14
C.2	Trip Productions (Persons)	5,6	14
C.3	Trip Attractions (Persons)	5,6	14
C.4	Matrix Associating Gates with Zones	2,5,6,7	-
C.5	Trip Productions Modified by Gate Counts and Shift Counts (Persons)	5,6,7,11	14
C.6	Trip Attractions Modified by Gate Counts and Shift Counts (Persons)	5,6,7,11	14
D.1	Origin-to-Gate and Gate-to-Destination Trips	2,5,6,7	3,11
D.2	Origin-Destination Array	2,5,6,7	3,11
D.3	Origin-Destination Array for Civilian Vehicle Trips	2,5,6,7	3,11
D.4	Origin-Destination Array for Military Vehicle Trips	2,5,6,7	3,11
E.1	Modal Split Vehicle Load Factors	4,9	-
E.2	Origin-to-Gate and Gate-to-Destination Trips	4,9	-
F.1	Calibration Factors	7	13
F.2	Origin-to-Gate and Gate-to-Destination Trips	7	13
G.1	Assignment Counts and Associated Computer Runtime	2,3,10	8
G.2	Vehicle Count, Type, and Hot/Cold Starts	2,3,10	8
H.1	Link Counts	All cards	-
H.2	Intersection Delays and Queueing	3	All cards
H.3	Parking Lot Travel Times and Delays	4,5	All cards
H.4	Link to Link Travel Times	2,3	All cards
I.1	Network Summary Parameters for Time Period	All cards	-

A.1. INPUT LISTING: OF EACH DATA CARD - WITH MODIFICATIONS MADE BY SUBROUTINE INPT.

```
78/ 9/29      WILLIAMS AFB          11-1900  CALIBRATE
1 240  62  60  50   9   1  -0   1   2   0=*****00.  6.3600.   -0.  -0.188=1=01877
2  1    1=644.=368.=778.=368.   -0  26.   66    7   10  -0.    3.04786323.2=29.6
2  2    1=644.=368.=778.=368.   -0  26.   -0   -0   -0  -0.    3.04786323.2=29.6
2  3    1=641.=245.=778.=245.   -0  26.   79    9   12  -0.    3.04786323.2=29.6
2  4    1=641.=245.=778.=245.   -0  26.   -0   -0   -0  -0.    3.04786323.2=29.6
2  5    1=638.=023.=778.=023.   -0  26.  101   11  173  -0.    3.04786323.2=29.6
2  6    1=638.=023.=778.=023.   -0  26.   -0   -0   -0  -0.    3.04786323.2=29.6
2  7    1=644.=368.=647.=402.   -0  26.   73   -0   -0  -0.    3.04786323.2=29.6
2  8    1=644.=368.=647.=402.   -0  26.   10   66    2  -0.    3.04786323.2=29.6
2  9    1=641.=245.=644.=368.   -0  26.    7    2   66  -0.    3.04786323.2=29.6
2 10    1=641.=245.=644.=368.   -0  26.   12   79    4  -0.    3.04786323.2=29.6
2 11    1=641.=245.=641.=028.   -0  26.    9    4   79  -0.    3.04786323.2=29.6
2 12    1=641.=245.=641.=028.   -0  26.  173  101    6  -0.    3.04786323.2=29.6
2 13    1=564.=687.=564.=880.   -0  26.   29   74   81  -0.    3.04786323.2=29.6
2 14    1=564.=687.=564.=880.   -0  26.  176   93   -0  -0.    3.04786323.2=29.6
2 15    1=568.=368.=568.=465.   -0  26.  176   -0   36  -0.    3.04786323.2=29.6
2 16    1=568.=368.=568.=465.   -0  26.   16  166   66  -0.    3.04786323.2=29.6
2 17    1=568.=245.=568.=368.   -0  26.   15   66  165  -0.    3.04786323.2=29.6
2 18    1=568.=245.=568.=368.   -0  26.   20  177   80  -0.    3.04786323.2=29.6
2 19    1=568.=245.=564.=023.   -0  26.   17   80  177  -0.    3.04786323.2=29.6
2 20    1=568.=245.=564.=023.   -0  25.  180  161  102  -0.    3.04786323.2=29.6
2 21    1=568.=916.=464.=826.   -0  26.   47  163   -0  -0.    3.04786323.2=29.6
2 22    1=568.=916.=464.=826.   -0  25.  179  174   44  -0.    3.04786323.2=29.6
2 23    1=464.=368.=468.=245.   -0  25.   -0  166   37  -0.    3.04786323.2=29.6
2 24    1=464.=368.=468.=245.   -0  26.   26   39  178  -0.    3.04786323.2=29.6
2 25    1=456.=245.=468.=026.   -0  25.   23  178   38  -0.    3.04786323.2=29.6
2 26    1=456.=245.=465.=026.   -0  25.   -0   41  182  -0.    3.04786323.2=29.6
2 27    1=479.=964.=388.=870.   -0  25.  187   -0   30  -0.    3.04786323.2=29.6
2 28    1=479.=964.=381.=870.   -0  25.   -0   -0   -0  -0.    3.04786323.2=29.6
2 29    1=564.=687.=388.=870.   -0  25.   -0   26  187  -0.    3.04786323.2=29.6
2 30    1=564.=687.=388.=870.   -0  25.   14   31   74  -0.    3.04786323.2=29.6
2 31    1=564.=687.=338.=890.   -0  25.  188  181   54  -0.    3.04786323.2=29.6
2 32    1=564.=687.=338.=890.   -0  25.   74   14   29  -0.    3.04786323.2=29.6
2 33    1=564.=680.=338.=583.   -0  25.  193   53  186  -0.    3.04786323.2=29.6
2 34    1=564.=680.=338.=583.   -0  25.   -0  178   13  -0.    3.04786323.2=29.6
2 35    1=568.=471.=333.=471.   -0  25.   -0  196  188  -0.    3.04786323.2=29.6
2 36    1=568.=471.=333.=471.   -0  25.   -0   16  176  -0.    3.04786323.2=29.6
2 37    1=464.=368.=336.=368.   -0  25.  103  197   -0  -0.    3.04786323.2=29.6
2 38    1=464.=358.=336.=368.   -0  25.  186   24   -0  -0.    3.04786323.2=29.6
2 39    1=468.=245.=235.=245.   -0  25.  201   57   80  -0.    3.04786323.2=29.6
2 40    1=468.=245.=235.=245.   -0  25.  178   28   23  -0.    3.04786323.2=29.6
2 41    1=462.=023.=236.=026.   -0  25.  206   69  206  -0.    3.04786323.2=29.6
2 42    1=462.=023.=236.=026.   -0  25.  182   -0   25  -0.    3.04786323.2=29.6
2 43    1=966.=586.=966.=361.   -0  25.   -0   78  199  -0.    3.04786323.2=29.6
2 44    1=566.=916.=327.=916.   -0  25.  209   -0  212  -0.    3.04786323.2=29.6
2 45    1=327.=826.=136.=797.   -0  25.   -0  217   68  -0.    3.04786323.2=29.6
2 46    1=327.=826.=136.=797.   -0  25.  184   -0  211  -0.    3.04786323.2=29.6
2 47    1=464.=826.=316.=672.   -0  25.   -0   -0   80  -0.    3.04786323.2=29.6
2 48    1=464.=826.=316.=672.   -0  25.   22   -0  183  -0.    3.04786323.2=29.6
2 49    1=316.=672.=643.=326.   -0  25.   -0   48   -0  -0.    3.04786323.2=29.6
2 50    1=316.=672.=643.=326.   -0  25.   -0   -0  240  -0.    3.04786323.2=29.6
2 51    1=769.=364.=816.=364.   -0  25.   85   -0  122  -0.    3.04786323.2=29.6
2 52    1=769.=364.=816.=364.   -0  25.  110   -0  119  -0.    3.04786323.2=29.6
```

```
5371600. -0.     -0.     -0.    251.     -0.     -0.     -0.     -0.     -0. -0.     -0.
5381200. -0.     -0.     -0.     70.     -0.     -0.     -0.     -0.     -0. -0.     -0.
5392 72. -0.     12.     14.     -0.     -0.     -0.     -0.     -0.     -0. -0.  21260.
5404 70. -0.     26.     13.     -0.     -0.     -0.     -0.     -0.     -0. -0.     -0.
5411300. -0.     -0.     -0.    102.     -0.     -0.     -0.     -0.     -0. -0.     -0.
5422 72. -0.     26.     29.     -0.     -0.     -0.     -0.     -0.     -0. -0.  44972.
5433613. -0.     26.    204.     -0.     -0.      9.    161.     -0.      4. -0.  24279.
5442 50. -0.     26.     16.     -0.     -0.     -0.     -0.     -0.     -0. -0.   8512.
6HOME-WORK .50.50= 1 .0005 .0045= 2 .0005 .0045= 3 .0049 .0005= 4 .0049 .0005
6SHOPPING  =00.103 62.48002.4800=-0=.0000=.0000=-0=.0000=-0=.0000=.0000
6SERVICE   =00.104 7 .3300 .33004 8=.0000=.00004 53.00008.0000=-0=.0000=.0000
6EXTERNAL  .01.015 3 .1565 .1648=-0=.0000=.0000=-0=.0000=.0000=-0=.0000=.0000
6INDUSTRIAL.50.502 1=.0000=.0000=-0=.0000=.0000=-0=.0000=.0000=-0=.0000=.0000
6ADMINISTER.50.506 1=.0000=.0000=-0=.0000=.0000=-0=.0000=.0000=-0=.0000=.0000
6FLT.LINE  .50.507 1=.0000=.0000=-0=.0000=.0000=-0=.0000=.0000=-0=.0000=.0000
6HOME      .50.501 1=.0000=.0000=-0=.0000=.0000=-0=.0000=.0000=-0=.0000=.0000
6MILITARY  .01.05010 .0003 .0003=-0=.0000=.0000=-0=.0000=.0000=-0=.0000=.0000
7     171  172 371  366.   -0.   -0.   -0.   -0.   -0.   -0.   -0.   -0.   -0.
9 1.28 1.28 1.28 1.28 1.28 1.00 1.00 1.28 1.28 1.28 1.28 1.00 1.00-0.00 600.
10 14 5171149151229 9323121920520720944 -0 -0 -0 -0 -0 -0 -0 -0 -0 -0 -0 -0 -0
10 14 5172150152230 9423222020642162 -0 -0 -0 -0 -0 -0 -0 -0 -0 -0 -0 -0 -0
T1=   3.771    T2=  11.961    T2-T1=   8.190
```

FIGURE 64. REPORT A.1: INPUT LISTINGS

wrong column or a factor is incorrectly interpreted in filling out the data form, then the error can often be recognized on this table. For example, the speed limit on a base's 240 links (typically 25 mph) was requested on Card Type 2. If the number 25 were placed in the wrong column, then the Input Listing might read 250 or 2,500, a mistake relatively easy to detect.

Report B.1: Zone Parking Capacities and Trip Lengths (Figure 65)

Each zone that is described on Card Type 4 or 5 has a capacity, length, and travel time associated with it. The capacity indicates the number of vehicles that can park in a zone. The length is the distance in meters that an average vehicle travels after entering the zone until it stops in a parking spot. The travel time and alternative travel time indicate the time in seconds that a vehicle takes to get from the approach link until it stops in a parking spot.

The user specifies parking capacity in internal zones and travel and alternate travel times in exterior zones from Air Force data. The computer generates the length and the travel times for internal zones, assuming that all vehicles travel an average distance in the parking lot. The current program is designed so that travel and alternate travel times in internal zones are assumed to be equal.

Report C.1: Array of Land Use Productions and Attractions (Figure 66)

The array shows the total number of trips that are predicted from and to all zones of each land use, except for home to work, work to home, and military vehicle trips. The rows indicate the number of productions, and the columns indicate the number of attractions by land use. The array will be used by the computer to generate trips when default values are specified on Card Type 6. In the sample report, 1,236 people enter the service zones. This large number would be typical at lunchtime.

Report C.2: Trip Productions--Persons (Figure 67)

This report indicates the number of person-trips (not to be confused with vehicle trips) produced by each zone for each trip purpose. Typically, there will be home-work and military trip purpose columns, where the user has specified both the origin and the destination. In the other columns, the origin and/or the destination of the trip may be generated by default if data are missing. In this case, the trip purpose is assumed to be identical to the land use. In the sample report, 436 people left Zone 43, primarily to go home or to other shopping and service zones. A total of 457 people left all zones to go shopping.

B. INITIALIZATION WILLIAMS AFB 11-1300 CALIBRATE

B.1. ZONE PARKING CAPACITIES AND TRIP LENGTHS

ZONE	CAPACITY	LENGTH	TRAVEL TIME	ALTERNATE TRAVEL TIME
MS	-0.	1603.	1440.	1600.
CH	-0.	223.	780.	780.
PH	-0.	1604.	2376.	2970.
TM	-0.	1603.	2080.	2340.
GL	-0.	222.	648.	648.
GT	-0.	1604.	2952.	2952.
1	88.	227.	36.	36.
2	116.	165.	26.	26.
3	157.	243.	38.	38.
4	170.	178.	28.	28.
5	75.	254.	40.	40.
6	288.	292.	46.	46.
7	102.	256.	40.	40.
8	30.	122.	19.	19.
9	120.	241.	38.	38.
10	57.	231.	36.	36.
11	70.	233.	36.	36.
12	81.	242.	38.	38.
13	178.	260.	41.	41.
14	126.	244.	38.	38.
15	80.	232.	36.	36.
16	38.	226.	35.	35.
17	81.	137.	21.	21.
18	306.	268.	42.	42.
19	20.	244.	38.	38.
20	566.	511.	80.	80.
21	186.	248.	39.	39.
22	186.	251.	39.	39.
23	85.	140.	22.	22.
24	195.	904.	141.	141.
25	82.	139.	22.	22.
26	350.	336.	52.	52.
27	165.	250.	39.	39.
28	64.	235.	37.	37.
29	217.	357.	56.	56.
30	29.	224.	35.	35.
31	186.	248.	39.	39.
32	92.	503.	79.	79.
33	50.	534.	83.	83.
34	300.	550.	86.	86.
35	592.	462.	72.	72.
36	9.	242.	38.	38.
37	600.	516.	81.	81.
38	200.	490.	76.	76.
39	72.	481.	75.	75.
40	70.	645.	101.	101.
41	300.	657.	103.	103.
42	72.	142.	22.	22.
43	613.	358.	56.	56.
44	50.	1923.	301.	301.

FIGURE 65. REPORT B.1: ZONE PARKING CAPACITIES AND TRIP LENGTHS

BATS MODEL OUTPUT 78/ 9/29 WILLIAMS AFB 11-1300 CALIBRATE PERIOD FROM 1100. TO 1200. HOURS

C.1. ARRAY OF LAND USE PRODUCTIONS AND ATTRACTIONS

FROM/TO	HOME	INDS	SHOP	SERV	EXTN	ADMN	FLTL
HOME	175.	7.	95.	354.	150.	13.	88.
INDS	8.	3.	13.	74.	5.	4.	13.
SHOP	65.	9.	59.	157.	87.	21.	62.
SERV	142.	30.	101.	246.	150.	39.	49.
EXTN	119.	4.	69.	186.	0.	7.	19.
ADMN	13.	4.	31.	96.	9.	1.	35.
FLTL	86.	12.	92.	123.	24.	33.	12.

FIGURE 66. REPORT C.1: ARRAY OF LAND USE PRODUCTIONS AND ATTRACTIONS

BATS MODEL OUTPUT 78/ 9/29 WILLIAMS AFB 11-1900 CALIBRATE

C 2 TRIP PRODUCTIONS (PERSONS)

FROM ZONE	USE	PURPOSE HOME-W	SHOPPI	SERVIC	EXTERN	INDUST	ADMINI	FLT.LI	HOME	MILITA	TOTAL
RS	EXTN	6	16	44	0	1	2	4	28	0	101
CH	EXTN	3	6	25	0	1	1	3	16	0	56
PH	EXTN	1	2	5	0	0	0	1	3	0	12
TH	EXTN	1	3	8	0	0	0	1	5	0	18
BL	EXTN	0	1	3	0	0	0	0	2	0	6
GT	EXTN	1	36	102	0	2	4	10	95	67	278
1	FLTL	0	7	9	2	1	3	1	7	9	39
2	FLTL	0	6	8	2	1	2	1	6	7	33
3	FLTL	0	25	34	7	3	8	3	24	5	110
4	FLTL	0	3	4	1	0	1	0	3	3	15
5	FLTL	0	21	29	6	3	8	3	20	25	118
6	FLTL	0	13	18	3	2	5	2	12	12	67
7	INDS	0	0	3	0	0	0	0	0	2	5
8	INDS	0	0	1	0	0	0	0	0	0	1
9	INDS	0	0	2	0	0	0	0	0	2	4
10	INDS	0	1	4	0	0	0	1	0	0	6
11	SERV	0	0	0	0	0	0	0	0	0	0
12	SERV	0	3	8	6	1	1	2	8	0	29
13	INDS	0	1	5	0	0	0	1	1	1	9
14	SERV	0	5	12	7	1	2	2	7	1	37
15	ADMN	1	6	25	2	1	0	6	3	4	54
16	ADMN	0	2	6	1	0	0	2	1	0	12
17	ADMN	0	6	16	2	1	0	7	2	0	36
18	SERV	0	11	28	17	3	4	6	16	0	85
19	INDS	0	1	5	0	0	0	1	0	27	34
20	INDS	0	2	12	1	0	1	2	1	42	61
21	SERV	0	90	74	48	9	12	15	42	37	264
22	HOME	2	22	83	35	2	9	21	41	0	209
23	SHOP	0	4	11	8	1	1	4	4	0	31
24	FLTL	0	18	21	4	2	6	2	15	6	71
25	ADMN	0	12	36	3	1	1	13	6	3	74
26	SERV	0	29	71	43	9	11	14	41	17	236
27	SERV	0	11	25	16	3	4	5	15	3	83
28	SERV	0	1	2	1	0	0	0	1	3	8
29	HOME	1	54	200	85	4	7	50	99	2	502
30	ADMN	0	3	10	1	0	0	4	1	2	21
31	SERV	0	6	14	8	2	2	3	8	0	43
32	SERV	0	0	1	1	0	0	0	1	1	4
33	SERV	0	3	7	4	1	1	1	4	0	21
34	HOME	1	6	18	6	0	1	5	8	0	46
35	INDS	0	2	13	1	0	1	2	1	123	143
36	INDS	0	4	24	2	1	1	4	3	3	42
37	HOME	1	8	31	13	1	1	8	15	0	78
38	HOME	0	2	8	4	0	0	2	4	0	21
39	INDS	0	0	1	0	0	0	0	0	7	8
40	SERV	0	2	6	3	1	1	1	3	0	18
41	HOME	0	3	13	5	0	0	3	8	0	30
42	INDS	0	1	3	0	0	0	1	0	14	19
43	SHOP	0	56	147	61	6	19	56	60	6	436
44	INDS	0	0	2	0	0	0	0	0	3	5
TOTAL		18	467	1242	426	66	115	278	606	428	3634

FIGURE 67. REPORT C.2 TRIP PRODUCTIONS--PERSONS

Report C.3: Trip Attractions--Persons (Figure 68)

This report is similar to Report C.2 and indicates the number of persons who travel to each zone by trip purpose and land use. In the sample table, of the 459 people who left all zones to go shopping during this time period, 60 went to Zone 23 and 399 went to Zone 43. A total of 408 people were attracted to Zone 43 for all trip purposes.

Report C.4: Matrix Associating Gates With Zones (Figure 69)

This matrix tells the user which gates (identified by column heading) are associated with each zone (identified by row heading). The computer prints a 1 in any column where a traveler would probably use a gate to go to or from a zone and leaves the column blank otherwise.

This report will help the user to accurately define trips between zones during 15-minute time periods. BATS predicts 15-minute counts by first determining the gate(s) used by most traffic to a zone. Reports C.4 and C.5 predict trips to each zone based on this matrix.

Report C.5: Trip Productions Modified by Gate Counts and Shift Counts--Persons (Figure 70)

This report divides the number of hourly trips shown in Report C.2 into 15-minute trip counts based on gate and shift counts. Shift counts are defined as 15-minute counts of work trips going to or coming from each work zone. The home-work trips occurring at the beginning and end of shifts are distributed into 15-minute time periods according to shift counts, and the remaining home-work trips are split in proportion to 15-minute gate counts. Non-home-work trips are distributed equally over the four 15-minute periods. The table can be used to evaluate shift counts or gate associations for individual zones when home-work trips are not realistic. Report C.5 is identical to Report C.2 if the user does not specify a 15-minute breakdown of data.

Report C.6: Trip Attractions Modified by Gate Counts and Shift Counts--Persons (Figure 71)

This report divides the number of hourly trips shown in Report C.3 into 15-minute trip counts based on gate and shift counts. Home-work and non-home-work trips are distributed as they are in Report C.5. Report C.6 is identical to Report C.3 if the user does not specify a 15-minute breakdown of data.

Report D.1: Origin-to-Gate (OG) and Gate-to-Destination (GD) Trips --Persons (Figure 72)

This report shows the number of person-trips routed between each gate and each zone. The zones are identified in each row and the gates

BATS MODEL OUTPUT 78/ 9/29 WILLIAMS AFB 11-1300 CALIBRATE PERIOD FROM 1100. TO 1200. HOURS

C.3. TRIP ATTRACTIONS (PERSONS)

TO ZONE	USE	PURPOSE HOME-W	SHOPPI	SERVIC	EXTERN	INDUST	ADMINI	FLT.LI	HOME	MILITA	TOTAL
MB	EXTN	1	0	0	199	0	0	0	0	0	200
CH	EXTN	0	0	0	116	0	0	0	0	0	116
PH	EXTN	0	0	0	23	0	0	0	0	0	23
TR	EXTN	0	0	0	36	0	0	0	0	0	36
GL	EXTN	0	0	0	13	0	0	0	0	0	13
GT	EXTN	0	0	0	39	0	0	0	0	57	96
1	FLTL	0	0	0	0	0	0	32	0	9	41
2	FLTL	0	0	0	0	0	0	27	0	7	34
3	FLTL	3	0	0	0	0	0	112	0	5	120
4	FLTL	0	0	0	0	0	0	13	0	3	16
5	FLTL	1	0	0	0	0	0	96	0	25	122
6	FLTL	1	0	0	0	0	0	59	0	12	72
7	INDS	0	0	0	0	4	0	0	0	2	6
8	INDS	0	0	0	0	1	0	0	0	0	1
9	INDS	0	0	0	0	3	0	0	0	2	5
10	INDS	0	0	0	0	7	0	0	0	0	7
11	SERV	0	0	0	0	0	0	0	0	0	0
12	SERV	0	0	72	0	0	0	0	0	0	72
13	INDS	1	0	0	0	7	0	0	0	1	9
14	SERV	0	0	90	0	0	0	0	0	1	91
15	ADMN	0	0	0	0	0	49	0	0	4	53
16	ADMN	0	0	0	0	0	11	0	0	0	11
17	ADMN	0	0	0	0	0	35	0	0	0	35
18	SERV	0	0	334	0	0	0	0	0	0	334
19	INDS	0	0	0	0	7	0	0	0	27	34
20	INDS	2	0	0	0	19	0	0	0	42	63
21	SERV	0	0	256	0	0	0	0	0	37	293
22	HOME	0	0	0	0	0	0	0	142	0	142
23	SHOP	0	60	0	0	0	0	0	0	0	60
24	FLTL	3	0	0	0	0	0	71	0	5	79
25	ADMN	0	0	0	0	0	69	0	0	3	72
26	SERV	1	0	73	0	0	0	0	0	17	91
27	SERV	0	0	210	0	0	0	0	0	3	213
28	SERV	0	0	0	0	0	0	0	0	3	3
29	HOME	0	0	0	0	0	0	0	343	2	345
30	ADMN	0	0	0	0	0	20	0	0	2	22
31	SERV	0	0	126	0	0	0	0	0	0	126
32	SERV	0	0	0	0	0	0	0	0	1	1
33	SERV	0	0	70	0	0	0	0	0	0	70
34	HOME	0	0	0	0	0	0	0	32	0	32
35	INDS	0	0	0	0	19	0	0	0	123	142
36	INDS	1	0	0	0	35	0	0	0	3	39
37	HOME	0	0	0	0	0	0	0	53	0	53
38	HOME	0	0	0	0	0	0	0	16	0	16
39	INDS	0	0	0	0	2	0	0	0	7	9
40	SERV	0	0	0	0	0	0	0	0	0	0
41	HOME	0	0	0	0	0	0	0	22	0	22
42	INDS	0	0	0	0	5	0	0	0	14	19
43	SHOP	1	399	0	0	0	0	0	0	6	406
44	INDS	0	0	0	0	2	0	0	0	3	5
TOTAL		18	459	1237	425	111	184	410	607	426	3878

FIGURE 68. REPORT C.3: TRIP ATTRACTIONS--PERSONS

BATS MODEL OUTPUT 78/ 7/28 TINKER AFB P.M. RUSH DESCRIPTIVE PERIOD FROM 1630. TO 1645. HOURS

C.4. MATRIX ASSOCIATING ZONES WITH GATES

ZONE	GATE 1	GATE 2	GATE 3	GATE 4	GATE 5	GATE 6	GATE 7	GATE 8	GATE 9	GATE10
1	1	1	0	0	0	0	0	0	0	0
2	1	1	0	0	0	0	0	0	0	0
3	1	1	0	0	0	0	0	0	0	0
4	1	1	0	0	0	0	0	0	0	0
5	1	1	0	0	0	0	0	0	0	0
6	1	1	0	0	0	0	0	0	0	0
7	1	1	0	0	0	0	0	0	0	0
8	1	1	0	0	0	0	0	0	0	0
9	1	1	0	0	0	0	0	0	0	0
10	1	1	1	0	0	0	0	0	0	0
11	0	1	0	1	0	0	0	0	0	0
12	0	1	1	1	0	0	0	0	0	0
13	0	0	0	1	0	0	0	0	0	0
14	0	0	1	1	0	0	0	0	0	0
15	1	1	1	1	0	0	0	0	0	0
16	0	1	0	1	1	1	1	0	0	0
17	1	0	0	0	0	0	0	1	0	0
18	0	0	0	0	0	0	0	1	0	0
19	0	0	0	0	0	0	1	0	0	0

FIGURE 69. REPORT C.4: MATRIX ASSOCIATING GATES WITH ZONES

GATE MODEL OUTPUT 79/ 9/29 WILLIAMS AFB 11-1000 CALIBRATE PERIOD FROM 1100. TO 1200. HOURS

C.5. TRIP PRODUCTIONS MODIFIED BY GATE COUNTS AND SHIFT COUNTS (PERSONS)

FROM ZONE	USE	PURPOSE HOME-W	SHOPPI	SERVIC	EXTERN	INDUST	ADMINI	FLT.LI	HOME	MILITA	TOTAL
MS	EXTN	6	16	44	0	1	2	4	28	0	101
OH	EXTN	2	9	29	0	1	1	3	16	0	59
PH	EXTN	1	2	5	0	0	0	1	3	0	12
TM	EXTN	1	3	6	0	0	0	1	5	0	16
GL	EXTN	0	1	3	0	0	0	0	2	0	6
GT	EXTN	1	36	102	0	2	4	10	66	57	278
1	FLTL	0	7	9	2	1	3	1	7	9	39
2	FLTL	0	6	8	2	1	2	1	6	7	33
3	FLTL	0	25	34	7	3	9	3	24	6	110
4	FLTL	0	3	4	1	0	1	0	3	3	15
5	FLTL	0	21	29	6	3	6	3	20	25	115
6	FLTL	0	13	18	5	2	5	2	12	12	67
7	INDS	0	0	3	0	0	0	0	0	2	5
8	INDS	0	0	1	0	0	0	0	0	0	1
9	INDS	0	0	2	0	0	0	0	0	2	4
10	INDS	0	1	4	0	0	0	1	0	0	6
11	SERV	0	0	0	0	0	0	0	0	0	0
12	SERV	0	3	8	5	1	1	2	8	0	28
13	INDS	0	1	5	0	0	0	1	1	1	9
14	SERV	0	5	12	7	1	5	2	7	1	37
15	ADMN	1	5	20	2	1	0	5	5	4	54
16	ADMN	0	2	5	1	0	0	2	1	0	12
17	ADMN	0	6	16	2	1	0	7	2	0	36
18	SERV	0	11	25	17	3	4	6	16	0	85
19	INDS	0	1	5	0	0	0	1	0	27	84
20	INDS	0	2	12	1	0	1	2	1	42	61
21	SERV	0	30	74	45	9	12	15	42	27	254
22	HOME	2	22	83	35	2	9	21	41	0	209
23	SHOP	0	4	11	9	1	1	4	4	0	31
24	FLTL	0	16	21	4	2	6	2	16	5	71
25	ADMN	0	12	36	3	1	1	13	5	3	74
26	SERV	0	29	71	43	9	11	14	41	17	235
27	SERV	0	11	26	16	3	4	5	15	3	83
28	SERV	0	1	2	1	0	0	0	1	0	6
29	HOME	1	54	200	85	4	7	50	99	2	502
30	ADMN	0	3	10	1	0	0	4	7	2	21
31	SERV	0	6	14	6	2	2	3	6	0	43
32	SERV	0	0	1	1	0	0	0	1	1	4
33	SERV	0	3	7	4	1	1	1	4	0	21
34	HOME	1	5	19	8	0	1	5	9	0	48
35	INDS	0	2	13	1	0	1	2	1	123	143
36	INDS	0	4	24	2	1	1	4	3	3	42
37	HOME	1	5	31	13	1	1	5	15	0	76
38	HOME	0	2	9	4	0	0	2	4	0	21
39	INDS	0	0	1	0	0	0	0	0	7	9
40	SERV	0	2	5	3	1	1	1	3	0	16
41	HOME	0	3	13	5	0	0	3	6	0	30
42	INDS	0	1	3	0	0	0	1	0	14	19
43	SHOP	0	56	147	61	6	15	56	90	5	496
44	INDS	0	0	2	0	0	0	0	0	3	5
TOTAL		18	457	1242	426	66	116	276	606	426	3634

FIGURE 70. REPORT C.5: TRIP PRODUCTIONS MODIFIED BY GATE COUNTS AND SHIFT COUNTS--PERSONS

GATS MODEL OUTPUT 78/ 9/29 WILLIAMS AFB 11-1300 CALIBRATE PERIOD FROM 1100. TO 1200 HOURS

C.6. TRIP ATTRACTIONS MODIFIED BY GATE COUNTS AND SHIFT COUNTS (PERSONS)

TO ZONE	USE	PURPOSE HOME-W	SHOPPI	SERVIC	EXTERN	INDUST	ADMINI	FLT.LI	HOME	MILITA	TOTAL
MB	EXTN	1	0	0	199	0	0	0	0	0	200
CH	EXTN	0	0	0	115	0	0	0	0	0	115
PH	EXTN	0	0	0	23	0	0	0	0	0	23
TN	EXTN	0	0	0	36	0	0	0	0	0	36
GL	EXTN	0	0	0	13	0	0	0	0	0	13
GT	EXTN	0	0	0	39	0	0	0	0	57	96
1	FLTL	0	0	0	0	0	0	32	0	9	41
2	FLTL	0	0	0	0	0	0	27	0	7	34
3	FLTL	3	0	0	0	6	0	112	0	8	120
4	FLTL	0	0	0	0	0	0	13	0	3	16
5	FLTL	1	0	0	0	0	0	96	0	25	122
6	FLTL	1	0	0	0	0	0	59	0	12	72
7	INDS	0	0	0	0	4	0	0	0	2	6
8	INDS	0	0	0	0	1	0	0	0	0	1
9	INDS	0	0	0	0	5	0	0	0	2	5
10	INDS	0	0	0	0	7	0	0	0	0	7
11	SERV	0	0	0	0	0	0	0	0	0	0
12	SERV	0	0	72	0	0	0	0	0	0	72
13	INDS	1	0	0	0	7	0	0	0	1	9
14	SERV	0	0	90	0	0	0	0	0	1	91
15	ADMN	0	0	0	0	0	49	0	0	4	53
16	ADMN	0	0	0	0	0	11	0	0	0	11
17	ADMN	0	0	0	0	0	36	0	0	0	36
18	SERV	0	0	334	0	0	0	0	0	0	334
19	INDS	0	0	0	0	7	0	0	0	27	34
20	INDS	2	0	0	0	19	0	0	0	42	63
21	SERV	0	0	256	0	0	0	0	0	37	293
22	HOME	0	0	0	0	0	0	0	142	0	142
23	SHOP	0	60	0	0	0	0	0	0	0	60
24	FLTL	3	0	0	0	0	0	71	0	6	79
25	ADMN	0	0	0	0	0	69	0	0	3	72
26	SERV	1	0	73	0	0	0	0	0	17	91
27	SERV	0	0	216	0	0	0	0	0	3	219
28	SERV	0	0	0	0	0	0	0	0	3	3
29	HOME	0	0	0	0	0	0	0	343	2	345
30	ADMN	0	0	0	0	0	20	0	0	2	22
31	SERV	0	0	126	0	0	0	0	0	0	126
32	SERV	0	0	0	0	0	0	0	0	1	1
33	SERV	0	0	70	0	0	0	0	0	0	70
34	HOME	0	0	0	0	0	0	0	32	0	32
35	INDS	0	0	0	0	19	0	0	0	123	142
36	INDS	1	0	0	0	35	0	0	0	3	39
37	HOME	0	0	0	0	0	0	0	53	0	53
38	HOME	0	0	0	0	0	0	0	15	0	15
39	INDS	0	0	0	0	2	0	0	0	7	9
40	SERV	0	0	0	0	0	0	0	0	0	0
41	HOME	0	0	0	0	0	0	0	22	0	22
42	INDS	0	0	0	0	5	0	0	0	14	19
43	SHOP	1	399	0	0	0	0	0	0	8	408
44	INDS	0	0	0	0	2	0	0	0	3	5
TOTAL		15	459	1237	426	111	184	410	607	428	3876

FIGURE 71. REPORT C.6: TRIP ATTRACTIONS MODIFIED

BY GATE COUNTS AND SHIFT COUNTS--PERSONS

GATS MODEL OUTPUT 79/ 9/20 WILLIAMS AFB 11-1600 CALIBRATE PERIOD FROM 1100. TO1200. HOURS

D.1. ORIGIN TO GATE (OG) AND GATE TO DESTINATION (GD) TRIPS (PERSONS)

ZONE	OG1	GD1	OG2	GD2	OD
MB	101.	200.	0.	0.	
CM	58.	115.	0.	0.	
PM	12.	23.	0.	0.	
TM	18.	36.	0.	0.	
GL	6.	13.	0.	0.	
GT	279.	96.	0.	0.	
1	3.	3.	28.	28.	
2	3.	2.	30.	32.	
3	8.	9.	102.	111.	
4	1.	1.	14.	15.	
5	10.	9.	106.	115.	
6	5.	5.	62.	66.	
7	0.	0.	5.	6.	
8	0.	0.	1.	1.	
9	0.	0.	4.	5.	
10	0.	0.	6.	7.	
11	0.	0.	0.	0.	
12	5.	11.	20.	61.	
13	0.	1.	5.	6.	
14	7.	14.	30.	77.	
15	3.	2.	61.	60.	
16	1.	0.	11.	11.	
17	2.	1.	34.	34.	
18	17.	50.	68.	284.	
19	4.	4.	30.	30.	
20	7.	9.	54.	54.	
21	91.	44.	219.	249.	
22	35.	26.	174.	114.	
23	6.	5.	25.	51.	
24	5.	7.	66.	72.	
25	3.	3.	71.	69.	
26	46.	15.	169.	76.	
27	16.	33.	67.	186.	
28	1.	0.	7.	3.	
29	65.	66.	417.	276.	
30	1.	1.	20.	21.	
31	9.	18.	35.	107.	
32	1.	0.	3.	1.	
33	4.	11.	17.	69.	
34	6.	6.	40.	26.	
35	20.	20.	123.	122.	
36	2.	3.	40.	37.	
37	13.	10.	65.	43.	
38	4.	3.	17.	12.	
39	1.	1.	7.	8.	
40	3.	0.	13.	0.	
41	5.	4.	25.	18.	
42	2.	2.	17.	17.	
43	62.	62.	364.	346.	
44	0.	1.	0.	5.	

FIGURE 72. REPORT D.1: ORIGIN-TO-GATE (OG) AND GATE-TO-DESTINATION (GD) TRIPS--PERSONS

are identified by OG and GD column headings. The number of persons coming from the origin zones and going to Gate 1 is listed under OG1. The number of persons going from Gate 1 to the destination zones is shown under GD1.

By comparing this array with the base map, the user can determine whether vehicles are following reasonable travel lines in going from external to internal zones. For instance, if vehicles tend to drive past their destination zone to use a particular gate, they are not following reasonable routes. The problem could be evaluated as too much delay while traveling on base, incorrect zone attractions, or incorrect gate counts.

One more gate number than the number of existing gates is included in the last two columns, which show all vehicles produced by internal zones OG_n and attracted by internal zones GD_n (where n is one more than the gate count).

Report D.2: Origin-Destination Array--Persons (Figure 73)

This report shows the number of persons traveling between each zone during the time period being simulated. The row heading identifies the zone of origin and the column heading identifies the zone of destination, so that the rows show trip production by zone and the columns show trip attraction by zone. The user can compare information on this array with data from other origin-destination surveys to determine the accuracy of the model.

Report D.3: Origin-Destination Array for Civilian Vehicle Trips --Persons (Figure 74)

This table is similar to Report D.2, except that it depicts person-trips made in civilian vehicles. The rows and columns represent the number of persons traveling between each zone by private vehicle.

Report D.4: Origin-Destination Array for Military Vehicle Trips --Persons (Figure 75)

This table is also formatted like Report D.2, except that it depicts person trips made in military vehicles. The rows and columns represent the number of persons traveling between each zone by military vehicle.

Report E.1: Modal Split-Vehicle Load Factors (Figure 76)

This report shows the factors for converting person trips to vehicle trips for each zone. The number of person trips from the origin and the destination, is divided by the appropriate load factor (persons per vehicle). The load factor, which is a weighted average for all vehicle types, yields the civilian and military vehicle trips from the

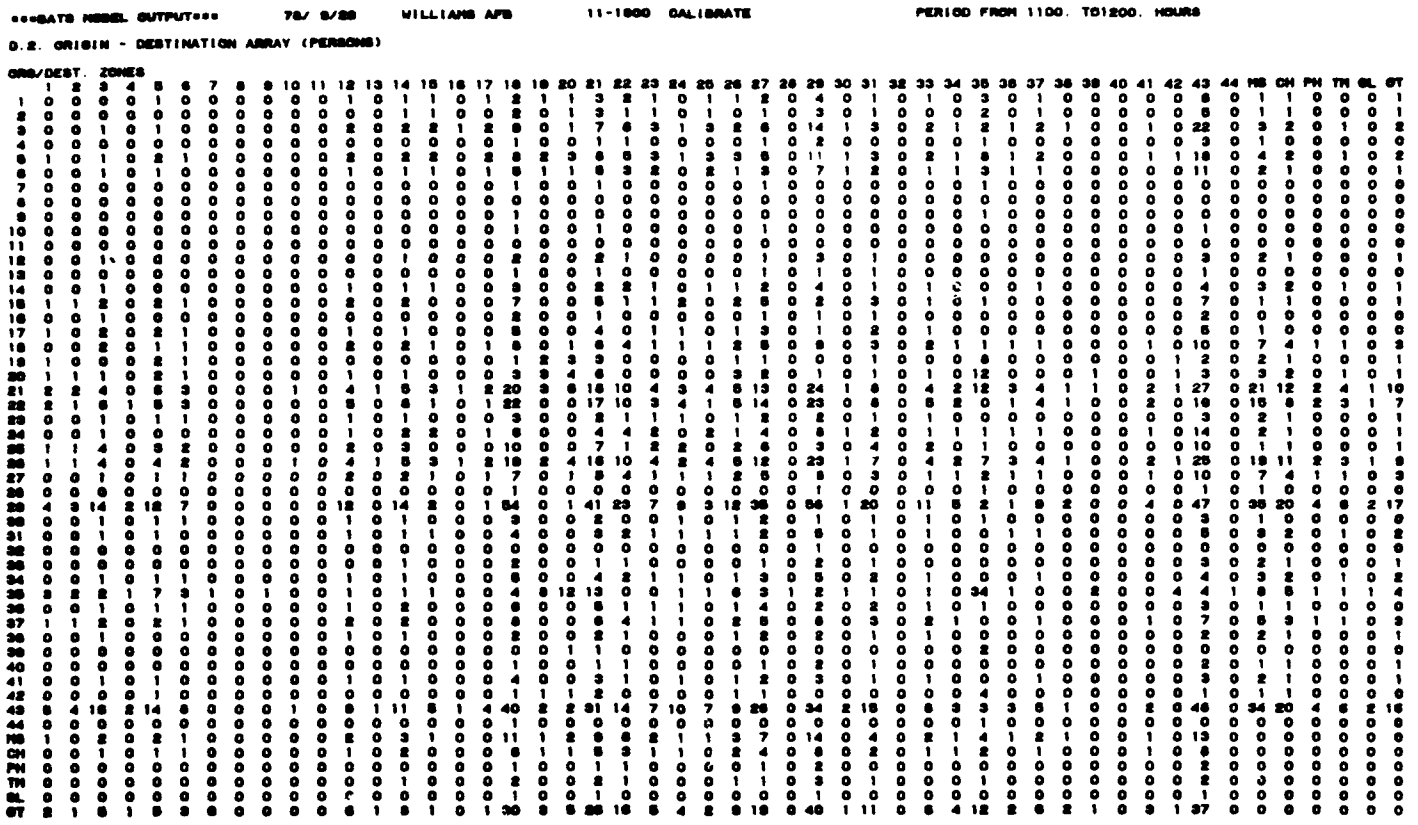
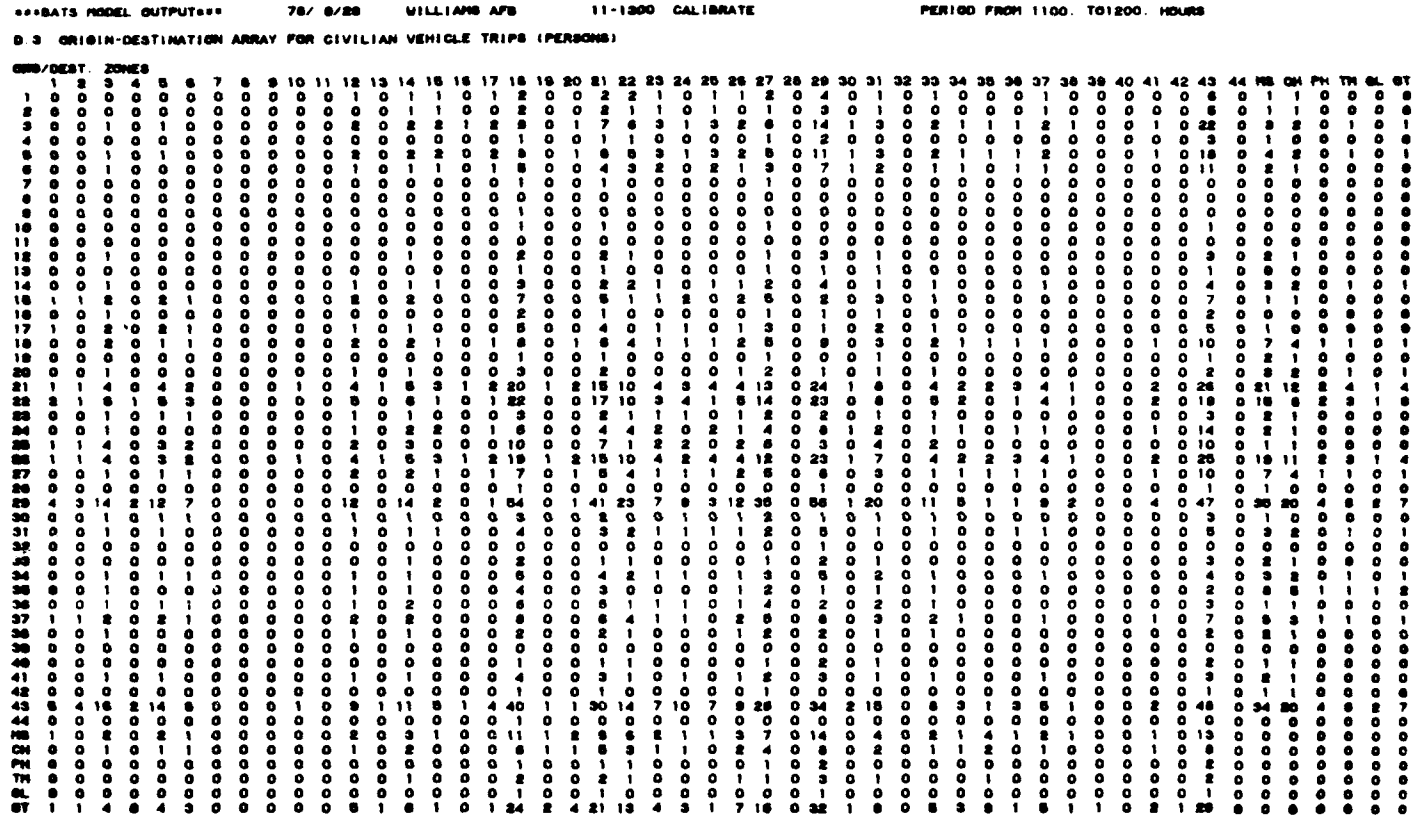


FIGURE 73. REPORT D.2: ORIGIN-DESTINATION ARRAY--PERSONS



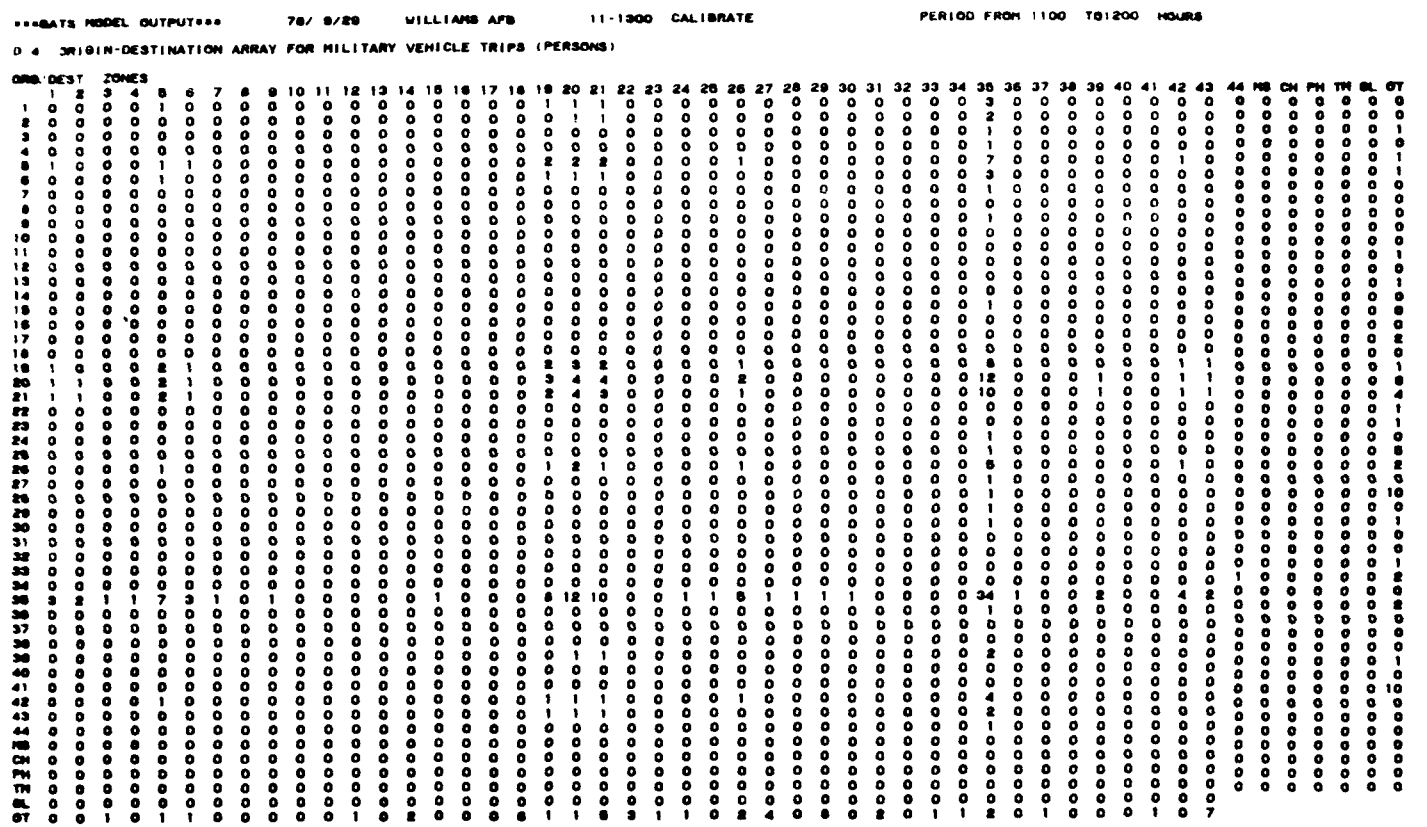
BATS MODEL OUTPUT 78/ 8/28 WILLIAMS AFB 11-1300 CALIBRATE PERIOD FROM 1100. TO1200. HOURS

D.3 ORIGIN-DESTINATION ARRAY FOR CIVILIAN VEHICLE TRIPS (PERSONS)

ORIG/DEST. ZONES

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	MB	GM	FM	TR	GL	OT
1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	2	0	0	2	2	1	0	1	1	2	0	4	0	1	0	1	0	0	0	1	0	0	0	0	0	6	0	1	1	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	0	0	2	1	1	0	1	0	1	0	3	0	1	0	0	0	0	0	1	0	0	0	0	0	6	0	1	1	0	0	0	0
3	0	0	1	0	1	0	0	0	0	0	0	2	0	2	2	1	2	2	0	1	7	6	3	1	3	2	6	0	14	1	3	0	2	1	1	1	2	1	0	0	1	0	22	0	3	2	0	1	0	1
4	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	3	0	1	0	0	0	0	1
5	0	0	1	0	1	0	0	0	0	0	0	2	0	2	2	0	2	3	0	1	6	5	3	1	3	2	5	0	11	1	3	0	2	1	1	1	2	1	0	0	1	0	18	0	4	2	0	1	0	1
6	0	0	1	0	0	1	0	0	0	0	0	1	0	1	1	0	1	5	0	0	4	3	2	0	2	1	3	0	7	1	2	0	1	1	0	1	1	0	0	0	0	0	11	0	2	1	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	2	1	0	0	0	0	1	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
14	0	0	1	0	0	1	0	0	0	0	0	1	0	1	1	0	0	3	0	0	2	2	1	0	1	1	2	0	4	0	1	0	1	0	0	0	1	0	0	0	0	0	4	0	1	2	0	1	0	1
15	1	1	2	0	0	2	1	0	0	0	0	2	0	2	2	0	0	7	0	0	5	1	1	2	0	2	6	0	2	0	3	0	1	0	0	0	0	0	0	0	0	0	7	0	1	1	0	0	0	0
16	0	0	1	0	0	2	1	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0
17	1	0	2	0	0	2	1	0	0	0	0	1	0	1	1	0	0	5	0	0	4	0	1	1	0	1	3	0	1	0	2	0	1	0	0	0	0	0	0	0	0	0	5	0	1	0	0	0	0	0
18	0	0	2	0	0	1	1	0	0	0	0	2	0	2	1	0	1	6	0	1	6	4	1	1	1	2	6	0	9	0	3	0	2	1	1	1	1	0	0	0	0	0	10	0	7	4	1	1	0	1
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
20	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	3	0	0	2	0	0	0	0	1	2	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	2	0	3	2	0	1	0	1
21	1	1	4	0	4	2	0	0	0	1	0	4	1	5	3	1	2	20	1	2	15	10	4	3	4	4	13	0	24	1	6	0	4	2	2	3	4	1	0	0	2	0	26	0	21	12	2	4	1	4
22	2	1	6	1	5	3	0	0	0	0	0	5	0	6	1	0	1	22	0	0	17	10	3	4	1	5	14	0	23	0	6	0	5	2	0	1	4	1	0	0	2	0	18	0	16	6	2	3	1	5
23	0	0	1	0	1	1	0	0	0	0	0	1	0	1	0	0	0	3	0	0	2	1	1	1	0	1	2	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	3	0	2	1	0	0	0	0
24	0	0	1	0	0	2	0	0	0	0	0	1	0	2	2	0	1	6	0	0	4	4	2	0	2	1	4	0	8	1	2	0	1	1	0	1	1	0	0	0	1	0	14	0	2	1	0	0	0	0
25	1	1	4	0	3	2	0	0	0	0	0	2	0	3	2	0	0	10	0	0	7	1	2	2	0	2	6	0	3	0	4	0	2	0	0	0	0	0	0	0	0	0	10	0	1	1	0	0	0	0
26	1	1	4	0	3	2	0	0	0	0	0	1	0	4	1	5	3	1	2	19	1	2	15	10	4	2	4	4	12	0	23	1	7	0	4	2	2	3	4	1	0	0	25	0	19	11	2	3	1	4
27	0	0	1	0	1	1	0	0	0	0	0	2	0	2	1	0	1	7	0	1	5	4	1	1	1	2	5	0	8	0	3	0	1	1	1	1	1	0	0	0	1	0	10	0	7	4	1	1	0	1
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
29	4	3	14	2	12	7	0	0	0	0	0	12	0	14	2	0	1	54	0	1	41	23	7	8	3	12	36	0	86	1	20	0	11	5	1	1	9	2	0	0	4	0	47	0	36	20	4	8	2	7
30	0	0	1	0	1	1	0	0	0	0	0	1	0	1	1	0	0	3	0	0	2	0	0	1	0	1	2	0	5	0	1	0	1	0	0	0	0	0	0	0	0	0	3	0	1	0	0	0	0	0
31	0	0	1	0	1	0	0	0	0	0	0	1	0	1	1	0	0	4	0	0	3	2	1	1	1	1	2	0	8	0	1	0	1	0	0	0	1	0	0	0	0	0	8	0	2	1	0	0	0	1
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	3	0	2	1	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	3	0	2	1	0	0	0	0
35	0	0	1	0	1	1	0	0	0	0	0	1	0	1	0	0	0	4	0	0	3	0	0	0	0	1	2	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	4	0	3	1	0	0	0	0
36	0	0	1	0	1	1	0	0	0	0	0	1	0	2	0	0	0	5	0	0	5	1	1	1	0	1	4	0	2	0	2	0	1	0	0	0	0	0	0	0	0	0	3	0	1	1	0	0	0	0
37	1	1	2	1	2	1	0	0	0	0	0	2	0	2	0	0	0	8	0	0	6	4	1	1	0	2	5	0	8	0	3	0	2	1	0	0	1	0	0	0	1	0	7	0	5	3	1	1	0	1
38	0	0	1	0	0	1	0	0	0	0	0	1	0	1	0	0	0	2	0	0	2	1	0	0	0	1	2	0	2	0	1	0	1	0	0	0	0	0	0	0	0	0	2	0	1	1	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0	1	1	0	0	0	0
41	0	0	1	0	1	0	0	0	0	0	0	1	0	1	0	0	0	4	0	0	3	1	0	0	1	0	2	0	3	0	1	0	1	0	0	0	1	0	0	0	0	0	3	0	2	1	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	3	0	1	1	0	0	0	0
43	6	4	16	2	14	8	0	0	0	1	0	9	1	11	5	1	4	40	1	1	30	14	7	10	7	9	26	0	34	2	15	0	8	3	1	3	5	1	0	0	2	0	48	0	34	20	4	8	2	7
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MB	1	0	2	0	2	1	0	0	0	0	0	2	0	3	1	0	0	11	1	2	8	6	2	1	1	3	7	0	14	0	4	0	2	1	1	1	2	1	0	0	1	0	13	0	8	4	1	2	0	0
GM	0	0	1	0	1	1	0	0	0	0	0	1	0	2	0	0	0	6	1	1	6	3	1	1	0	2	4	0	8	0	2	0	1	0	0	0	1	0	0	0	0	0	8	0	4	2	0	1	0	0
FM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0	1	1	0	0	0	0
TR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0	1	1	0	0	0	0
GL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	3	0	2	1	0	0	0	0
OT	1	1	4	0	4	3	0	0	0	0	0	6	1	8	1	0	1	24	2	4	21	13	4	3	1	7	16	0	32	1	8	0	5	3	0	1	5	1	1	0	2	1	29	0	0	0	0	0	0	0

FIGURE 74. REPORT D.3: ORIGIN-DESTINATION ARRAY FOR CIVILIAN VEHICLE TRIPS--PERSONS



GATS MODEL OUTPUT 78/ 9/29 WILLIAMS AFB 11-1300 CALIBRATE PERIOD FROM 1100 TO1200 HOURS

D 4 ORIGIN-DESTINATION ARRAY FOR MILITARY VEHICLE TRIPS (PERSONS)

ORG \ DEST ZONES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	MB	CH	PH	TR	GL	GT
1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
5	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	2	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0
19	1	1	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	3	4	4	0	0	0	0	1	2	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	1	1	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	2	4	3	0	0	0	0	0	1	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1	0	0	0	0	0	1	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MB	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

FIGURE 75. REPORTS D.4: ORIGIN-DESTINATION ARRAY FOR MILITARY VEHICLE TRIPS--PERSONS

SATS MODEL OUTPUT 76/ 6/29 WILLIAMS AFB 11-1900 CALIBRATE PERIOD FROM 1100. TO1200. HOURS

E.1. MODAL SPLIT - VEHICLE LOAD FACTORS

ZONE	PERSONS PER VEHICLE	PERSONS PER MIL. VEHICLE	CIVILIAN VEH TRIPS ORG-GATE	CIVILIAN VEH TRIPS GATE-DEST	MILITARY VEH TRIPS ORG-GATE	MILITARY VEH TRIPS GATE-DEST	PERCENT MOTOR VEHICLES	PERCENT MILITARY VEHICLES	PERSON TRIPS FROM ORIGIN	PERSON TRIPS TO DEST.
NS	1.26036	1.25226	79.67	187.86	0.00	0.00	99.300	90.300	101.000	200.000
CH	1.26036	1.25226	46.69	90.60	0.00	0.00	99.300	90.300	56.000	115.000
PH	1.26036	1.25226	9.45	16.12	0.00	0.00	99.300	90.300	12.000	23.000
TH	1.26036	1.25226	14.18	28.36	0.00	0.00	99.300	90.300	18.000	36.000
GL	1.26036	1.25226	4.73	10.24	0.00	0.00	99.300	90.300	6.000	13.000
GT	1.26036	1.25226	174.89	30.72	46.62	46.62	99.300	90.300	279.000	96.000
1	1.26780	1.26000	24.36	26.48	6.64	6.71	103.000	100.000	39.383	41.866
2	1.26320	1.26000	20.96	22.08	5.17	5.03	100.000	100.000	33.075	34.327
3	1.26320	1.26000	63.49	91.21	3.38	3.37	100.000	100.000	108.788	119.630
4	1.27160	1.26000	9.86	10.11	2.58	2.61	101.000	100.000	15.481	16.083
5	1.26040	1.26000	72.89	76.90	17.84	17.73	101.000	100.000	114.841	122.147
6	1.22960	1.26200	48.59	49.29	8.61	8.84	85.000	100.000	66.844	71.436
7	1.26320	1.24360	2.82	3.40	1.71	1.73	100.000	100.000	5.307	6.461
8	1.24820	1.24360	.80	.83	0.00	0.00	93.000	100.000	1.000	1.036
9	1.24080	1.26000	1.74	2.62	1.66	1.69	86.000	100.000	4.307	5.415
10	1.27160	1.24360	4.72	5.70	0.00	0.00	100.000	100.000	6.000	7.252
11	1.25480	1.26000	0.00	0.00	0.00	0.00	100.000	100.000	0.000	0.000
12	1.22960	1.24360	20.33	56.46	0.00	0.00	100.000	100.000	25.000	71.884
13	1.27160	1.26000	6.40	6.37	.78	.80	100.000	100.000	9.154	9.263
14	1.26000	1.24360	26.08	69.96	1.00	.95	100.000	100.000	37.154	90.759
15	1.22120	1.26000	41.45	40.39	2.47	2.46	86.000	100.000	63.781	62.479
16	1.26320	1.24360	8.60	8.04	0.00	0.00	100.000	100.000	12.000	11.416
17	1.26000	1.24360	26.13	27.60	0.00	0.00	100.000	100.000	36.000	35.332
18	1.27440	1.24360	66.70	262.47	0.00	0.00	100.000	100.000	85.000	334.492
19	1.24820	1.19040	6.38	6.43	21.89	22.16	83.000	86.000	34.148	34.401
20	1.23600	1.24640	16.85	16.92	32.67	33.62	100.000	100.000	61.453	62.852
21	1.24080	1.24360	161.66	206.19	30.66	28.39	100.000	100.000	263.685	292.385
22	1.19040	1.24360	176.85	119.16	0.00	0.00	83.000	100.000	209.333	141.839
23	1.26600	1.24360	24.49	47.41	0.00	0.00	86.000	100.000	31.000	60.020
24	1.24820	1.26600	63.62	66.46	3.38	3.45	93.000	101.000	70.788	75.630
25	1.26000	1.27720	66.71	63.67	2.48	2.45	100.000	99.000	74.481	72.086
26	1.27160	1.27720	170.69	58.08	13.61	13.06	98.000	99.000	234.612	90.506
27	1.26000	1.27720	62.	166.42	2.83	2.77	100.000	99.000	83.461	219.114
28	1.27720	1.24360	3.74	0.00	2.82	2.78	100.000	100.000	8.461	3.461
29	1.20720	1.24360	414.23	284.16	1.84	2.00	74.000	100.000	502.474	345.551
30	1.26320	1.26000	16.16	16.81	1.66	1.64	100.000	100.000	21.307	22.068
31	1.27720	1.24360	33.67	96.66	0.00	0.00	100.000	100.000	43.000	126.048
32	1.27720	1.24360	2.17	0.00	1.11	.83	100.000	100.000	4.154	1.154
33	1.27720	1.24360	16.44	54.48	0.00	0.00	100.000	100.000	21.000	69.662
34	1.20720	1.24360	38.90	26.73	0.00	0.00	83.000	100.000	46.167	32.273
35	1.27720	1.20440	17.28	16.36	100.32	100.21	99.000	100.000	142.896	141.662
36	1.24820	1.26000	31.44	29.11	2.48	2.51	83.000	100.000	42.481	39.579
37	1.20720	1.24360	64.76	44.23	0.00	0.00	83.000	100.000	78.167	53.390
38	1.20720	1.24360	17.40	12.38	0.00	0.00	83.000	100.000	21.000	14.941
39	1.24820	1.26000	.62	1.83	5.41	5.36	83.000	100.000	8.076	9.148
40	1.27720	1.24360	12.53	0.00	0.00	0.00	100.000	100.000	15.000	0.000
41	1.20720	1.24360	24.86	18.48	0.00	0.00	83.000	100.000	30.000	22.313
42	1.24820	1.26000	4.81	4.86	10.66	10.66	83.000	100.000	19.151	19.331
43	1.27440	1.26000	336.63	313.72	6.74	6.46	100.000	100.000	436.229	406.067
44	1.24820	1.24960	1.76	1.77	2.68	2.67	99.000	100.000	5.461	5.533

FIGURE 76. REPORT E.1: MODAL SPLIT-VEHICLE LOAD FACTORS

origin zone to all gates and from the gates to the destination zone. The user can thereby see the effects of load factor on the number of vehicle trips. Increasing the load factor results in a decrease in the number of vehicles.

In addition, this report shows the percent of civilian and military motor vehicles on the roads. If the percent of civilian vehicles equals 85, for example, then 85% of all trips are made by motor vehicle and 15% are made by bicycle or on foot. Bus trips are not included in this table and persons riding the bus have been omitted from the final two columns.

Report E.2: Origin-to-Gate (OG) and Gate-to-Destination (GD) Trips --Motor Vehicles (Figure 77)

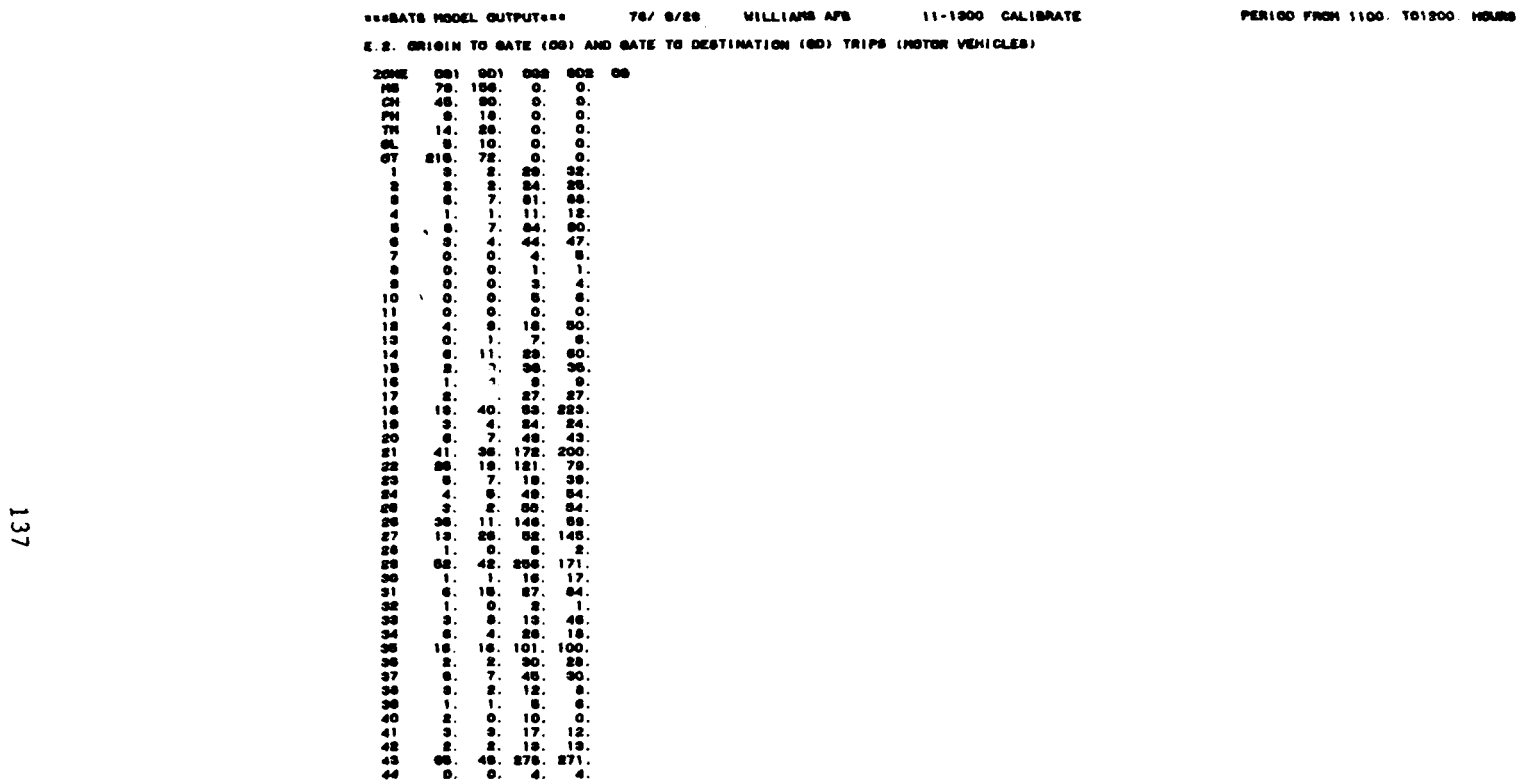
This report is similar to Report D.1, except that the trips are shown in terms of motor vehicles. The zones are identified in each row and the gates in each column. The load factor and the percentage of motor vehicles, which vary from zone to zone, are used to convert person trips to vehicle trips. With both this report and Report D.1, the user can compare the number of vehicles with the number of persons traveling through a gate into and out of each zone. This gives a measure of both the occupancy rate (load factor) and the number of those who bicycle and ride buses. For example, although dormitories generate numerous person trips to various zones on base, they also have a higher percentage of bicyclists and bussed personnel. Thus, entries in these zones are proportionately higher.

Report F.1: Calibration Factors--Factors*Gate Counts = Attractions or Productions (Figure 78)

This report is only four columns wide and one row long, but it indicates whether the trip generation, distribution, and modal split data fit the counts at each gate. A factor = 1.0 indicates that there is perfect correspondence between the gate counts and the other data. If the factor is much different from 1.0, then some input data, such as the demographic variables or the trip purpose coefficients used in generating trips, may be incorrect.

The four columns give the calibration factor for exterior productions (trips originating off base and coming on base), exterior attractions (trips destined off base and coming from the base), interior productions (trips originating on base and destined off base), and interior attractions (trips destined on base and originating off base).

The calibration factors also provide a way of calibrating predictive runs by the gate counts used on descriptive runs. In a descriptive run, the user simulates a current situation. When the user



GATE MODEL OUTPUT 76/ 6/26 WILLIAMS AFB 11-1300 CALIBRATE PERIOD FROM 1100. TO1200. HOURS

E.2. ORIGIN TO GATE (OG) AND GATE TO DESTINATION (GD) TRIPS (MOTOR VEHICLES)

ZONE	OG1	GD1	OG2	GD2	OG
MB	79.	156.	0.	0.	
CN	45.	90.	0.	0.	
FM	9.	18.	0.	0.	
TR	14.	28.	0.	0.	
GL	5.	10.	0.	0.	
GT	216.	72.	0.	0.	
1	9.	2.	29.	32.	
2	2.	2.	24.	28.	
3	6.	7.	61.	68.	
4	1.	1.	11.	12.	
5	6.	7.	84.	90.	
6	3.	4.	44.	47.	
7	0.	0.	4.	5.	
8	0.	0.	1.	1.	
9	0.	0.	3.	4.	
10	0.	0.	6.	6.	
11	0.	0.	0.	0.	
12	4.	5.	16.	50.	
13	0.	1.	7.	8.	
14	6.	11.	25.	60.	
15	2.	7.	36.	38.	
16	1.	1	8.	9.	
17	2.		27.	27.	
18	19.	40.	69.	223.	
19	3.	4.	24.	24.	
20	6.	7.	48.	43.	
21	41.	36.	172.	200.	
22	26.	19.	121.	79.	
23	5.	7.	19.	39.	
24	4.	5.	49.	54.	
25	3.	2.	55.	54.	
26	36.	11.	146.	59.	
27	13.	25.	52.	145.	
28	1.	0.	5.	2.	
29	52.	42.	206.	171.	
30	1.	1.	16.	17.	
31	6.	15.	57.	84.	
32	1.	0.	2.	1.	
33	3.	5.	13.	46.	
34	5.	4.	25.	18.	
35	16.	16.	101.	100.	
36	2.	2.	30.	28.	
37	5.	7.	45.	30.	
38	5.	2.	12.	5.	
39	1.	1.	5.	6.	
40	2.	0.	10.	0.	
41	3.	3.	17.	12.	
42	2.	2.	15.	13.	
43	65.	45.	270.	271.	
44	0.	0.	4.	4.	

FIGURE 77. REPORT E.2: ORIGIN-TO-GATE (OG) AND GATE-TO-DESTINATION (GD) TRIPS--MOTOR VEHICLES

SATS MODEL OUTPUT 78/ 9/29 WILLIAMS AFB 11-1300 CALIBRATE PERIOD FROM 1100. TO1200. HOURS

F.1. CALIBRATION FACTORS (FACTOR*GATE COUNT = ATTRACTIONS OR PRODUCTIONS)

EXTERIOR PRODUCTIONS	EXTERIOR ATTRACTIONS	INTERIOR PRODUCTIONS	INTERIOR ATTRACTIONS
1.004	1.009	.968	.974

FIGURE 78. REPORT F.1: CALIBRATION FACTORS--FACTORS*GATE COUNTS = ATTRACTIONS OR PRODUCTIONS

is satisfied that the current situation is represented, a new situation is predicted. For example, if a new situation involves opening a new gate, or opening a new industrial building, then new patterns of flow will occur at the gates. The calibration factors printed on the descriptive run should be applied to the predictive run by inputting Card Type 13. The number of trips coming to or leaving the base will be the same as for the descriptive run, and only the proportion using each gate will vary.

Report F.2: Origin-to-Gate (OG) and Gate-to-Destination (GD) Trips After Application of Calibration Factors and Parking Rerouting --Motor Vehicles (Figure 79)

This report is similar to Reports D.1 and E.2, and shows the number of vehicles assigned to each zone in the network. Only the data have been refined by computer application of calibration factors and parking rerouting. The previous reports were constructed using a weighting factor to route trips to heavily used gates. A "smoothing" matrix manipulation that factors the OG (origin-to-gate array) takes place so that the rows add up to the origin zone counts and the columns add up to the entrance gate counts for external zones or exit gate counts for internal zones. The GD (gate-to-destination array) is factored so that the rows add up to the zone attraction counts and the columns add up to the entrance gate counts for internal zones or exit gate counts for external zones. Smoothing is performed so that simulated results match measured gate counts. In addition, if the parking capacity is exceeded in a zone, vehicles are rerouted to an adjacent zone. This would show up as a large change in the number of trips to a zone. Using the calibration factor produces only uniform changes in the number of trips.

Report G.1: Assignment Counts and Associated Computer Run Times (Figure 80)

This report tells the user about the progress of the most time consuming subroutine of the program. The time required for the computer to make an assignment and the total run time is indicated. In addition, the number of vehicles assigned to a path between an origin and a gate, between a gate and a destination, and between an internal origin and all internal destinations is specified. The final column identifies the number of paths to which vehicles are assigned from each zone. Between each gate-zone or zone-zone pair there can be one or two paths. Based on this report, the user can decide whether to implement some time-saving options. This report gives information primarily on the inner functioning of the model and is useful to a computer programmer.

Report G.2: Vehicle Count, Type, and Hot/Cold Status (Figure 81)

This report presents information about the number, type, and status of vehicles assigned to each link. Columns 2-6 give the total number of vehicles on the link (SUM), the number of vehicles traveling straight onto the next link (THRU), the number of vehicles turning right onto the

SATS MODEL OUTPUT 76/ 9/29 WILLIAMS AFB 11-1300 CALIBRATE PERIOD FROM 1100. TO1200 HOURS

F.2. ORIGIN TO GATE (OG) AND GATE TO DESTINATION (GD) TRIPS
AFTER APPLICATION OF CALIBRATION FACTORS AND PARKING REROUTING (MOTOR VEHICLES)

ZONE	OG1	GD1	OG2	GD2	OG
MB	79.	196.	0.	0.	
CH	46.	89.	0.	0.	
PH	9.	18.	0.	0.	
TR	14.	28.	0.	0.	
BL	5.	10.	0.	0.	
GT	214.	71.	0.	0.	
1	3.	2.	29.	32.	
2	3.	2.	24.	26.	
3	6.	7.	81.	88.	
4	1.	1.	11.	12.	
5	8.	7.	84.	90.	
6	4.	4.	44.	47.	
7	0.	0.	4.	5.	
8	0.	0.	1.	1.	
9	0.	0.	3.	4.	
10	0.	0.	5.	6.	
11	0.	0.	0.	0.	
12	4.	9.	16.	80.	
13	0.	1.	7.	6.	
14	6.	11.	23.	60.	
15	2.	2.	36.	36.	
16	1.	0.	9.	9.	
17	2.	1.	27.	27.	
18	14.	41.	69.	223.	
19	3.	4.	24.	24.	
20	6.	7.	43.	43.	
21	42.	97.	172.	200.	
22	26.	20.	121.	79.	
23	5.	7.	19.	39.	
24	4.	6.	49.	54.	
25	3.	2.	65.	64.	
26	36.	11.	146.	59.	
27	13.	27.	52.	146.	
28	1.	0.	6.	2.	
29	54.	43.	256.	171.	
30	1.	1.	16.	17.	
31	6.	15.	27.	84.	
32	1.	0.	2.	1.	
33	3.	6.	13.	46.	
34	6.	4.	28.	16.	
35	17.	17.	101.	100.	
36	2.	2.	30.	28.	
37	8.	7.	45.	30.	
38	3.	2.	12.	8.	
39	1.	1.	5.	6.	
40	2.	0.	10.	0.	
41	4.	3.	17.	12.	
42	2.	2.	13.	13.	
43	87.	50.	278.	271.	
44	0.	0.	4.	4.	

FIGURE 79. REPORT F.2: ORIGIN-TO-GATE (OG) AND GATE-TO-DESTINATION (GD) TRIPS AFTER APPLICATION OF CALIBRATION FACTORS AND PARKING REROUTING MOTOR VEHICLES

BATS MODEL OUTPUT 76/ 9/26 WILLIAMS AFB 11-1900 CALIBRATE

G.1. ASSIGNMENT COUNS AND ASSOCIATED COMPUTER RUN TIMES

ZONE	ASSGN. VEH. ORG. TO GATES	ASSGN.VEH. GATES TO DEST.	ASSGN. VEH. INTERNAL O-D	ASSIGNMENT TIME	TOTAL TIME	NO. PATHS FOLLOWED
1	2.633	2.366	26.227	2.857	24.696	21
2	2.509	1.866	22.002	.548	25.148	21
3	6.350	6.926	61.674	.639	25.785	30
4	1.196	.864	10.503	.482	26.247	17
5	8.106	7.487	56.621	.791	27.038	36
6	3.548	3.946	44.639	.690	27.728	32
7	.263	.368	4.146	.532	28.260	17
8	.237	.316	2.950	.731	28.991	19
10	0.000	.204	2.671	.414	29.405	18
12	4.201	8.084	13.364	.759	30.164	26
13	.126	1.018	2.593	.378	30.543	22
14	5.779	11.036	20.430	.487	31.030	31
15	2.014	1.769	36.853	.487	31.517	36
16	.818	.340	6.338	.395	31.912	27
17	1.814	1.068	26.360	.448	32.359	34
18	19.781	40.658	48.795	.581	32.939	43
19	3.449	9.935	24.842	.469	33.408	35
20	8.191	7.304	44.881	.565	33.973	43
21	42.165	26.898	169.067	.610	34.583	56
22	25.451	19.819	116.129	.484	35.067	49
23	4.796	7.195	17.551	.419	35.486	30
24	9.663	9.085	49.361	.686	36.172	50
25	2.782	2.473	35.922	.518	36.690	49
26	36.330	11.464	149.024	.788	37.478	62
27	13.261	26.545	49.076	.901	37.379	52
28	1.186	.380	3.686	.369	38.348	37
29	54.206	42.686	233.063	.612	38.960	62
30	1.068	.887	14.754	.501	39.461	45
31	9.471	15.304	24.270	.575	40.036	49
32	.942	.127	.960	.395	40.431	36
33	9.236	8.502	10.267	.424	40.855	46
34	5.601	4.426	26.083	.478	41.334	52
35	16.692	16.921	56.600	.765	42.099	66
36	1.900	1.978	27.403	.545	42.644	56
37	9.352	7.331	42.331	.646	43.290	58
38	2.641	2.075	10.509	.506	43.796	52
39	.892	.909	5.720	.406	44.201	46
40	2.427	0.000	6.336	.424	44.625	61
41	3.661	3.043	16.739	.487	45.112	57
42	1.712	1.843	13.562	.466	45.577	56
43	66.652	49.974	252.132	.700	46.277	60
44	.372	.427	3.916	.425	46.702	63

FIGURE 80. REPORT G.1: ASSIGNMENT COUNTS AND ASSOCIATED COMPUTER RUN TIMES

BATS MODEL OUTPUT 78/ 8/29 WILLIAMS AFB 11-1300 CALIBRATE PERIOD FROM 1100. TO1200. HOURS

G.2 VEHICLE COUNT, TYPE, AND HOT/COLD STATUS

LINK	SUM	THRU	RT	LEFT	TERM	LDV	LDT1	LDT2	HDT	HDD	MDT	LDVM	LDT1M	LDT2M	HDTM	HDDM	MDTM	COLDS	HOTS
1	81.35	67.10	0.00	13.10	1.15	47.70	6.21	1.27	.09	.15	3.02	3.23	11.53	.31	1.61	3.20	0.00	16.26	63.95
2	8.46	0.00	0.00	0.00	8.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	41.85	38.22	2.43	0.00	0.00	34.78	3.50	.28	0.00	0.00	1.78	.24	.87	.09	.02	.04	0.00	0.71	31.94
4	39.85	0.00	0.00	0.00	39.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	98.09	78.07	11.78	7.24	0.00	72.04	11.83	2.07	.18	.28	3.88	1.00	4.89	.09	.63	1.12	0.00	22.82	76.28
6	36.80	0.00	0.00	0.00	36.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	76.06	19.66	0.00	0.00	56.51	12.82	.67	0.00	0.00	0.00	.42	.06	5.10	.01	.03	.59	0.00	3.63	16.04
8	21.23	8.21	4.06	0.00	8.96	8.30	1.42	.08	.00	0.00	.53	.85	2.66	.07	.42	.85	0.00	2.36	5.69
9	25.86	19.37	0.00	3.82	2.67	8.87	1.06	.02	0.00	0.00	.47	.06	13.34	.76	.04	.85	0.00	3.41	19.96
10	29.36	21.69	4.39	2.42	.66	8.80	2.02	.25	.02	.02	.71	3.34	7.36	.22	1.77	3.86	0.00	6.76	22.71
11	52.42	18.01	0.00	15.45	18.96	16.04	1.83	.11	0.00	0.00	.88	.78	12.72	1.06	.04	.84	0.00	9.87	27.88
12	36.10	22.91	0.00	8.26	6.83	10.76	2.48	.06	.02	0.00	.82	3.16	6.16	.16	1.72	3.79	0.00	6.02	23.16
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	1.03	1.03	0.00	0.00	0.00	.82	.11	.06	0.00	0.00	.16	.02	.09	.00	.01	.02	0.00	.22	.81
15	34.73	29.93	0.00	0.00	7.80	24.83	.10	0.00	0.00	0.00	.02	.37	1.15	.06	.11	.20	0.00	8.66	21.27
16	25.13	21.83	2.23	.87	0.00	18.81	4.35	.27	.07	0.00	1.86	.81	.93	.01	.25	.56	0.00	4.88	19.39
17	48.82	30.04	0.00	18.78	0.00	38.18	2.83	.27	0.00	0.00	.94	1.10	3.06	.12	.27	.50	0.00	8.98	37.18
18	29.83	8.41	0.00	21.11	0.00	18.46	5.04	.27	.06	0.00	1.43	.86	1.88	0.00	.45	1.01	0.00	6.73	22.04
19	13.83	42.13	0.00	.12	1.38	7.82	.66	.06	0.00	0.00	.21	.87	2.21	.06	.22	.40	0.00	1.84	10.41
20	8.86	8.41	0.00	0.00	1.23	2.80	1.33	.14	.06	0.00	.28	.88	1.43	0.00	.45	1.00	0.00	1.26	5.40
21	108.86	90.22	0.00	0.00	18.63	7.26	4.41	.91	.88	0.00	0.00	18.87	28.63	0.00	8.29	20.90	0.00	12.10	98.84
22	286.82	79.36	16.89	30.27	0.00	28.87	6.87	.84	.14	.06	1.36	10.82	61.42	2.14	6.37	10.33	0.00	18.38	114.13
23	6.86	0.00	4.82	0.00	.03	1.86	.66	.03	0.00	0.00	.23	.12	6.19	.43	.06	.12	0.00	1.07	7.78
24	2.80	2.80	0.00	0.00	0.00	.13	.18	0.00	.02	0.00	.06	.16	1.91	0.00	.18	.30	0.00	.88	2.91
25	11.68	6.82	0.00	1.40	1.37	3.20	.84	.03	0.00	0.00	.23	.12	6.19	.43	.06	.12	0.00	1.31	8.81
26	6.30	0.00	4.17	0.00	2.13	1.18	.37	0.00	.03	0.00	.08	.16	1.91	0.00	.18	.30	0.00	.80	3.37
27	36.66	34.66	0.00	0.00	0.00	27.34	3.86	.83	.06	.07	1.27	.81	4.04	.06	.82	.48	0.00	8.20	30.38
28	28.00	0.00	0.00	0.00	28.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	1.77	0.00	0.00	1.77	0.00	1.16	.22	0.00	0.00	0.00	.38	0.00	.29	0.00	0.00	.03	0.00	.29	1.48
30	3.86	0.00	0.00	0.00	3.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31	12.82	12.82	0.00	0.00	0.00	11.81	.38	0.00	0.00	0.00	.63	.08	.23	.01	.03	.06	0.00	2.70	10.22
32	10.16	10.16	0.00	0.00	0.00	7.09	2.18	.08	0.00	0.00	.74	0.00	.13	.01	0.00	0.00	0.00	2.16	8.00
33	28.86	28.86	0.00	0.00	0.00	24.42	0.00	0.00	0.00	0.00	0.00	.20	.86	.06	.11	.20	0.00	5.60	20.38
34	22.80	0.00	22.80	0.00	0.00	18.21	4.06	.14	.07	0.00	1.21	.81	.80	.01	.28	.56	0.00	4.80	18.84
35	3.36	0.00	2.27	.06	1.03	2.32	.01	0.00	0.00	0.00	.00	.00	.00	0.00	0.00	0.00	0.00	.83	1.61
36	62.62	0.00	0.00	0.00	62.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
37	104.87	82.42	12.46	0.00	0.00	72.61	12.88	1.88	.06	.17	3.87	1.88	9.80	.38	.47	.88	0.00	20.80	83.86
38	62.80	62.80	0.00	0.00	0.00	29.16	9.83	.49	.02	0.00	3.16	.83	8.41	.70	.21	.47	0.00	8.81	35.88
39	27.08	26.17	1.90	0.00	0.00	20.56	3.07	.27	0.00	.02	1.48	.35	1.08	.10	.06	.09	0.00	5.84	21.09
40	36.41	35.26	2.16	.08	0.00	26.08	6.13	.30	0.00	0.00	1.84	.08	.79	.03	.02	.04	0.00	5.81	22.03
41	182.68	134.27	66.24	0.00	20.12	86.41	18.18	3.43	.26	.44	6.84	6.42	29.88	.41	2.86	6.17	0.00	31.14	141.87
42	172.77	142.24	0.00	10.18	20.33	68.84	16.88	.78	.37	0.00	4.27	18.81	34.42	.44	7.06	16.16	0.00	21.78	101.01
43	42.86	0.00	42.56	0.00	.38	42.07	0.00	0.00	0.00	0.00	0.00	.07	.33	.02	.04	.07	0.00	8.83	33.75
44	66.89	46.67	0.00	7.62	12.61	23.76	4.83	.27	.06	.02	1.77	1.87	20.62	.31	1.02	2.03	0.00	8.18	48.03
45	7.62	0.00	0.00	7.62	0.00	5.66	.78	0.00	0.00	0.00	.78	.06	.86	.01	.03	.06	0.00	1.66	5.84
46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
47	102.84	0.00	0.00	102.84	0.00	7.84	4.82	.98	.86	0.00	0.00	21.84	32.76	0.00	10.82	23.80	0.00	13.46	70.78
48	105.21	100.36	0.00	0.00	2.65	11.86	3.25	.82	.10	.01	.66	10.10	67.82	2.02	5.16	9.82	0.00	6.66	83.36
49	101.80	0.00	101.80	0.00	0.00	10.84	8.00	.82	.06	.01	.46	10.18	69.76	2.02	5.16	9.86	0.00	6.66	84.82

FIGURE 81. REPORT G.2: VEHICLE COUNT, TYPE, AND HOT/COLD STATUS

next link (RT), the number of vehicles turning left onto the next link (LEFT), and the number of vehicles terminating their trip on this link (TERM).

The next 12 columns show the number of each type of civilian and military vehicle on each link. Motor vehicle categories were defined in Section III; military vehicle types correspond to civilian vehicle types but are distinguished on this report by having the suffix M added.

The final two columns show the number of cold start (COLDS) and hot start (HOTS) vehicles on each link. The hot start vehicles are defined as having been driven for more than 505 seconds.

Report H.1: Link Counts

This report presents the vehicle count predicted going straight (THRU), right (RT), left (LT), and terminating (TERM) on each link of the network.

Report H.2: Intersection Delays and Queueing (Figure 82)

This report prints out delay time and queue length for each signalized and unsignalized intersection in the simulated network. An unsignalized intersection is reported with one line of output. The delay and queue length for each approach to the intersection are printed under the column headings identifying each approach. A signalized intersection requires ten printed lines on the report, showing the green phase length, the ratio of volume to capacity per hour of green for each approach, delay, queue length, volume demand, and approach capacity.

The report can be used to identify problem locations in the network. When a congested situation is predicted, then the simulation can be used to assess the effects of network changes, new controls, or other proposed improvements. The inputs should be checked to ensure accuracy. The actual intersection should be observed to verify that a problem exists in reality. When a problem does exist but is not being simulated, the data inputs to the model will need to be modified. The capacity of each approach to an intersection is one of the first parameters that should be checked for accuracy. This value is usually generated by default, but can be input as a parameter of any intersection on Card Type 3.

Report H.3: Parking Lot Travel Times and Delays (Figure 83)

This report indicates the running times in seconds generated by all vehicles parking in each zone during a specified time period. TOTAL TIME is the number of seconds all vehicles spend running in the zone. TT ARRV is the time spent by an average arriving vehicle finding a place to park. TT DEPT is the time spent by an average departing vehicle. BACKING Q is the time spent by an average arriving vehicle waiting for another vehicle to back out of a stall. Q DELAY is the time spent waiting for a stall to become available when the lot is full. DEPARTS is the number of departing vehicles during the time period, and ARRIVALS is the number of arriving vehicles during the time period. LENGTH is average distance in meters traveled on entering the parking zone.

H.2. INTERSECTION DELAYS AND QUEUEING

		N-APPR DELAY (SEC)	N-APPR QUEUE (VEH)	E-APPR DELAY (SEC)	E-APPR QUEUE (VEH)	S-APPR DELAY (SEC)	S-APPR QUEUE (VEH)	W-APPR DELAY (SEC)	W-APPR QUEUE (VEH)
INTERSECTION	1	4.	0.	1.	0.	4.	0.	1.	0.
INTERSECTION	2	4.	0.	1.	0.	4.	0.	1.	0.
INTERSECTION	3	4.	0.	1.	0.	4.	0.	1.	0.
INTERSECTION	4	0.	0.	0.	0.	0.	0.	0.	0.
INTERSECTION	5	0.	0.	0.	0.	0.	0.	1.	0.
INTERSECTION	6	0.	0.	0.	0.	0.	0.	0.	0.
INTERSECTION	7	0.	0.	0.	0.	0.	0.	0.	0.
INTERSECTION	8	4.	0.	1.	0.	4.	0.	1.	0.
INTERSECTION	9	5.	0.	2.	0.	5.	0.	2.	0.
INTERSECTION	10	0.	0.	0.	0.	0.	0.	1.	0.
INTERSECTION	11	2.	0.	5.	0.	2.	0.	5.	0.
INTERSECTION	12	0.	0.	0.	0.	0.	0.	0.	0.
INTERSECTION	13	4.	0.	0.	0.	4.	0.	0.	0.
INTERSECTION	14	1.	0.	0.	0.	0.	0.	0.	0.
INTERSECTION	15	0.	0.	0.	0.	0.	0.	0.	0.
INTERSECTION	16	0.	0.	1.	0.	0.	0.	1.	0.
INTERSECTION	17	4.	0.	0.	0.	4.	0.	0.	0.
INTERSECTION	18	0.	0.	1.	0.	0.	0.	0.	0.
INTERSECTION	19	0.	0.	0.	0.	0.	0.	0.	0.
INTERSECTION	20	5.	0.	2.	0.	5.	0.	2.	0.
INTERSECTION	21	5.	0.	3.	0.	5.	0.	3.	0.
INTERSECTION	22	0.	0.	4.	0.	0.	0.	4.	0.
INTERSECTION	23	0.	0.	0.	0.	0.	0.	0.	0.
INTERSECTION	24	0.	0.	1.	0.	0.	0.	0.	0.
INTERSECTION	25	0.	0.	0.	0.	0.	0.	0.	0.
INTERSECTION	26	0.	0.	0.	0.	0.	0.	0.	0.
INTERSECTION	27	0.	0.	0.	0.	1.	0.	0.	0.
INTERSECTION	28	0.	0.	1.	0.	0.	0.	1.	0.
INTERSECTION	29	0.	0.	0.	0.	1.	0.	0.	0.
INTERSECTION	30	0.	0.	0.	0.	0.	0.	0.	0.
INTERSECTION	31	1.	0.	4.	0.	1.	0.	4.	0.
INTERSECTION	32	0.	0.	0.	0.	0.	0.	0.	0.
INTERSECTION	33	0.	0.	0.	0.	1.	0.	0.	0.
INTERSECTION	34	5.	0.	3.	0.	5.	0.	3.	0.
INTERSECTION	35	0.	0.	0.	0.	0.	0.	0.	0.
INTERSECTION	36	1.	0.	0.	0.	1.	0.	0.	0.
INTERSECTION	37	0.	0.	0.	0.	1.	0.	0.	0.
INTERSECTION	38	0.	0.	0.	0.	0.	0.	1.	0.
INTERSECTION	39	1.	0.	0.	0.	0.	0.	0.	0.
INTERSECTION	40	0.	0.	1.	0.	1.	0.	1.	0.
INTERSECTION	41	1.	0.	0.	0.	0.	0.	0.	0.
INTERSECTION	42	1.	0.	0.	0.	0.	0.	0.	0.
INTERSECTION	43	0.	0.	1.	0.	1.	0.	1.	0.
INTERSECTION	44	0.	0.	0.	0.	1.	0.	0.	0.
INTERSECTION	45	5.	0.	2.	0.	5.	0.	2.	0.
INTERSECTION	46	1.	0.	0.	0.	0.	0.	0.	0.
INTERSECTION	47	0.	0.	4.	0.	0.	0.	4.	0.
INTERSECTION	48	1.	0.	4.	0.	1.	0.	4.	0.
INTERSECTION	49	0.	0.	1.	0.	0.	0.	0.	0.
INTERSECTION	50	0.	0.	0.	0.	0.	0.	0.	0.
INTERSECTION	51	1.	0.	0.	0.	0.	0.	0.	0.
INTERSECTION	52	1.	0.	0.	0.	0.	0.	0.	0.
INTERSECTION	53	0.	0.	0.	0.	1.	0.	0.	0.
INTERSECTION	54	6.	1.	4.	1.	6.	1.	4.	1.
INTERSECTION	55	2.	0.	5.	0.	2.	0.	5.	0.
INTERSECTION	56	0.	0.	0.	0.	0.	0.	0.	0.
INTERSECTION	57	1.	0.	4.	0.	1.	0.	4.	0.
INTERSECTION	58	0.	0.	0.	0.	0.	0.	0.	0.
INTERSECTION	59	1.	0.	0.	0.	1.	0.	0.	0.
INTERSECTION	60	0.	0.	0.	0.	0.	0.	0.	0.

INTERSECTION 61

	PHASE 1	PHASE 2	PHASE 3	PHASE 4
TIME(SEC)	13.	19.	-0.	-0.
V/QCAP	.05569	.14661	0.00000	0.00000

	NORTH-APPR	SOUTH-APPR	EAST-APPR	WEST-APPR	N-APP-LEFT	S-APP-LEFT	E-APP-LEFT	W-APP-LEFT
DELAY(SEC)	6.	0.	4.	0.	0.	0.	4.	0.
QUEUE(VEH)	0.	0.	0.	0.	0.	0.	0.	0.
VOLUME(VEH)	180.	0.	971.	808.	0.	0.	0.	0.
CAPACITY(VEH)	1940.	867.	1378.	1503.	0.	0.	0.	0.
V/QCAP	.05569	0.00000	.14661	.07449	0.00000	0.00000	0.00000	0.00000

		N-APPR DELAY (SEC)	N-APPR QUEUE (VEH)	E-APPR DELAY (SEC)	E-APPR QUEUE (VEH)	S-APPR DELAY (SEC)	S-APPR QUEUE (VEH)	W-APPR DELAY (SEC)	W-APPR QUEUE (VEH)
INTERSECTION	62	0.	0.	0.	0.	0.	0.	0.	0.

FIGURE 82. REPORT H.2: INTERSECTION DELAYS AND QUEUEING

GATB MODEL OUTPUT 76/ 9/28 WILLIAMS AFB 11-1300 CALIBRATE PERIOD FROM 1100. TO 1200. HOURS

H.3. PARKING LOT TRAVEL TIMES AND DELAYS

	ZONE	TOTAL TIME (SEC)	TT ARRV (SEC)	TT DEPT (SEC)	BACKING Q (SEC)	Q DELAY (SEC)	DEPARTS (VEH)	ARRIVALS (VEH)	LENGTH (METERS)
PARKING	1	2619.997	36.943	47.943	0.000	0.000	80.415	92.324	227.228
PARKING	2	1648.426	28.961	37.961	0.000	0.000	28.410	29.341	166.402
PARKING	3	7903.210	39.068	51.068	0.000	0.000	84.444	91.814	249.941
PARKING	4	833.533	27.941	39.941	0.000	0.000	12.091	12.849	176.862
PARKING	5	8639.667	41.443	53.443	0.000	0.000	88.610	94.199	264.120
PARKING	6	4362.930	45.895	57.895	0.000	0.000	40.693	43.865	282.164
PARKING	7	374.388	40.460	52.460	0.000	0.000	3.698	4.476	267.818
PARKING	8	31.848	19.041	31.041	0.000	0.000	.629	.852	121.907
PARKING	9	289.206	37.712	49.712	0.000	0.000	2.992	8.724	240.526
PARKING	10	386.183	36.420	48.420	0.000	0.000	4.178	8.062	231.070
PARKING	11	0.000	36.406	48.406	0.000	0.000	0.000	0.000	233.001
PARKING	12	3660.026	57.410	69.410	0.000	0.000	16.578	47.542	241.943
PARKING	13	665.604	40.841	52.841	0.000	0.000	7.069	7.196	260.017
PARKING	14	4465.565	45.900	57.900	0.000	0.000	26.316	64.093	244.219
PARKING	15	2822.261	36.191	48.191	0.000	0.000	33.602	32.973	231.621
PARKING	16	668.127	35.182	47.182	0.000	0.000	8.288	7.672	226.229
PARKING	17	1377.836	21.374	33.374	0.000	0.000	26.359	24.887	138.793
PARKING	18	18747.497	61.830	73.830	0.000	0.000	99.418	233.204	266.429
PARKING	19	1736.898	36.187	60.187	0.000	0.000	16.583	19.724	243.554
PARKING	20	7021.257	79.924	91.924	0.000	0.000	40.438	41.343	511.068
PARKING	21	17477.606	41.065	53.065	0.000	0.000	177.448	186.308	247.629
PARKING	22	6440.227	39.177	51.177	0.000	0.000	108.611	73.680	260.733
PARKING	23	1815.221	25.210	37.210	0.000	0.000	21.132	40.613	140.931
PARKING	24	14855.603	143.439	155.439	0.000	0.000	47.198	52.422	904.179
PARKING	25	3190.322	21.792	33.792	0.000	0.000	57.962	56.078	139.466
PARKING	26	15084.003	62.974	84.974	0.000	0.000	178.411	88.718	335.196
PARKING	27	15209.780	61.062	73.062	0.000	0.000	66.276	170.980	249.976
PARKING	28	385.696	36.725	48.725	0.000	0.000	8.032	2.499	235.036
PARKING	29	25348.611	55.765	67.765	0.000	0.000	236.859	164.304	366.896
PARKING	30	1376.463	35.364	47.364	0.000	0.000	16.373	18.948	223.942
PARKING	31	9967.590	47.008	59.008	0.000	0.000	30.316	66.678	247.755
PARKING	32	333.978	78.691	90.691	0.000	0.000	2.984	833	502.985
PARKING	33	8821.870	135.568	147.568	0.000	0.000	14.608	48.954	534.345
PARKING	34	3987.604	85.947	97.947	0.000	0.000	26.643	17.173	550.064
PARKING	35	14507.351	72.163	84.163	0.000	0.000	93.196	92.291	481.971
PARKING	36	1879.901	37.817	49.817	0.000	0.000	22.099	20.586	242.029
PARKING	37	8162.606	80.678	92.678	0.000	0.000	41.612	28.409	517.622
PARKING	38	1598.085	76.488	88.488	0.000	0.000	11.186	7.860	489.523
PARKING	39	1026.298	75.524	87.524	0.000	0.000	9.948	6.896	480.532
PARKING	40	1271.647	100.719	112.719	0.000	0.000	11.282	0.000	644.603
PARKING	41	3048.024	102.592	114.592	0.000	0.000	16.970	11.672	656.588
PARKING	42	791.267	22.173	34.173	0.000	0.000	18.995	14.119	141.767
PARKING	43	40996.466	55.939	67.939	0.000	0.000	340.962	316.236	368.010
PARKING	44	2228.401	300.680	312.680	0.000	0.000	9.611	3.867	1923.345

FIGURE 83. REPORT H.3: PARKING LOT TRAVEL TIMES AND DELAYS

By looking at the queueing numbers under BACKING Q and Q DELAY, the user may identify those zones where parking lots are filled, causing delays that result in most low-speed emissions. The report may also be used to evaluate the effects of new or larger parking areas on total running time.

Report H.4: Link-to-Link Travel Times (Figure 84)

This report indicates how long it takes to drive from the upstream end of a link (from which traffic flows) to the downstream end (the traffic destination) and to move through the intersection. The report is useful in determining the travel time over any sequence of links, and therefore the preferred routes between zones. It also provides a rough estimate of carbon monoxide and hydrocarbon emissions on each link because running time is directly proportional to the emission rate of the pollutants.

Report I.1: Network Summary Parameters for Time Period (Figure 85)

By summarizing the results of each iteration of the BATS model, this report provides a means of comparing descriptive and predictive runs for similar time periods. TOTAL TRAVEL TIME ON NETWORK summarizes vehicles times travel time for every link of the network. A decrease in this parameter from the descriptive to the predictive run indicates an improved network; an increase indicates a more heavily used or a less efficient network.

TOTAL RUNNING TIME IN PARKING ZONES indicates the contribution of parking lots to the overall traffic running time.

TOTAL VEHICLE MILES TRAVELED ON NETWORK summarizes vehicles times link length for every network link during a particular time period. This value is useful in determining why TOTAL TRAVEL TIME ON NETWORK changes between two runs. If this parameter increases, then the TOTAL TRAVEL TIME should increase. If this parameter remains constant from run to run, then a decrease in TOTAL TRAVEL TIME shows a definite improvement to the traffic flow on the network. (If TOTAL TRAVEL TIME and TOTAL VEHICLE MILES TRAVELED ON THE NETWORK both remain constant, there has been no change in the traffic flow.) If this parameter decreases from run to run, then a decrease in TOTAL TRAVEL TIME would also be expected.

TOTAL INTERSECTION DELAY ON NETWORK summarizes vehicles times delay at all intersections. Usually intersection delay is the reason for increased TRAVEL TIME so a decrease in this parameter indicates improvement in the network operation.

TOTAL STOPS AT INTERSECTIONS summarizes the vehicles times percent stops for all approaches to all intersections. This parameter describes the degree of stopping and starting on the network, which indicates smoothness of flow. This parameter also shows how the effects of replacing 4-way stops with signalized intersections or military policemen during peak periods would change the network flow.

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H.4. LINK TO LINK TRAVEL TIMES(SECONDS)

LINK	TRAVEL TIMES			LINK	TRAVEL TIMES			LINK	TRAVEL TIMES			LINK	TRAVEL TIMES			LINK	TRAVEL TIMES			LINK	TRAVEL TIMES		
1	13.	13.	13.	2	12.	12.	12.	3	13.	13.	13.	4	12.	12.	12.	5	14.	14.	14.	6	12.	12.	12.
7	22.	22.	22.	8	26.	26.	26.	9	14.	14.	14.	10	14.	14.	14.	11	24.	24.	24.	12	24.	24.	24.
13	10.	10.	10.	14	10.	10.	10.	15	10.	10.	10.	16	10.	10.	10.	17	10.	10.	10.	18	14.	14.	14.
19	24.	24.	24.	20	26.	26.	26.	21	12.	12.	12.	22	14.	14.	14.	23	10.	10.	10.	24	14.	14.	14.
25	24.	24.	24.	26	21.	21.	21.	27	12.	12.	12.	28	12.	12.	12.	29	23.	23.	23.	30	23.	23.	23.
31	22.	22.	22.	32	21.	21.	21.	33	21.	21.	21.	34	22.	22.	22.	35	22.	22.	22.	36	21.	21.	21.
37	12.	12.	12.	38	12.	12.	12.	39	22.	22.	22.	40	20.	20.	20.	41	22.	22.	22.	42	20.	20.	20.
43	21.	21.	21.	44	22.	22.	22.	45	18.	18.	18.	46	17.	17.	17.	47	18.	18.	18.	48	19.	19.	19.
49	36.	36.	36.	50	37.	37.	37.	51	4.	4.	4.	52	8.	8.	8.	53	10.	10.	10.	54	14.	14.	14.
55	7.	7.	7.	56	6.	6.	6.	57	11.	11.	11.	58	16.	16.	16.	59	26.	26.	26.	60	25.	25.	25.
61	20.	20.	20.	62	20.	20.	20.	63	21.	21.	21.	64	21.	21.	21.	65	21.	21.	21.	66	25.	25.	25.
67	19.	19.	19.	68	19.	19.	19.	69	35.	35.	35.	70	34.	34.	34.	71	10.	10.	10.	72	10.	10.	10.
73	11.	11.	11.	74	11.	11.	11.	75	30.	30.	30.	76	30.	30.	30.	77	21.	21.	21.	78	21.	21.	21.
79	7.	7.	7.	80	7.	7.	7.	81	10.	10.	10.	82	10.	10.	10.	83	7.	7.	7.	84	7.	7.	7.
85	24.	24.	24.	86	24.	24.	24.	87	9.	9.	9.	88	9.	9.	9.	89	9.	9.	9.	90	9.	9.	9.
91	9.	9.	9.	92	9.	9.	9.	93	26.	26.	26.	94	26.	26.	26.	95	46.	46.	46.	96	46.	46.	46.
97	44.	44.	44.	98	43.	43.	43.	99	43.	43.	43.	100	43.	43.	43.	101	6.	6.	6.	102	6.	6.	6.
103	9.	9.	9.	104	6.	6.	6.	105	12.	12.	12.	106	12.	12.	12.	107	21.	21.	21.	108	21.	21.	21.
109	9.	9.	9.	110	4.	4.	4.	111	11.	11.	11.	112	16.	16.	16.	113	26.	26.	26.	114	21.	21.	21.
115	11.	11.	11.	116	11.	11.	11.	117	106.	106.	106.	118	106.	106.	106.	119	22.	22.	22.	120	21.	21.	21.
121	11.	11.	11.	122	11.	11.	11.	123	21.	21.	21.	124	24.	24.	24.	125	11.	11.	11.	126	11.	11.	11.
127	15.	15.	15.	128	15.	15.	15.	129	11.	11.	11.	130	16.	16.	16.	131	10.	10.	10.	132	17.	17.	17.
133	9.	9.	9.	134	10.	10.	10.	135	10.	10.	10.	136	11.	11.	11.	137	11.	11.	11.	138	10.	10.	10.
139	48.	48.	48.	140	49.	49.	49.	141	27.	27.	27.	142	31.	31.	31.	143	15.	15.	15.	144	15.	15.	15.
145	7.	7.	7.	146	9.	9.	9.	147	10.	10.	10.	148	10.	10.	10.	149	17.	17.	17.	150	17.	17.	17
151	21.	21.	21.	152	21.	21.	21.	153	29.	29.	29.	154	33.	33.	33.	155	8.	8.	8.	156	12.	12.	12.
157	57.	57.	57.	158	57.	57.	57.	159	15.	15.	15.	160	10.	10.	10.	161	41.	41.	41.	162	41.	41.	41.
163	212.	212.	212.	164	212.	212.	212.	165	172.	172.	172.	166	172.	172.	172.	167	20.	20.	20.	168	23.	23.	23.
169	151.	151.	151.	170	143.	143.	143.	171	48.	48.	48.	172	48.	48.	48.	173	15.	15.	15.	174	15.	15.	15.
175	10.	10.	10.	176	10.	10.	10.	177	10.	10.	10.	178	11.	11.	11.	179	14.	14.	14.	180	11.	11.	11.
181	11.	11.	11.	182	12.	12.	12.	183	61.	61.	61.	184	63.	63.	63.	185	10.	10.	10.	186	9.	9.	9.
187	7.	7.	7.	188	7.	7.	7.	189	17.	17.	17.	190	15.	15.	15.	191	12.	12.	12.	192	12.	12.	12.
193	22.	22.	22.	194	15.	15.	15.	195	14.	14.	14.	196	10.	10.	10.	197	10.	10.	10.	198	10.	10.	10.
199	17.	17.	17.	200	17.	17.	17.	201	9.	9.	9.	202	11.	11.	11.	203	10.	10.	10.	204	7.	7.	7.
205	11.	11.	11.	206	11.	11.	11.	207	15.	15.	15.	208	10.	10.	10.	209	8.	8.	8.	210	8.	8.	8.
211	9.	9.	9.	212	9.	9.	9.	213	13.	13.	13.	214	9.	9.	9.	215	15.	15.	15.	216	10.	10.	10.
217	12.	12.	12.	218	11.	11.	11.	219	9.	9.	9.	220	12.	12.	12.	221	9.	9.	9.	222	11.	11.	11.
223	2.	2.	2.	224	3.	3.	3.	225	9.	9.	9.	226	12.	12.	12.	227	9.	9.	9.	228	9.	9.	9.
229	12.	12.	12.	230	10.	10.	10.	231	9.	9.	9.	232	9.	9.	9.	233	19.	19.	19.	234	19.	19.	19.
235	17	17	17.	236	17.	17.	17.	237	108.	108.	108.	238	107.	107.	107.	239	60.	60.	60.	240	60.	60.	60.

FIGURE 84. REPORT H.4: LINK-TO-LINK TRAVEL TIMES

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I.1. NETWORK SUMMARY PARAMETERS FOR TIME PERIOD

TOTAL TRAVEL TIME ON NETWORK                    71.(VEH-HRS)
TOTAL RUNNING TIME IN PARKING ZONES             73.(VEH-HRS)
TOTAL VEHICLE MILES TRAVELED ON NETWORK       1603.(VEH-MI)

TOTAL INTERSECTION DELAY ON NETWORK              5.(VEH-HRS)
TOTAL STOPS AT INTERSECTIONS                  4818.(VEH)
TOTAL OF INTERSECTION AVERAGE QUEUE LENGTHS    849.(M)
```

FIGURE 85. REPORT I.1: NETWORK SUMMARY PARAMETERS FOR TIME PERIOD

TOTAL OF INTERSECTION AVERAGE QUEUE LENGTH summarizes the average queued vehicles times 9.0 meters divided by the number of lanes for all approaches to all intersections. It is useful for determining whether a street widening or turn channelization project has improved flow on the network.

For some evaluations, the hourly summaries will have to be summed to determine if a net improvement has occurred. For instance, if some work shift times are being changed from 6:45 am to 7:15 am, then the TOTAL TRAVEL TIME for both 6:30 - 6:45 and 7:00 - 7:15 would need to be evaluated to see if there would be significant improvement on the network.

PLOTTED OUTPUT (PLOT) (Figure 86)

Three types of plots can be requested by the BATS user. The first is the LINK PLOT, which shows the link numbers and the position of each street on the network. The scale factor used to make the plot is shown as "SCALE = 1 IN/400 FT" if 1 inch equals 400 feet (the default scale factor).

The second plot, an hourly volume flow plot, displays relative traffic flow on the links by widening or narrowing the thickness of each link line. The numerical flow values as well as the zone numbers are also printed on the map. When tick marks (or hair lines) are attached to link lines, they indicate the level of traffic congestion.

The third plot is a daily volume flow plot. This plot differs from the hourly plot in that it produces an hourly volume histogram for the day, showing the percent of trips taken during each hour. Because the PLOT routines are pictorial, they are the easiest output to visualize and understand quickly, and one of the most effective methods for presenting BATS results to other interested parties.

AQAM FILE

The AQAM file, which is written on TAPE 7 in coded format, replaces data sets 20, 28-32 in the AQAM deck. The instructions for using the AQAM file are contained in the update to the AQAM manual. The AQAM file can be printed by copying it on an output device such as a printer.

The AQAM file can be written for one hour or for an accumulation of hours. In either case, the AQAM results are expressed in terms of yearly vehicle miles per link or zone and average speed on the link or in the zone. If the AQAM file is generated for a peak hour, it will show a much larger yearly flow than an AQAM file generated for an entire day. The user is cautioned not to attempt to project yearly emissions from an hourly run of the BATS model. A full day's run of BATS will produce more realistic yearly values for input to AQAM.

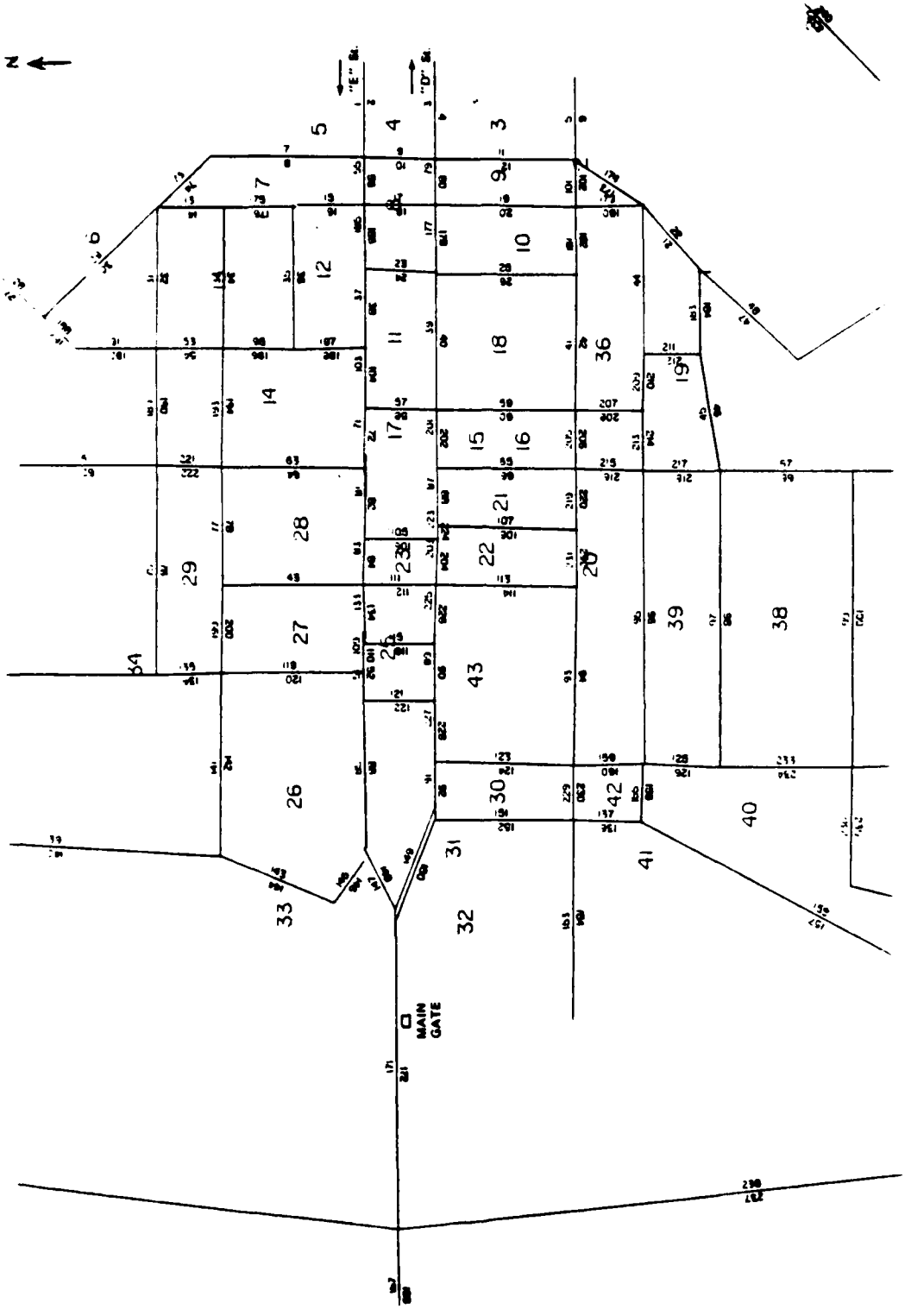

FIGURE 86. PLOTTED OUTPUT (PLOT)

GLOSSARY

Terms used in the BATS manual will be familiar to persons experienced in transportation and traffic management activities. A few terms, however, are peculiar to computer modeling. To avoid confusion with either set of terms, the following glossary is provided:

Assignment

The theoretical allocation of traffic to a proposed or existing highway link.

Capacity

The maximum number of vehicles per hour that can reasonably be expected to pass over a given section of a lane or a roadway in one direction (or in both directions for a two- or three-lane highway) under prevailing roadway and traffic conditions.

Capacity, Design

A term denoting the traffic volumes that result in level of service C, the level typically associated with urban roadways. At level of service C, stable operation continues although an occasional vehicle backup may develop.

Computer Run

One pass through the computer model to simulate a traffic situation.

Delay

The time consumed while traffic (or a specified component of traffic) is impeded in its movement by some element over which it has no control; usually expressed in seconds or minutes per vehicle.

Demographic Variables (DV)

Demographic Variables (DV) are the characteristics that describe a zone. For example, population, number of housing units, number of cars per person, and average number of people in a family are useful DVs for a residential zone. Number of employees, vehicle occupancy, parking lot size, and work hours are useful DVs for industrial or office building zones. Types of shopping, floor space, annual sales, and parking area are DVs for a shopping zone. Participation rates, parking lot size, parking lot gate capacities, and parking lot emptying time are sample DVs for recreation zones.

Flow

The movement of traffic over a roadway.

Gate Counts

The number of vehicles passing through a gate (in either direction) at a specified time of day; usually measured in one-hour or 15-minute increments.

Input Data

The final set of data required to run the BATS model; usually in the form of numbers or letters to be recorded on coded sheets.

Intersection

The point where two to eight links meet, although two or more connected links do not automatically define an intersection. A user must designate an intersection using an intersection number and the connected links. Signals, stop signs, manual controls, or no control at all may be specified for an intersection.

Intersection Approach

Those lanes of an intersection leg that are used by traffic moving towards the intersection, e.g., the northern approach.

Intersection Link

One of the roadways forming part of an intersection.

Land Use

Defines the principal activities in a zone, including housing, industry, office buildings, shopping, recreation, and flight-lines.

Level of Service

A qualitative measure of the effect of a number of factors, which include speed, travel time, traffic interruptions, freedom of maneuver, safety, driving comfort and convenience, and operational costs; usually given a letter grade from A to F, with A being free-flow, E, capacity, and F, forced-flow.

Link

One direction of traffic flow on a street, one block in length. Links combine to make up the roadway network on the base. Each link is assigned a unique identifying number and has end points identified by x and y coordinates. Two hundred and forty exterior and interior links are possible in the model. Speeds, lanes, parking restrictions, and connections to other links are associated with links.

Load Factor

The number of persons traveling in a vehicle expressed as the ratio of persons per vehicle.

Origin and Destination Study

An analysis of the number, purpose, and mode of trips from various zones of origin to various zones of destination.

Parking, Accumulation

The cumulative number of vehicles parked at a facility at any given time.

Parking, Demand

The requirement for parking space as indicated by the number of drivers having a specific site as a destination; stated in terms of spaces.

Parking, Peak-Hour

The highest accumulation of parked vehicles during 60 consecutive minutes.

Parking, Utilization

At a given time, the ratio formed when accumulation of vehicles is divided by supply (number of parking spaces); stated in terms of vehicles per space, or as a percentage. A peak utilization of 0.85 vehicles/space is sometimes used as a design standard.

Planning, Transportation

The process by which transportation improvements of new facilities are systematically conceived, tested for adequacy, and programmed for future construction. The planning process is composed of the following elements: organizing, stating the objectives, obtaining the information, preparing and evaluating land use and transportation plans within the framework of the objectives, selecting the best plan, and working for its adoption and implementation.

Roadway

That portion of a highway improved, designed, or ordinarily used for vehicular travel, exclusive of the berm or shoulder. In the event a highway includes two or more separate roadways, the term "roadway," as used here, refers to any such roadway separately but not to all such roadways collectively.

Sign, Traffic

A device mounted on a fixed or portable support whereby a specific message is conveyed by means of words, or symbols, officially erected for the purpose of regulating, warning, or guiding traffic.

Signal, Controller

The timing mechanism which determines the phase and cycle length of a traffic signal; may be connected to other controllers to form a signal system, in which case the controller also determines the "offset" between signals.

Signal, Cycle

The time period required for one complete sequence of signal indications.

Signal, Phase

The portion of the total time cycle allocated to the right-of-way of a given traffic movement, or to any combination of traffic movements that receive the right-of-way simultaneously. Thus, the cycle length is divided into two or more phases.

Signal, Traffic-Actuated

A type of traffic-control signal in which the intervals are varied in accordance with the demands of traffic as registered by the actuation of detectors. Often qualified with the terms semi-, partially-, totally-, or fully-.

Signal, Traffic-Control

Any device, whether manually, electrically, or mechanically operated, by which traffic is alternately directed to stop and permitted to proceed.

Streets, Primary

All roads or streets on the installation that serve as the main distributing arteries for traffic originating within or without the installation. They provide access to, through, and between the various functional areas of the installation.

Streets, Secondary

All installation roads and streets that supplement the primary highway system by providing access within the various functional areas, as well as travel to and between.

Subroutine

A portion of the model designed to treat one aspect of the simulation, such as the plotting routine that graphically illustrates the base roadway network when given the link coordinates and intersection information.

Thoroughfare Plan

The proposed physical layout of a network of primary streets and highways.

Traffic-Control Devices

All signs, signals, markings, and devices placed or erected for the purpose of regulating, warning, or guiding traffic, by authority of a public body of officials having jurisdiction.

Traffic Engineering

That phase of engineering that deals with the planning and geometric design of streets, highways, and abutting lands, and with traffic operation thereon, as their use is related to the safe, convenient, and economic transportation of persons and goods.

Traffic Lane

A strip of roadway intended to accommodate and delimit the movement of a single line of vehicles.

Traffic, Peak

The maximum traffic flow in a given circumstance, usually stated in vehicles per hour.

Traffic, Peak-Hour

The highest number of vehicles observed to traverse a section of roadway during 60 consecutive minutes.

Traffic, Through

That part of the traffic circulating within a given area, or at a given point in that area, having neither origin nor destination within the area.

Trip, Person

A one-way trip from origin to destination by an individual person. Person Trips = Vehicle Trips x Vehicle Occupancy.

Trip, Vehicle

A one-way trip from origin to destination performed by a vehicle, regardless of the number of passengers.

Vehicle

Any wheeled device for conveying persons or property upon a roadway, excluding devices moved by human power or moving upon fixed tracks.

Vehicle Occupancy

The number of persons traveling in a vehicle expressed as the ratio of persons per vehicle (same as load factor).

Volume

The flow rate of traffic on a given roadway, usually stated in vehicles per hour.

x,y Coordinates

x,y coordinates define the ends and direction of a link in relationship to a predetermined point on the map.

Zone

A zone is an area where trips can logically be grouped, for example, an industrial, a shopping area, an office area, or a housing area. A zone must be accessed by at least one link, and is defined by those links that access it.

Appendix A

MASTER CHECKLIST

(Section II - Tasks)

Task Number	Step Number	Completed	Approved	Name of Task or Step	Items Needed	Typical Performer	Input To	Assigned to		Time Required
								Name	Date	
1				ASSEMBLE RESOURCE DOCUMENTS	oBase maps 2 scaled 1" = 400' (#1 and #2) 1 scaled 1" = 200'	Sergeant supervising	Task 2			1-4 hours
					oTransportation or planning documents for base	Airman	Task 2, Step 4, Task 7			Except BLIS Report which depends upon computer center load.
					oTraffic engineering studies for base		Task 7			
					oParking lot maps					
					oBLIS Building printouts Bldgs. by no. Bldgs. by Cust. Custodian (one per page)		Task 5			
					oBLIS Military Vehicle Utilization Report					
					oTAB A-1		Task 3, Step 3			
					oSource Emissions Inventory (AQAM) inputs					
					oBase phone directory		Task 3,4			
					oBase org. chart					
					oLand use map					
					oReal estate listing		Task 3,4			
					oMylar grid		Task 2, step 3			

MASTER CHECKLIST
(Section II - Tasks)

Task Number	Step Number	Completed	Approved	Name of Task or Step	Items Needed	Typical Performer	Input To	Assigned to		Time Required
								Name	Date	
2				SPECIFY THE NETWORK						
	1			Define Links	oMap #1 (From Task 1) oStraight Edge or ruler	Airman	Task 2 Step 2			1/2 hour
	2			Number Links	oTracing Paper oMap #1	Airman	Task 2, Step 4 Task 3 Cards 2, 3, 4, 7 and 10			1 hour
	3			Identify and record x,y Coordinates	oMap #1 oMylar grid	Sergeant	Card 2			1-1/2-3 days
	4			Define Intersections	oMap #1 oTransportation or planning document or field work oSignalized intersection data collection sheets	Airman with Supervisor	Task 2, Step 5 Card 3			1 day
	5			Number intersections	oMap #1 oNETINT (optional)	Airman or computer operator if NETINT is used.				1/2-1 hour

MASTER CHECKLIST
(Section II - Tasks)

Task Number	Step Number	Completed	Approved	Name of Task or Step	Items Needed	Typical Performer	Input To	Assigned to		Time Required
								Name	Date	
3				DEFINE ZONES						
	1			Determine starting point	oMap #2 (from Task 1) oTraffic engineering studies oReal estate building listing oBase phone directory oTable 1 oLand use map	Supervisor	Task 3 Steps 2, 3,4			1-2 hours
	2			Determine Land Use	oMap #2 oReal estate listing oPhone directory	Airman	Task 3 Steps 3,4 Tasks 4,5,6 Cards 4,5, 6,11			
	3			Define Zones o Off Base	oTAB A-1 or base management summary	Airman with supervisor assistance	Task 3 Step 4			1-1/2 hours
				o On Base	oMap #2					
	4			Number Zones	oMap #2	Airman	Tasks 5,6 Cards 4,5 11			

MASTER CHECKLIST
(Section II - Tasks)

Task Number	Step Number	Completed	Approved	Name of Task or Step	Items Needed	Typical Performer	Input To	Assigned to		Time Required
								Name	Date	
4				MAKE A ZONE DIRECTORY						
	1			List Buildings by Building Number	oCompleted Table 2 (Task 3, Step 2) OR oReal estate listing OR oBase map	Airman	Task 4, Steps 2,3 Tasks 5,6			2-3 hours
	2			Associate buildings with their zones	oMap #2 AND oTable 3 from Step 1 OR oReal estate listing OR oTable 2 from Task 3	Airman	Task 4 Step 3 Tasks 5,6			1 hour
	3			List buildings by zone	oOne of the above AND oTable 4	Airman	Tasks 5,6			1 1-1/2 hrs.

MASTER CHECKLIST
(Section II - Tasks)

Task Number	Step Number	Completed	Approved	Name of Task or Step	Items Needed	Typical Performer	Input To	Assigned to		Time Required
								Name	Date	
5				COMPILE WORK TRIP INFORMATION						
	1			Collect building occupancy data Using BLIS report	oBLIS computer printout oExhibit A	Lieutenant or perhaps a sergeant	Cards 5,11			5-10* wk.dys
				By phone	oBase Org. Chart oTable 5					5-7 wkdys
	2			Record Zone Numbers	oCompleted BLIS report forms OR oCompleted Table 5	Airman	Card 11			1-2 hours
	3			Complete Work Trip Data Collection Forms (Table 6)	oSame as Task 2	Airman	Card 11			

*First 5 days is time from mailing request for information to response; second 5 days are follow-up on non-respondents.

MASTER CHECKLIST
(Section II - Tasks)

Task Number	Step Number	Completed	Approved	Name of Task or Step	Items Needed	Typical Performer	Input To	Assigned to		Time Required
								Name	Date	
6				COMPILE NON-WORK TRIP INFORMATION	Some of this information may be on returned BLIS forms; the rest must be collected by phoning or visiting non-work activities	Sergeant or Lieutenant	Card 5,6			3-4 days

MASTER CHECKLIST
(Section II - Tasks)

Task Number	Step Number	Completed	Approved	Name of Task or Step	Items Needed	Typical Performer	Input To	Assigned to		Time Required
								Name	Date	
7				COLLECT CALIBRATION DATA		Airman				
	a			Collect Gate Counts	oRecent gate counts OR oField work Manual or Mechanical counting		Cards 7,9			
	b			Collect Speed and Delay	oRecent traffic studies OR oField work AND oTable 8	Airmen (2) one to drive, one to take notes				
	c			Collect Time of Day Parking Lot Counts	oRecent counts OR oField work AND oTable 9		Card 4			
	d			Collect Street Counts	oRecent counts OR oField work AND oTable 10		Cards 8,9			
	e			Collect Military Vehicle Data	oBLIS Report of military vehicle utilization oBase phone directory oTable 11	Sergeant	Card 5			

CODING FORMS CHECKLIST
(Section III)

Descriptive [ ] Predictive [ ] [ ] Number of Card Sets in Run (Header Cards)

Set Number	Number	Card Name	Input to Coding Form	Typical Performer	Number of Cards Needed	Assigned to		Compl.	Approv.	Keypached
						Name	Date			
	0	Header	oDescription of run being made	Supervisor	1 per set, min. of 1 per run					
	1	Run description	oNumber and characteristics of all other cards in the set	Supervisor	1 per set, min. of 1 per run					
	2	Link description	oMap #1 (Network Description Map)	Airman	1-240 per run					
	3	Intersection description	oMap #1 AND/OR oNETINT Listing AND oSignalized Intersection Data Collection Forms	Airman	1-70 per run					
	4	Zone description	oMap #2 (Land Use Map) oTables 9 and 10 OR oExisting traffic counts	Airman	1-50 per run					
	5	Demographic variables	oMap #2 Table 9 oTable 9 OR oExisting parking lot maps oTable 7	Sergeant or Lieutenant	1-50 per run					
	6	Trip purpose	oTables 6 and 7	Lieutenant	1-15 per set					
	7	Gate description	oMap #1 oGate counts (Task 7a)	Airman	1-10 per set					
	8	Vehicle counts	oStreet counts oTable 10	Sergeant	None necessary to run model					
	9	Load factors	oGate counts and/or oStreet counts oTask 7a oTable 10		Minimum of 1 per run					
	10	Truck Route	oMap #1	Airman	0-4					

CODING FORMS CHECKLIST (Continued)

Set Number	Number	Card Name	Input to Coding Form	Typical Performer	Number of Cards Needed	Assigned to		Compl.	Approv.	Keypnched
						Name	Date			
	11	Work shift counts	oTable 6	Airman	2-6 cards for each 15-min period					
	12	Plot parameters	oMap #1	Supervisor	0-1 per set					
	13	Calibration factors	oUsually Report F.1 from the descriptive run of the model	Supervisor	0-1 per set					
	14	PLUALU Array	oRecent traffic study	Supervisor	0-7 per set					
	15	Demographic variables	The demographic variables used on Card Type 5	Airman	0-1 per set					
	16	Namelist data	Fortran IV User Manual	AQAM user	0-2 per set					

Appendix B

PROCEDURES IF DATA COLLECTION TASKS ARE CONTRACTED TO AN OUTSIDE AGENCY

Because of its familiarity with and access to the types of data required by BATS, it is assumed that the base Civil Engineering Office will collect and maintain the data base in most cases. However, manpower shortages could necessitate contracting the data collection tasks to an outside agency.

Most information needed for BATS must be collected on the base being studied. Therefore, if this data collection is to be carried out by someone from outside the base, several preparatory steps are suggested to make the task easier and more efficient.

Once the contract has been signed and work is ready to begin, the contractor should send a letter to the Base Commander or Civil Engineering Director clearly stating the following facts:

- The purpose of the visit (i.e., data collection).
- The proposed arrival date and estimated length of visit.
- The types of data or information to be collected.
- The list of personnel, on- and off-base, who will be contacted during the visit.
- A proposed day-by-day schedule of activity during the visit.
- A request for an on-base contact (preferably the environmental engineer from the base Civil Engineering Office or an equivalent person).
- A request for a statement of authorization for release of the data to the study team.

Once the on-base contact has been assigned, he should be requested to provide the reference sources available at the four offices listed in Task 1, Section II.

The contractors should prepare a briefing for presentation to the Base Commander if arranged, and for presentation to the Civil Engineer, unless he is the officer authorizing the study. This briefing should include:

- o The objective of the study
- o An explanation of the BATS model
- o An outline of the data collection effort and time schedule
- o Potential uses of the model
- o Benefits to the base.

At this point, the contractor is ready for the site visit. If the on-base contact has completed Task 1, Section II, the contractor can begin with Task 2.

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