EPA-450/3-74-056-f

JUNE 1974

HACKENSACK MEADOWLANDS AIR POLLUTION STUDY AQUIP SOFTWARE SYSTEM USER'S MANUAL

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

EPA-450/3-74-056-f

HACKENSACK MEADOWLANDS AIR POLLUTION STUDY - AQUIP SOFTWARE SYSTEM USER'S MANUAL

by

Edward C. Reifenstein III, Robert J. Horn III,
and Michael J. Keefe

Environmental Research and Technology, Inc.
429 Marrett Road
Lexington, Massachusetts 02173

Contract No. EHSD 71-39

Prepared for

ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Research Triangle Park, N. C. 27711

June 1974

This report is issued by the Environmental Protection Agency to report technical data of interest to a limited number of readers. Copies are available free of charge to Federal employees, current contractors and grantees, and nonprofit organizations—as supplies permit—from the Air Pollution Technical Information Center, Environmental Protection Agency, Research Triangle Park, North Carolina 27711; or, for a fee, from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161.

This report was furnished to the Environmental Protection Agency by the Environmental Research and Technology, Inc., in fulfillment of Contract No. EHSD 71-39. The contents of this report are reproduced herein as received from the Environmental Research and Technology, Inc. The opinions, findings, and conclusions expressed are those of the author and not necessarily those of the Environmental Protection Agency. Mention of company or product names is not to be considered as an endorsement by the Environmental Protection Agency.

Publication No. EPA-450/3-74-056-f

PREFACE

The Hackensack Meadowlands Air Pollution Study final report consists of a summary report, 5 task reports, and 3 appendices, each bound separately. This report is the fifth of the 5 task reports. Its purpose is to describe the operational characteristics and requirements of the AQUIP software system developed and implemented in the course of this study. The report assumes familiarity with the methodologies described in the first two task reports of the study -- those of emissions projection and air pollution prediction -- and thus concentrates on procedures for using the software components of the system. Supplementary material for this report consists of the FORTRAN IV source listings of the computer programs as implemented. This material is contained in Appendix C of the study.

ACKNOWLEDGEMENTS

The work upon which this report is based was performed pursuant to Contract No. EHSD-71-39 with the Environmental Protection Agency, and Contract No. 1P-290 with the New Jersey Department of Environmental Protection.

The authors wish to thank the Data Processing personnel of the New Jersey Department of Health, and the New Jersey Department of Transportation, for their assistance in the implementation of the AQUIP System. In particular, the efforts of Bruce Jones, Charles Fleischer, and Peter Fahey of the Department of Health and Paul Cranmer and Tom Taylor of the Department of Transportation are greatly appreciated.

TABLE OF CONTENTS

TABLE OF CONTENTS, contd.

TABLE OF CONTENTS, contd.

TABLE OF CONTENTS, contd.

TABLE OF CONTENTS, contd.

TABLE OF CONTENTS, contd.

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS, contd.

LIST OF ILLUSTRATIONS, contd.

LIST OF TABLES

1. INTRODUCTION

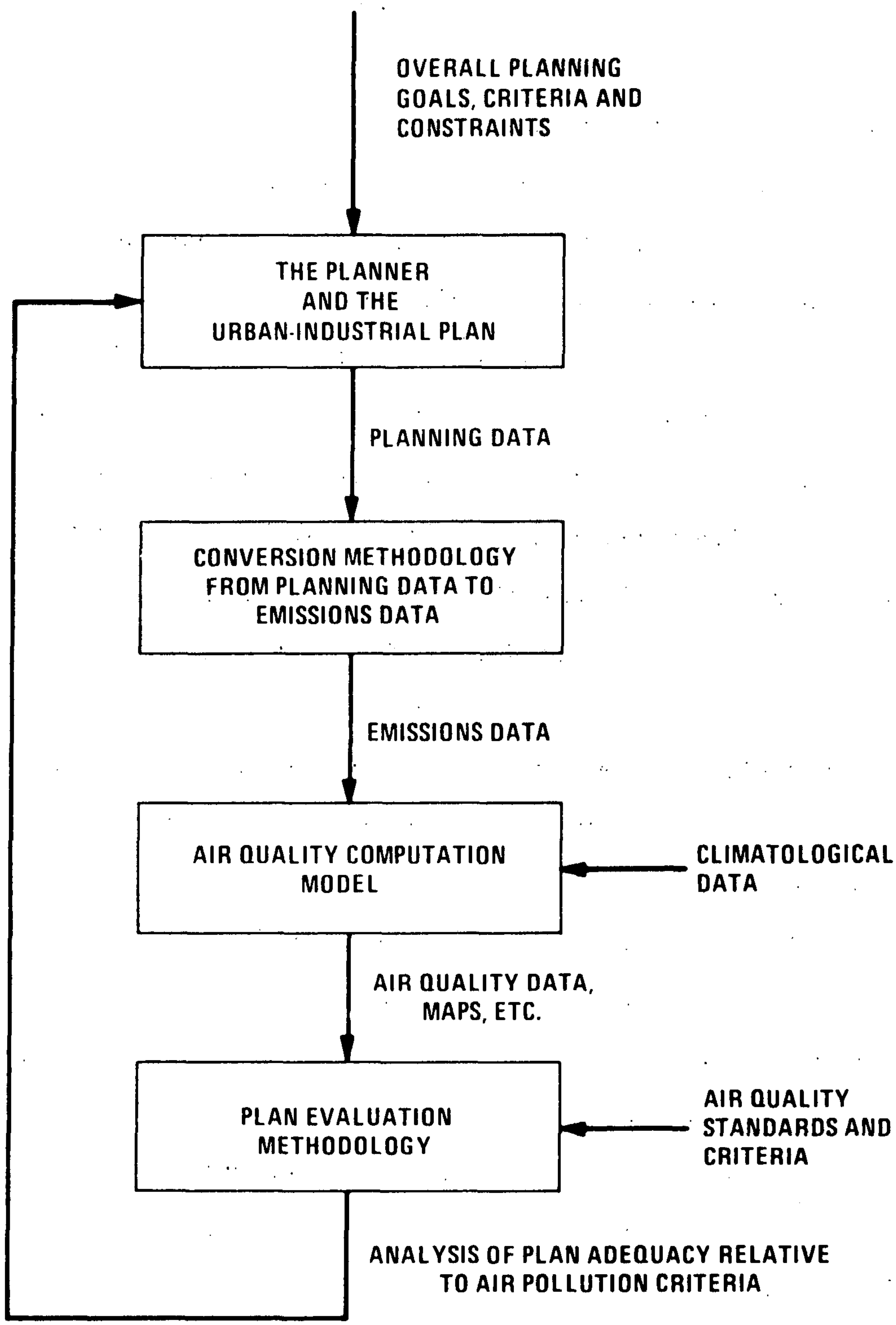
The Air Quality for Urban and Industrial Planning System (AQUIP) has been developed as a set of techniques, methodologies, data sets and software components which permit urban and transportation planners to evaluate land-use plans on the basis of air-pollution considerations.

The interactive and iterative nature of this process of plan evaluation is represented schematically in Figure 1. Essentially, the AQUIP system may be thought of as made up of the following basic procedures: (1) the preparation of input data descriptive of one alternative land-use or transportation plan; (2) the conversion of these data into pollutant emissions data; (3) the prediction and display of predicted mean ambient pollutant concentrations within the area of interest; (4) the evaluation and ranking of the input plan with respect to other plans by the application of quantitatively described criteria; and (5) subsequent modification of the input data and repetition of the process. Of these five procedures all but the first together form a model, in which the techniques and methodologies are quantitatively embodied as software components.

The techniques and methodologies for emissions projection, air-quality prediction, and plan evaluation have been described in additional Task Reports for this study. This report is concerned with the AQUIP software system - its design, use and maintenance as a vital element in this interaction and evaluation process.

1.1 Overview of the AQUIP System

The actual implementation of the AQUIP software system is based upon a set of procedures which makes use of input data sets and model parameter



6414

Figure 1 The AQUIP System Conceptual Design data sets, to perform computations using four basic computer programs, and to provide tabular and graphical output. The logical relationships among these elements are shown in the summary flow chart of Figure 2. Data sets are shown as rectangles, computation steps as circles, and printed output as document symbols. In addition, each element is identified by a code made up of a generic letter followed by a number. The letter prefixes and their meanings are:

- I Input data set, prepared by the system user
- M Model parameter data set, established initially for the study conditions, and modified only as necessary for updates to the model.
- P Computation step involving one of the four basic computer programs
- C Computed data set formed as an output of one computation step and used as an input to another.
- T Tabulated outputs (or line printer graphics) delivered to the system user.

This same basic identification procedure is used throughout this manual to enable each element of the AQUIP system to be identified, described and implemented. The discussions are necessarily organized around the four individual computer programs since they form the nodes of the information flow path, and - through their format requirements and run options - determine the overall modes and capabilities of the system.

In the following discussion several of the important points of interaction between the planner and the model are brought out with some examples of the various roles which sub-components of the model can play in the planning process. A similar discussion appears with each major program in

5149

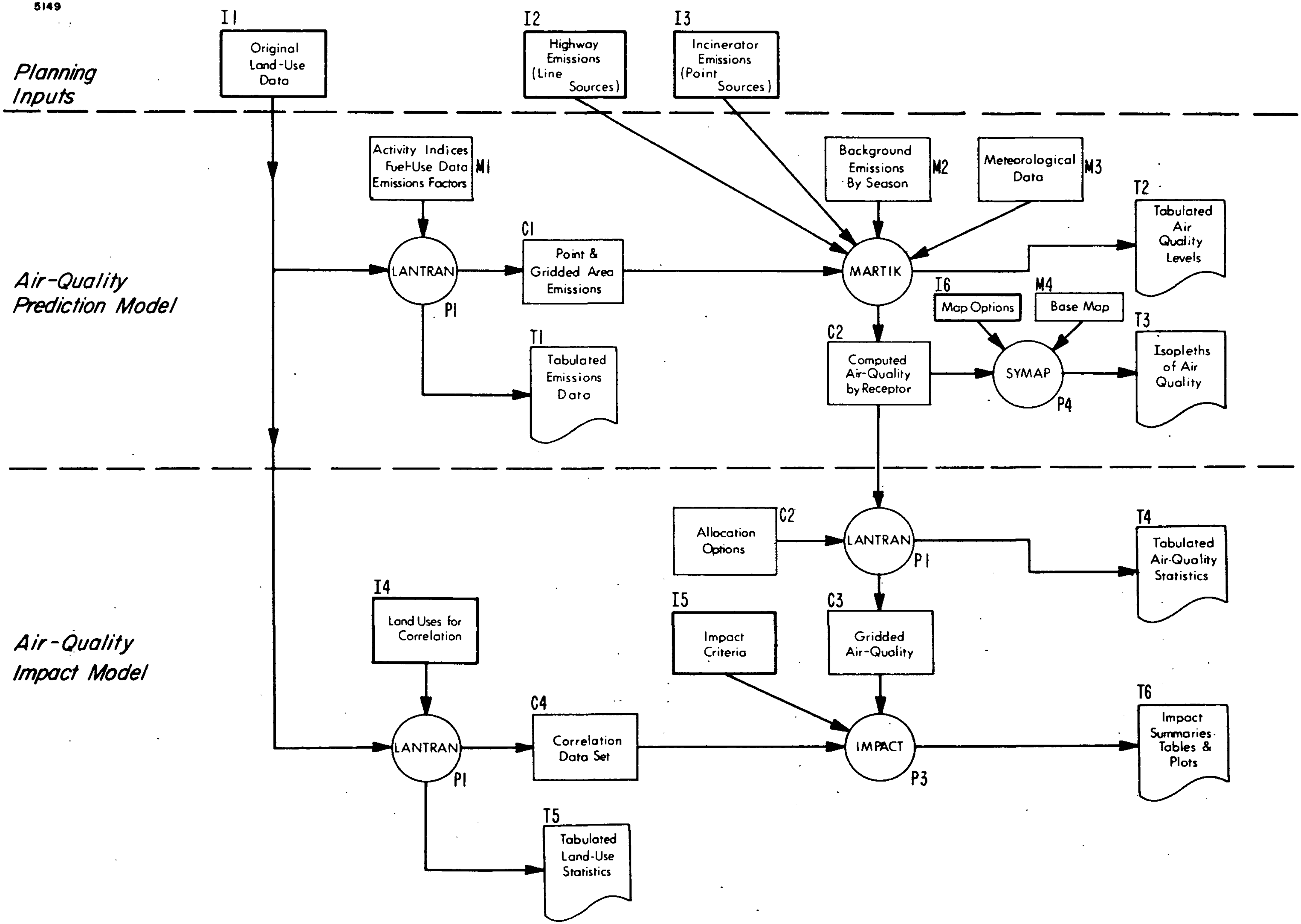


Figure 2 AQUIP Software System

a section entitled "AQUIP implementation". In all cases, reference is made to the general flow diagram of Figure 2.

For clarity, we will first trace through the operations involved in using the model for specific functions, and then relate these functions to the overall process of Figure 1.

1.1.1 Planning Inputs

<u>Preparation of Land-Use Data</u>

The objective of the AQUIP system is to test hypothetical configurations of land uses or "activities" with respect to their impact upon air quality, and to provide information necessary to rank them in relation to alternatives. The primary input to the model is thus a numerical description of a land-use plan, either a comprehensive plan such as those models in the present study or a subset of a plan (such as proposed highway or shopping center). Ultimately, the form of the numerical description is an emissions inventory, and the data could be prepared in this form to begin with. It is obviously more practical (particularly in view of the complex nature of the emissions-projection process) to prepare the inputs in a form as close as possible to the actual planning variables (such as density of dwelling units or zoning classifications) associated with the plan.

For this reason, original land use data are prepared by the user, working directly from a map of the study region. This process as used for the Hackensack Meadowlands is described in Section 2.3.1, LANTRAN compute routines for AQUIP. Zones applicable to each activity are defined and classified. Each such zone is then indicated on the map as a polygon area bounded by straight-line segments. These zones are referred to as "figures". Points with which activities (and ultimately emissions) are associated are also indicated. Highways are located, and then represented as being made up of straight-line segments. The activity regions are then assigned a set of activity "codes" and "values" which define the procedures used to c compute their emissions. For example, a residential region could be represented as a polygon figure and assigned a "residential classification code" together with values which determine how it is to be treated.

Geographical data for figures (defined as discussed above) are prepared by coding the coordinates of the "vertices" of their boundaries. These data are then incorporated into the "original land use" data set (I1), together with the codes and values. The result of this operation, therefore, is a data set describing a land-use alternative in terms of planning variables for subjection to the emissions-projection methodologies as described in the Task 1 study report and embodied in the LANTRAN computer program.

The reader is referred to in the following sections in the Task 1 report which cover the basic principles necessary to understand how the LANTRAN program was used with the Hackensack Meadowlands data. These should be carefully read in conjunction with the abbreviated description contained in Section 2.3.1: Terminology, Part I, Sections 1.5, 2.1, 2.2, 4.2.1, 5.1.4, 5.1.5, 5.1.6, Part II, Section 4, Appendix A.

1.1.2 Preparation of Direct Emissions Data

Not all data involved with a particular plan are suitable for definition in terms of activities. For this reason, highways and some types of points (such as power plants and incinerators) are treated separately. In the case of the highway data, the geographical coordinates of the end-points of the various links are coded, together with emissions derived by application of emissions factors to projected traffic conditions. These data become the "highway emissions" data set (12), used as a direct input to the MARTIK diffusion modeling program.

Similarly, the geographical coordinates which locate power plants, incinerators, or other "point-sources" are coded together with direct emission rates and stack parameters specially determined in general for each source. These data become the "point-source" data set (13), used as a direct input to the diffusion model.

1.1.3 Air Quality Prediction Model

Computation of Emissions from Activity Data

Having prepared the original land use data as described above, the user proceeds to compute from these data the emissions which they represent. This step is performed by the LANTRAN program, and is described in detail in Section 2.3.6. The computation involves, essentially, the allocation of data defined on the set of "figures" to a grid-cell system, and is necessitated by the fact that in any planning area, the number of small discrete sources is so large that allocation to area sources is essential. Since the diffusion model requires rectangular area sources, a grid system is indicated, and LANTRAN makes the essential transition from figure-based to grid-based data. In principle, it is emissions defined on the figures which are allocated by LANTRAN; in fact, the program performs one additional step: land-use data are first converted to emissions data which are then allocated to the grid system. Some of the emissions data are, however, represented in the output as points, rather than as gridded area sources, because: (1) certain activities generate point sources (such as schools for residential areas); and (2) individual discrete sources with emissions greater than some threshold

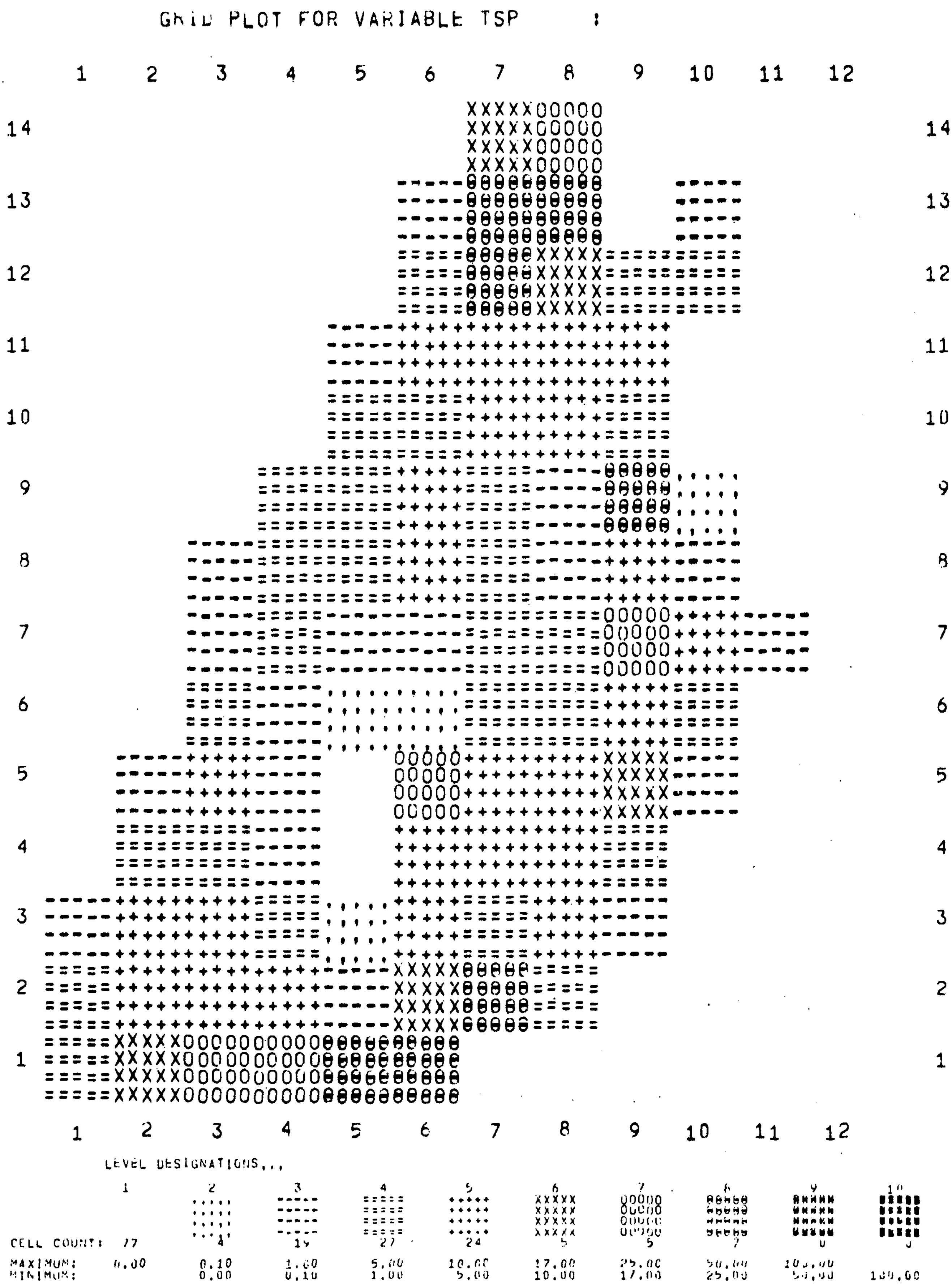


Figure 3 Graphical Display Showing Emission Rates as Allocated to the Chosen Grid System

must be considered separately. The result of this computation step is the "point and gridded are source" data set (C1), in the form of three card decks (corresponding to the summer, winter and annual seasons), for use as a direct input to the diffusion model, together with tabulated output describing the emissions characteristics of the input data, and graphical displays of emission rates by pollutant as allocated to the chosen grid system. An example of such a display is given in Figure 3.

Diffusion Analysis for Total Air-Quality

This step performs the essential transition from the emissions generated by a particular land-use plan to the air-quality which is associated with the plan and is described in detail in Section 3.3. The emissions inventory data sets, (I2), (I3) and (C1) as described above, are input to the MARTIK program, along with the model data sets which define the ("receptor") sites at which concentrations are to be computed, the meteorological parameters and the emissions assigned to the "background" region (outside the study region). The result of this step is a set of computed concentrations for each pollutant, at each of the desired receptor sites. Three MARTIK runs (each with the appropriate total emission inventory) define the "computed air quality" which is returned to the user as a tabulated output (T2) and passed to additional operations as the data set (C2). An example of the tabulated output from MARTIK is shown in Figure 4.

ARITHMETIC MEAN POLLUTANT CONCENTRATIONS

COORDINATE SCALE UNIT (METERS)= 1000.000

RECEPTOR NUMBER	X-COORD SCALE U	Y-COORD SCALE U	HEIGHT METERS	TSP UG/M**3	SOX PPM	CO PPM	HC UG/M**3	NOX UG/M**3
1	579.0	4524.0	0.0	1.6273	0.0009	0.0181	3.8731	1.0770
2	578.0	4523.0	0.0	1.5552	0.0009	0.0160	3.4776	1.0423
3	579.0	4523.0	0.0	2.2689	0.0018	0.0366	7.2917	1.5176
4	580.0	4523.0	0.0	2.4819	0.0017	0.0330	6.7997	1.6596
5	578.0	4522.0	0.0	2.0589	0.0012	0.0218	4.7036	1.4349
6	579.0	4522.0	0.0	2.7549	0.0021	0.0406	8.2060	1.8275
7	580.0	4522.0	0.0	2.7940	0.0014	0.0253	5.6915	1.8728
8	581.0	4522.0	0.0	2.8914	0.0008	0.0102	3.2256	1.9220
9	582.0	4522.0	0.0	3.6530	0.0008	0.0063	2.9710	2.3623
10	577.0	4521.0	0.0	1.7346	0.0005	0.0060	1.8957	1.2272
11	578.0	4521.0	0.0	2.5351	0.0011	0.0174	4.2134	1.8467
12	579.0	4521.0	0.0	2.7511	0.0013	0.0214	5.0989	2.1092
13	580.0	4521.0	0.0	3.2236	0.0010	0.0133	3.9099	2.2114
14	581.0	4521.0	0.0	3.7592	0.0009	0.0072	3.1758	2.4970
15	582.0	4521.0	0.0	6.0581	0.0012	0.0052	4.3320	3.7122
16	583.0	4521.0	0.0	7.7605	0.0015	0.0042	4.6677	4.7857
17	577.0	4520.0	0.0	2.1361	0.0005	0.0050	1.9393	1.5487
18	578.0	4520.0	0.0	2.7200	0.0007	0.0062	2.5813	1.9749
19	579.0	4520.0	0.0	3.2234	0.0007	0.0065	2.7749	2.2928
20	580.0	4520.0	0.0	3.6197	0.0007	0.0052	2.7622	2.5100
21	581.0	4520.0	0.0	4.3339	0.0009	0.0044	3.0115	2.8035
22	582.0	4520.0	0.0	6.7634	0.0013	0.0036	4.1043	4.1590
23	583.0	4520.0	0.0	14.4047	0.0030	0.0035	7.8435	9.0361
24	576.0	4519.0	0.0	1.8093	0.0004	0.0031	1.4469	1.2879
25	577.0	4519.0	0.0	2.4644	0.0005	0.0047	2.1047	1.7138
26	578.0	4519.0	0.0	3.0203	0.0006	0.0056	2.5930	1.9657
27	579.0	4519.0	0.0	3.3194	0.0006	0.0036	2.3515	2.2874
28	580.0	4519.0	0.0	3.9917	0.0007	0.0032	2.6936	2.5367
29	581.0	4519.0	0.0	5.3937	0.0010	0.0032	3.5116	3.1303
30	582.0	4519.0	0.0	10.1600	0.0021	0.0030	5.7109	6.4346
31	583.0	4519.0	0.0	14.4849	0.0030	0.0027	7.8013	9.2564
32	576.0	4518.0	0.0	2.0763	0.0004	0.0030	1.5794	1.4355
33	577.0	4518.0	0.0	2.7417	0.0005	0.0044	2.2476	1.8046
34	578.0	4518.0	0.0	3.1616	0.0006	0.0041	2.4200	2.0331
35	579.0	4518.0	0.0	3.3509	0.0006	0.0027	2.2460	2.1408

Figure 4 Example of the Tabulated Output of the MARTIK Program

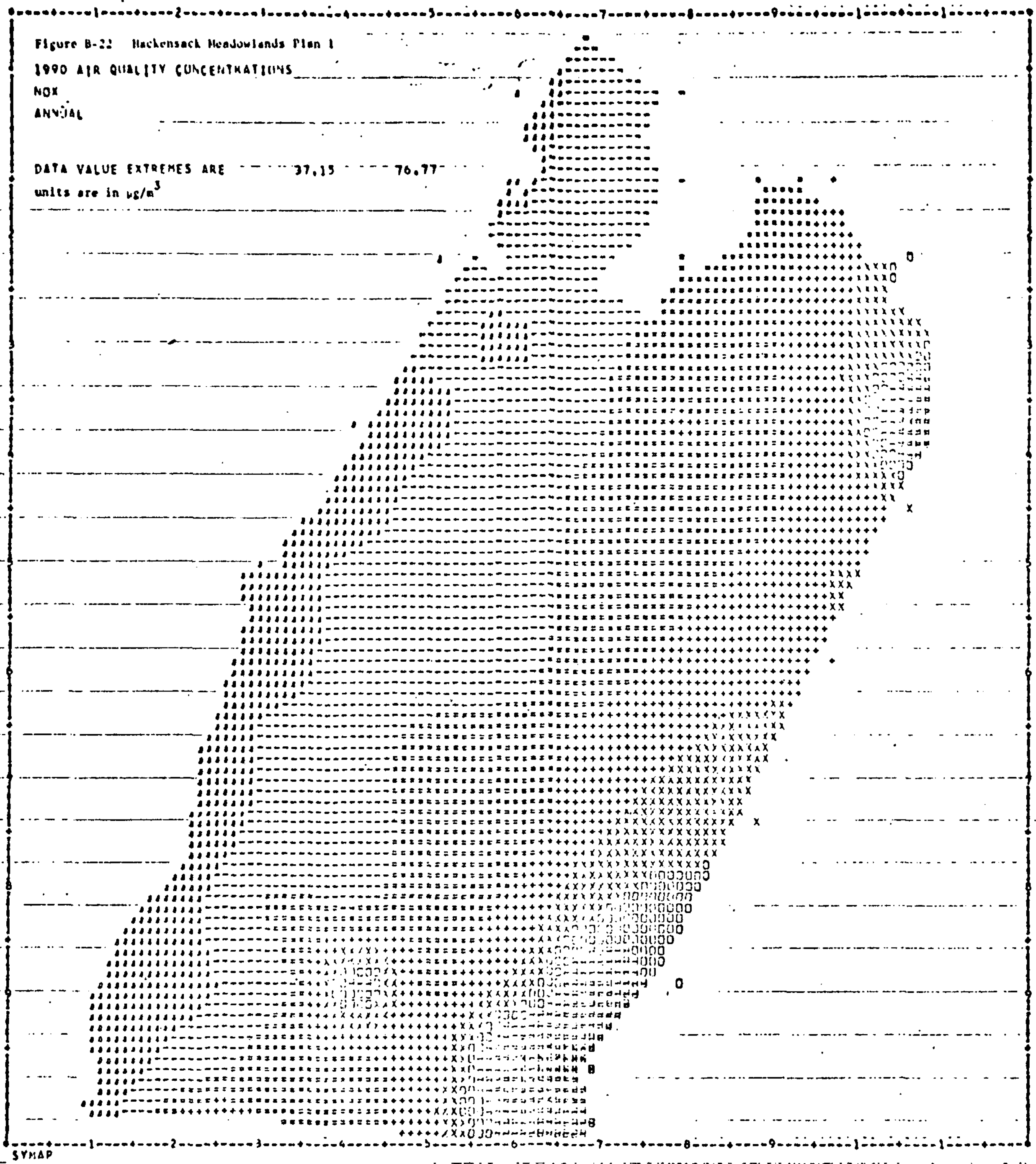
Diffusion Analysis for Sensitivity Studies

A number of special types of diffusion analyses may be performed, involving subsets of the total emissions inventory together or in combination. These are discussed in detail in the MARTIK discussion Section 3.3. An example of this application is the computation of differential concentrations (positive or negative) resulting from the relocation of a proposed highway. Data preparation for this type of study may involve selection of subsets of the data sets used for analysis of a total plan, as described above, or it may involve the coding of emission-source data directly for use by the MARTIK program.

Graphic Display of Computed Air Quality

The final step involved in the AQUIP air-quality prediction model is the plotting of air pollution concentrations, using the SYMAP program, for each case considered. The procedures for plotting with the SYMAP program are discussed in Chapter 5, and related to isopleth maps of air quality in Section 5.3.

Essentially, the result of a SYMAP plotting run is a graphical display of the study area, with printer-generated shading proportional to the computed concentration at each point. An example of this (isopleth or contour) form of map is shown in Figure 5. The data used as input to the program are the receptor "values" computed by MARTIK and output on the data set (C2). Inputs prepared by the user of the system consist of options which select the pollutant to be displayed, and control the appearance of the output map.



SYMAP

ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL
(MAXIMUM INCLUDED IN HIGHEST LEVEL ONLY)

MINIMUM	30.00	35.00	40.00	45.00	50.00	55.00	60.00	65.00	70.00	75.00
MAXIMUM	35.00	40.00	45.00	50.00	55.00	60.00	65.00	70.00	75.00	80.00

PERCENTAGE OF TOTAL ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL

10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00

FREQUENCY DISTRIBUTION OF DATA POINT VALUES IN EACH LEVEL

LEVEL	1	2	3	4	5	6	7	8	9	10
SYMBOLS	[illegible]	[illegible]	---------	[illegible]	+++++++++	XXXXXXXXX	000000000	[illegible]	[illegible]	[illegible]
FREQ.	0	17	25	23	16	5	4	2	2	2

Figure 5 Example of SYMAP

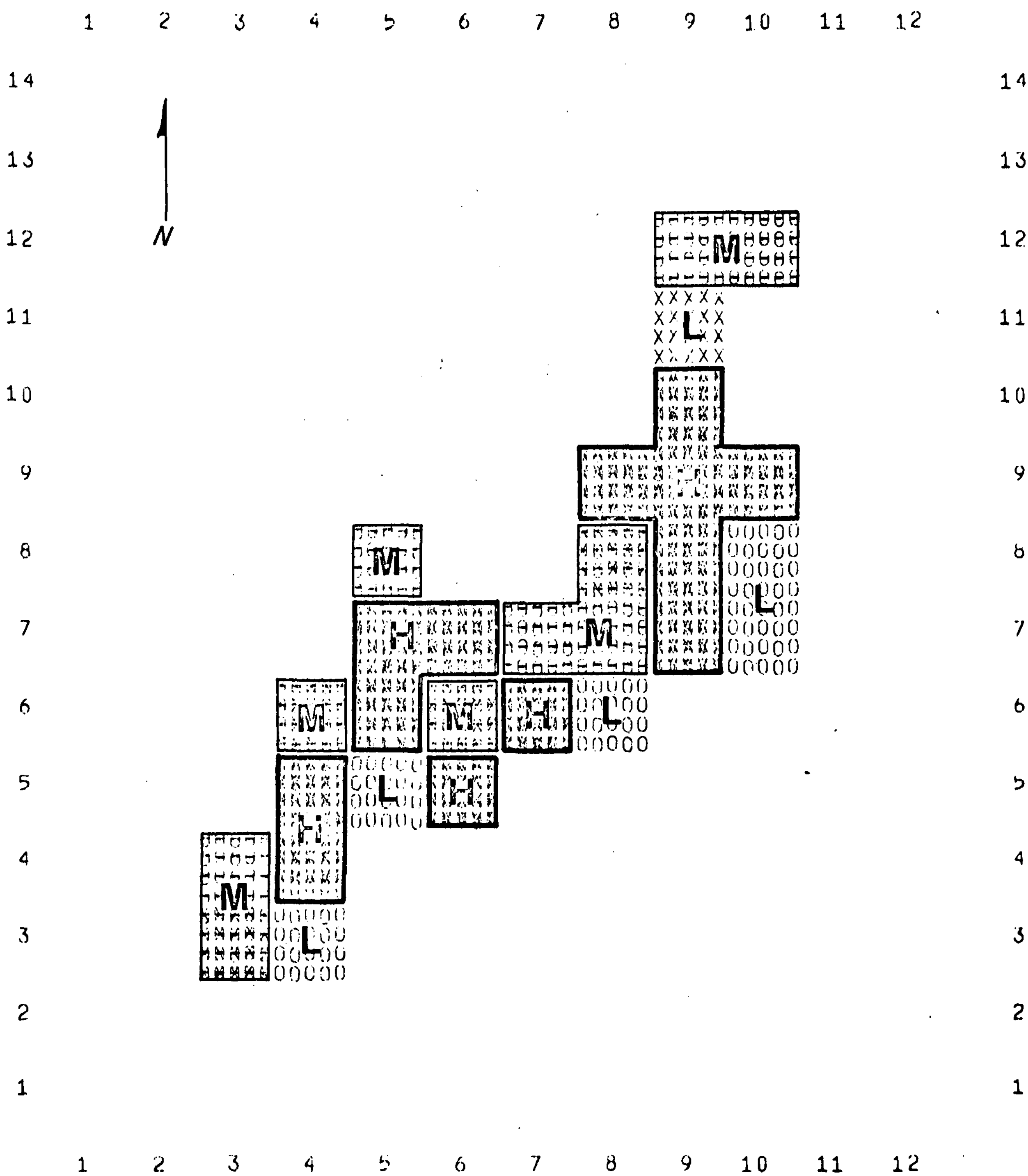
1.1.4 Air Quality Impact Model

Preparation of Data for Correlation with Air Quality

In this step, subsets of the original plan data are used to select and manipulate land-use data which is to be used for correlation with predicted air quality. The computations involved in this process are performed by the LANTRAN program, and are discussed in detail in Section 2.3.6. Operation of the program is similar to its use in the preparation of emissions data, except that, instead of emissions defined on a set of land use "figures", the quantities allocated are variables such as population density and extent of industrial land use. The result of this step is a data set, referred to as the "correlation data set" (C4), which is created in the form of an output card deck for input to the IMPACT program. In addition, grid plots of each selected land use are generated as shown in Figure 6.

Preparation of Computed Air Quality Allocated to a Grid System

The result of a diffusion analysis with the MARTIK program is a set of concentrations computed for the given receptor sites. The purpose of this step is to convert these results to mean air quality defined on the grid system chosen for analysis. This conversion is performed by the LANTRAN program, which constructs a mean surface through the receptor points and then assigns to each cell of the grid system the surface value at the cell center. This step is necessary since there is no essential relationship between the spacing or distribution of receptor points and the grid system used in the impact analysis model. The computation step may be performed routinely, with no interaction from the user (other than



LEVEL DESIGNATIONS...

	1	2	3	4	5	6	7	8	9	10
CELL COUNT:	139	0	0	0	0	1	5	6	4	13
VALUE:	0.0	0.0	0.0	0.0	0.0	59.23	3110.27	10698.72	15689.90	118046.75
MAXIMUM:	0.00	0.15	1.00	10.00	50.00	300.00	1000.00	3000.00	5000.00	
MINIMUM:		0.00	0.15	1.00	10.00	50.00	300.00	1000.00	3000.00	5000.00

Figure 6 Graphical Display Showing Population Density as Computed by the LANTRAN Program

to define the grid system, perhaps once and for all). The results of the air-quality prediction model are embodied in the data set (C2) computed by the MARTIK program and used as an input to LANTRAN. Tabulated output lists the concentrations as allocated to each grid cell, and graphical output, if specified, is similar to that shown in Figure 3 for emissions. Output from the program is the "gridded air quality" data set (C3) used as an input to the impact analysis procedure.

Analysis of the Air Pollution Impact of the Original Land Use Data

This is the final step in the AQUIP modeling system which brings together the outputs of the system, expressed as computed concentrations, and quantitative information (such as integrated population exposure) necessary for final evaluation and ranking of planning alternatives. The analysis is performed using the IMPACT computer program, in which the user specifies as input to the program a set of operations which manipulate the computed air-quality data, correlates these data with land-use data, air-quality standards, etc. The planner interacts directly with the AQUIP model at this point, since it is he who defines the criteria by which the plan and its alternatives are to be ranked. The criteria are than translated into a set of IMPACT operations, which are coded as a "hyper-language." Any number of "gridded" data sets may be brought together, involving total air-quality calculations by MARTIK, land uses for correlation or emissions data as computed by LANTRAN. The result of each "operation" or set of operations is quantitative information for each cell of the grid system. These results are tabulated and presented graphically as grid plots such as the example of Figure 7.

Examples of the types of analyses which may be performed using the IMPACT program are given in Sections 4.3.3, and 4.5. They include examination of compliance with absolute air quality standards, results of

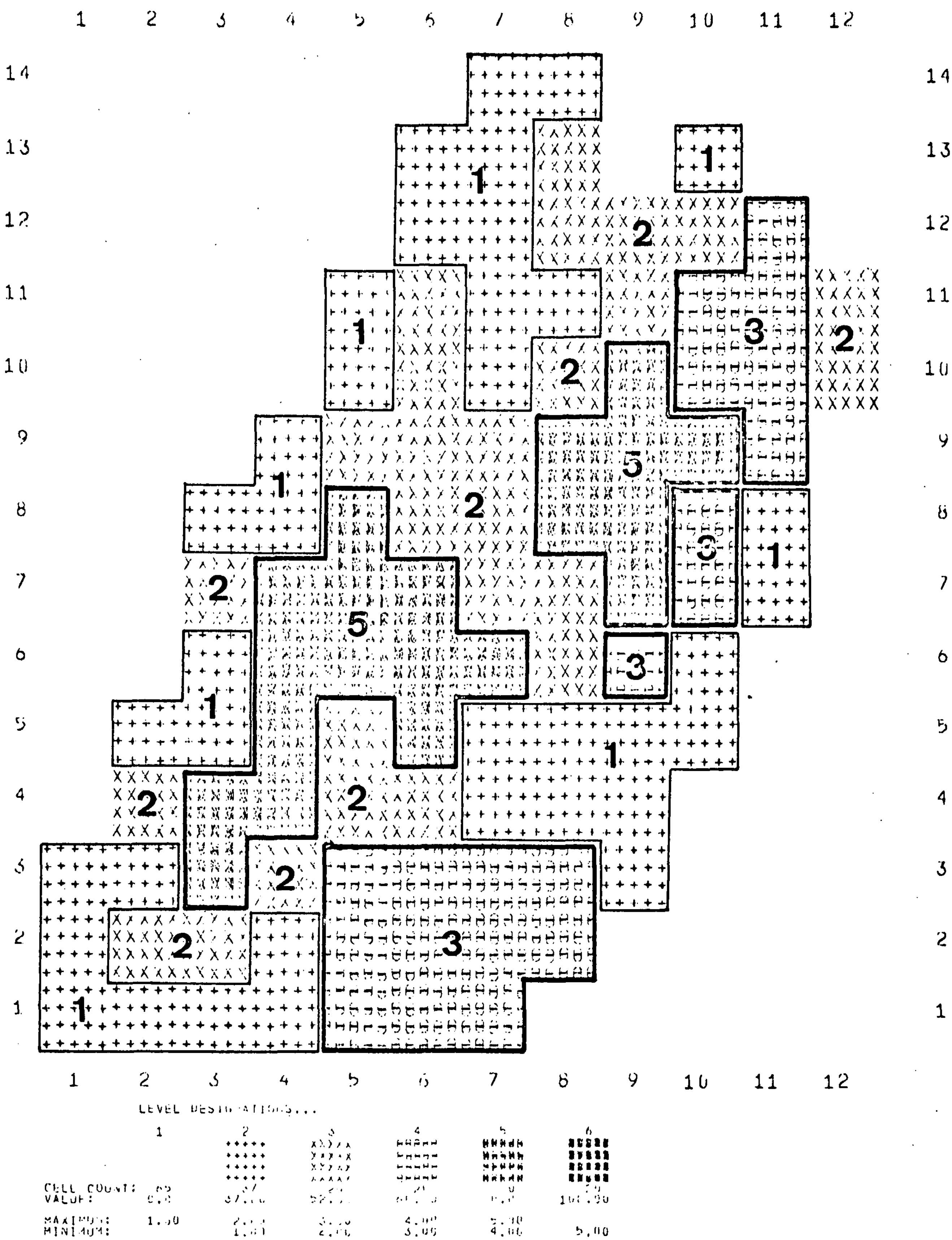


Figure 7 Graphical Display of Land-Use Compatibility Score as Computed by the IMPACT Program

sensitivity studies, determination of integrated pollutant dosages by land-use, and the development of ranking indices ("land-use compatibility scores") by which multiple factors are taken into account to achieve a single number for plan ranking.

<u>Summary</u>

The full set of procedures discussed in this section make up the model as shown in Figure 1. If carried through from start to finish, the planner interacts only at the point of preparation of the initial plan, and evaluation of the results of the impact analysis. The "cycle" is repeated as new alternatives are presented and analyzed. In fact, the possible points of interaction and iteration occur throughout the system. Certain criteria may be placed upon emissions, for example, in which case the iterative cycle repeats itself at the output of the emissions computation step. An initial series of diffusion analyses involving the total inventory may suggest another to provide some direct indication of differential effects, or the contribution of some subset of the total inventory. Finally, with the grid-based data sets constructed as discussed above, any number of different types of analyses may be carried out with the same data, each one representing a "question" posed by the planner and returning to him numerical information on which to base his "answer".

It should be noted that some minor variations exist between the programs as implemented in different computer systems. These differences are in the format with which the values are <u>printed</u>: they do not affect the values in any way.

On the NJDOT system there is presently a date card needed for some of the programs to run; this requirement is being phased out by NJDOT.

1.2 Elements of the AQUIP System

The elements shown in Figure 2, and in the individual data flow sections are described below.

1.2.1 System Input Data Sets

I1. Original Land-Use Data - This data set is specified as a set of point, line or polygen "figures" to which "values" representing planning variables are assigned.

I2. Highway Emissions Data - This data set is specified as a set of "line" sources, to which emission densities have been assigned by the application of emission factors to traffic data.

I3. Point Source Emissions Data - This data set is specified as a set of "point" sources to which emission rates have been assigned.

I4. Land Uses for Correlation - Specified as a set of "figures" representing land uses to be correlated with air quality predictions.

I5. Impact Criteria Data Set - This data set is a set of operations to be performed upon gridded air-quality data for comparison with standards or correlation with various land uses.

I6. Map Options - Which select variables for isopleth plotting and specify characteristics of output maps.

1.2.2 Model Parameter Data Sets

M1. Activity Indices - To relate activities specified in the given land-use data to fuel demand.

Fuel-Use Data - To specify overall fuel availability data;

Emissions Factors - To relate fuel use or process rate by activity to emissions by pollutant; and

LANTRAN Program Parameters - To specify the grid properties, program options and computation parameters.

M2. Background Emissions, by Season - A previously generated data set to account for the contribution of all point, line and area emissions sources outside the study area to computed concentrations at the receptor sites.

M3. Meteorological Data - The set of normalized weighting factors to be assigned to each of the 480 meteorological conditions, based on the relative frequency of occurrence of these conditions;

Meteorological Parameters - To determine such model characteristics as plume dispersion coefficients, mixing layer depth and vertical wind-velocity profile; and

MARTIK Program Parameters - To specify receptor properties program options and computation parameters.

M4. SYMAP Base Map - The set of SYMAP input packages which define the study region and the coordinates of the data points.

M5. Allocation Options - The set of LANTRAN control options required for allocation of computed concentrations by receptor to the chosen grid system.

1.2.3 Computer Programs

P1. LANTRAN - Land-Use Data Transformation Program. The fundamental purpose of this program is to convert data defined on point, line, or irregular polygon "figures" to a regular grid system.

P2. MARTIK - Martin-Tikvart Diffusion Modeling Program. Computes the arithmetic mean air-quality levels at designated receptor locations for a given distribution of emission sources with meteorological data specified for the averaging period of interest and the climatology of the study region.

P3. IMPACT - Impact Analysis and Display Program. This program performs arithmetic and logical operations as specified at run-time by a "user hyper-language" on each element of a gridded system of data, allowing cell-by-cell comparison with user-specified criteria.

P4. SYMAP - Synagraphic Computer Mapping Program. A general-purpose graphics display program presently implemented for the display of isopleths of air quality as computed by MARTIK.

1.2.4 Computed Data Sets

C1. Point and Gridded Area Source Emissions - Allocated by pollutants to the specified grid system. The point sources in the data set represent discrete sources with emissions in excess of a given threshold. The area sources represent the remaining activities distributed to grid cells on the basis of the area of "figures", or "extent".

C2. Computed Air Quality - By pollutant for each of the specified receptors.

C3. Gridded Air Quality - By pollutant converted to mean concentration for each grid cell.

C4. Correlation Data Set - A gridded data set representing allocation of specified land-uses or their derivatives (e.g., population density) selected for correlation with air-quality levels.

1.2.5 System Outputs

T1. Tabulated Emissions - Projected emissions as computed by LANTRAN for the given ensemble of input data and model parameters, given as a summary for each constituent land-use "figure", with tables and plots of resultant emissions presented for the specified grid system.

T2. Tabulated Air-Quality Predictions - For the given ensemble of planning inputs, model parameters and meteorological conditions. Tabulated by pollutant for each of a specified set of "receptor" locations within the study region.

T3. Isopleths of Predicted Air Quality - A graphical display of isopleths of pollutant concentrations generated by the line printer using an overprint technique to produce "shading".

T4. Tables and Plots of Predicted Total Air Quality - Expressed in absolute units of concentration for each cell of the study region grid system.

T5. Tables and Plots of Land-Use Data - To be used for correlation with gridded air quality data.

T6. Tables and Plots Presenting the Results of Impact Analyses - e.g., (1) statistics of compliance with standards; (2) integrated dosage by land use; and (3) overall land-use compatibility.

1.3 System Design Philosophy

Since the detailed operations involved in any software system are of a complex nature, successful implementation must rely heavily upon: (1) optimal interfacing among programs using compatible data set structures and formats; (2) deck setup procedures which are as simple as possible and in any case similar for all programs; (3) straightforward procedures for system modification without the necessity of modifying the programs themselves; and (4) data-checking procedures in the input phases of all programs to eliminate invalid or inconsistent inputs.

The design of the AQUIP system has proceeded with these criteria in mind. Of the four computer programs which make up the system, two already existed before the system was designed: the SYMAP program (developed and distributed by the Graduate School of Design at Harvard), and the MARTIK (ERT version) program. Evolution of the input data formats and deck setup procedures proceeded along the lines already shown to be successful with the MARTIK program. For this reason, LANTRAN, IMPACT and MARTIK use a completely self-consistent set of card input formats, data set structures, and system modification procedures. Formats, and deck setups for the SYMAP program are <u>similar</u> but nonetheless different, and hence must be treated separately in the manual. The interfacing of data sets with the SYMAP program, however, poses no problem since data-set manipulations are performed in a user-written subroutine which guarantees compatibility with the other programs.

The following sections discuss in detail the card input format, deck setup and program logic conventions which apply to the LANTRAN, IMPACT and MARTIK (and, in some cases, to SYMAP as well).

1.3.1 Organization of Program Input

Program input provides information for: (1) <u>control</u> purposes to distinguish between various program modes; (2) for <u>parameter</u> initialization; and (3) to create data sets. All programs in the AQUIP system are organized along the "Keyword Package" concept. The input to the program thus consists of a sequence of packages, each identified by a keyword which initiates a set of program functions. Where appropriate, the keyword card (which is the first card of any package) is followed by a card data set.

The MARTIK, LANTRAN and IMPACT programs, as well as the utility programs, follow the ERT standard keyword package format described below in Section 1.3.2. The SYMAP program is also structured along keyword-package lines but the keyword format is different. A discussion of SYMAP formats and usage conventions will therefore be given separately (Section 5.1).

Care has been taken in the design of the keyword packages to insure that (1) the same keyword names in different programs correspond to the same function; and (2) keyword packages in different programs correspond to identical card formats, even though some programs may only use a subset of available card fields.

In all cases, a standard form of package delimiter has been used (to denote the end of an input package and signal the reading of the next keyword card). All programs (including SYMAP) make use of a '99999' card (punched columns 1 through 5) as a basic package delimiter. Further forms used for nested data packages are discussed in Section 1.3.6. Similarly, all programs (including SYMAP) use a keyword 'ENDJOB' card (punched columns 1 through 6) to terminate program execution. All input card formats allow for card sequencing in columns 73 through 80.

Input card formats for all programs except SYMAP allow for imbedded user comments for printing in the program output by punching a non-blank character in columns 71 and 72 of the data card preceding the comments. All card data sets may optionally be taken from a (tape or disk) file (as card images) identified by a parameter punched on the keyword card. Finally, all AQUIP programs make use of an optional user-written subroutine to allow special computations to be performed at user-specified points in program execution, or to accommodate non-standard input formats. For MARTIK, LANTRAN and IMPACT, the user-written subroutine is called whenever a 'COMPUTE' keyword card is encountered. For SYMAP, an optional user-written routine is called to read or manipulate each of the input data packages. These user-written subroutines provide the means for incorporating special features into a (complicated) standard computer program. In the case of the AQUIP system, they serve two functions:

1. They tailor the methodologies directly to the particular application - in this case the Hackensack Meadowlands Study. Application of the AQUIP software system to another region would require only the modification of the user-written routines. These routines thus become a part of the "model parameter data sets".

2. They allow the interfacing of data sets with the SYMAP program, whose card-formats are, themselves, not compatible with the other formats used in the AQUIP system.

In summary, the keyword-package structure of program logic provides a maximum of flexibility in using the AQUIP programs individually and together. Inherent in the concept is a cyclic pattern of program logic; execution of each package accomplishes some specified function, card input, data set manipulations, whether it be computations or print. After completion, control returns to the "nucleus" of the program, whose only function is to read and recognize the next keyword package card and transfer control to another appropriate routine. Some packages may never be invoked in any run; others may be invoked many times. One job submission may actually consist of many separate and even unrelated cases by stacking keyword packages.

1.3.2 Keyword Package Formats

1. Keyword Card Format

Columns	Contents	Format	Meaning
1-12	KEYWORD	3A4	Alphanumeric identifier for package.
13-15	IC	I3	Blank or zero if card input is to be taken from the card reader; otherwise IC is the logical unit number of the device from which card images are to be read. If IC is punched as a negative number, it is rewound before reading begins.
16-18	IFORM	I3	Blank or zero except for 'COMPUTE' keyword in which case subroutine COMP is to be called with IFORM as an argument, and for 'MSG' in MARTIK.
19-20			Not used.
21-70	TITLE	12A4,A2	Alphanumeric message to be printed in the output at the beginning of package execution.
71-72	JC	A2	Blank - if no comments card follows; non-blank if next card is a comments card.
73-80	KARD	I8	Card sequence number.

2. Data Card Format

Columns	Contents	Format	Meaning
1-70	(data)		Input data in application-dependent format.
71-72	JC	A2	Blank if not followed by a comments card; non-blank if followed by a comments card.
73-80	KARD	I8	Card sequence number (I8)

3. Comments Card Format

Columns	Contents	Format	Meaning
1-14			Not used.
15	IF	A1	Blank if no space before printing of line, 0 if a space is to be inserted before printing, 1 if line is to begin at the top of the next page.
16-20			Not used.
21-70	COM	12A4,A2	Line of comments.
71-72	JC	A2	Blank - if no comments card follows (i.e., this is the last comments card); non-blank if next card is another comments card.
73-80	KARD	I8	Card sequence number.

4. Last Card of Data Set

Columns	Contents	Format	Meaning
1-5	'99999'		End of data identifier.
6-72			Not used
73-80	KARD	I8	Card sequence number.

1.3.3 'Parameters' Package

All programs (except SYMAP) allow for the modification of program parameters or run options through the use of a PARAMETERS keyword package. Parameters or option variables are set to default values at compilation, and hence only those which are to be modified need be entered. The format of the data package itself is a FORTRAN IV namelist with the name "& INPUT." A summary of namelist rules follows:

1. A namelist input consists of a series of variable assignments beginning with &INPUT and ending with &END, with each assignment of the form: VAR = X1,X2,...., where VAR is a variable or array name and X1,X2,...., Xn are the first n values to be assigned. If VAR is undimensioned, only one value follows. If VAR is subscripted, values are assigned beginning with the specified element. Examples of assignments are:

```
TMIN      =  0.02,
RCAL(1,4) =  0.92, 0.77,
UNIT      =  11,12,
RBKG      =  600*0.,
PRINT     = .TRUE.,
```

In the example, the variable TMIN is assigned the value 0.02, overriding the default value of 0.01. Elements (1,4) and (2,4) of array RCAL are set to 0.92 and 0.77 respectively. UNIT(1) is set to 11 and UNIT(2) is set to 12. All 600 elements of array RBKG (dimensioned 6,100) are set to zero. Finally, the logical variable PRINT is set to .TRUE. (logical variables take on values of .TRUE. or .FALSE.).

2. The format of namelist assignments is free within a field extending from column 2 of any namelist card to and including column 72. Within that field there may be as many assignments of the form given above as desired, and the assignments may be in any order. Assignments are delimited by commas and imbedded blanks are ignored. As many namelist cards may be used as desired. For convenience, related assignments are grouped together on one card, so that minor changes require only the repunching of a single card. Columns 73-80 are available for card sequencing. (For further information on namelist conventions, refer to a FORTRAN IV Manual.)

The format for a 'PARAMETERS' package is given explicitly below, and is the same for all programs except SYMAP. The actual variable names, their types, dimension information, default values and meanings are tabulated in the discussions of the programs themselves.

FIRST CARD

Columns	Contents	Format	Meaning
1-10	'PARAMETERS'		
13-15	IC	I3	Blank or zero if parameters are to be taken from cards; otherwise data set ref. no of file containing PARAMETERS package.
16-20			Not used.
21-70	TITLE	12A4,A2	Run heading for printing.

SECOND CARD

Columns	Contents	Format	Meaning
2-7	'&INPUT'		

FOLLOWING CARDS

Columns	Contents	Format	Meaning
2-72			Parameters to be initialized by FORTRAN NAMELIST &INPUT. See list for individual programs.

LAST CARD

Columns	Contents	Format	Meaning
2-5	'&END'		

Example #1

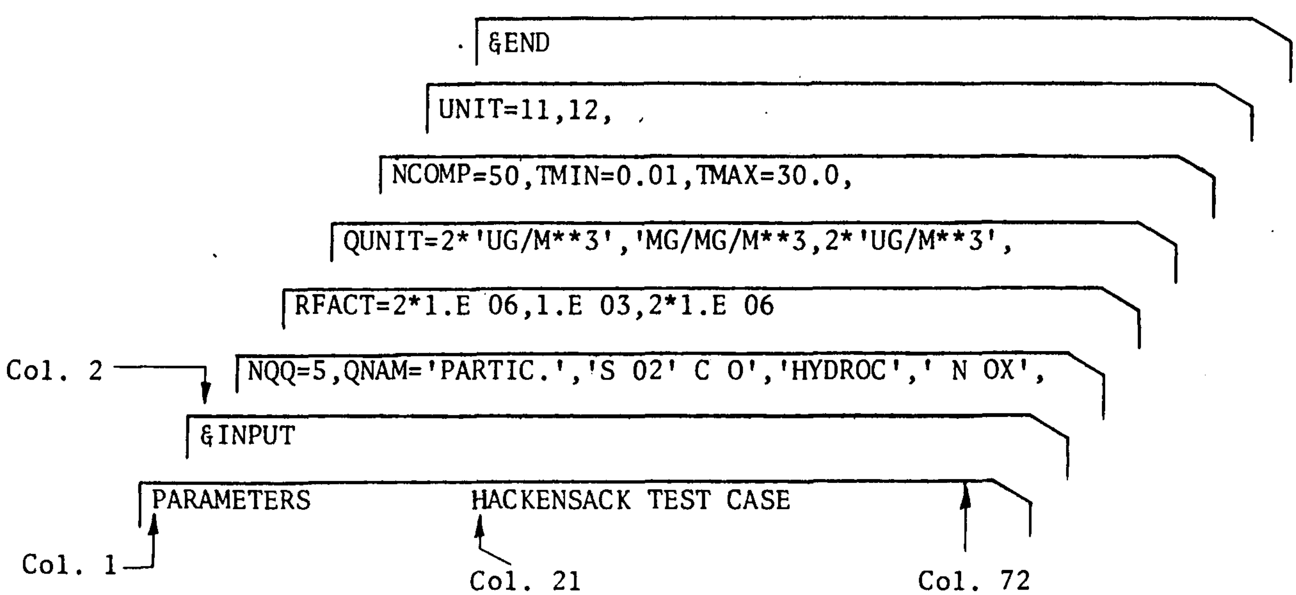


Figure 8 Sample Card Deck for PARAMETERS Package

Note that the 'PARAMETERS' package is the one exception to the rule that packages are delimited by '99999' cards. In this case, the end of the namelist is signaled by &END, which appears after the last namelist assignment (not necessarily on a card by itself). If only one or two variables are to be changed, it is sometimes more convenient to put the entire namelist string on a single card, as shown in Figure 9.

Example #2

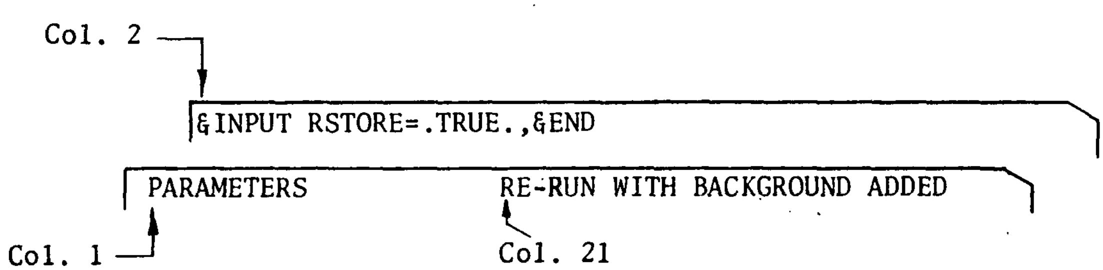


Figure 9 PARAMETERS Package with a Single Namelist Card

1.3.4 'COMMENTS' Package

The 'COMMENTS' package has been implemented in MARTIK, LANTRAN and IMPACT for the purpose of annotating the printed output with a set of user-written comments used as a data set. The first card of the package is the keyword card with 'COMMENTS' punched in columns 1 through 8. If the IC parameter is zero, the package is read from cards, otherwise from the data set with reference number IC. For each card in the package, including the keyword card itself, the contents of columns 21 through 70 are printed as comments. All but the last card of the package must have a non-blank character punched in columns 71 and 72. The second and following cards are in the format given in Section 1.3.2, Item 3.

1.3.5 'ENDJOB' Keyword Card

The 'ENDJOB' card is used in all programs (including SYMAP) to terminate program execution and end the job. Reading of the 'ENDJOB' card causes the message 'END OF PROGRAM.' to be printed in the output.

1.3.6 Nested Card Data Sets

For nested data sets requiring sub-delimiters, the outer delimiter is a '99999' card, the first inner delimiter is '88888', the second '77777', carried inward to nine levels of nesting as seen in the following diagrams:

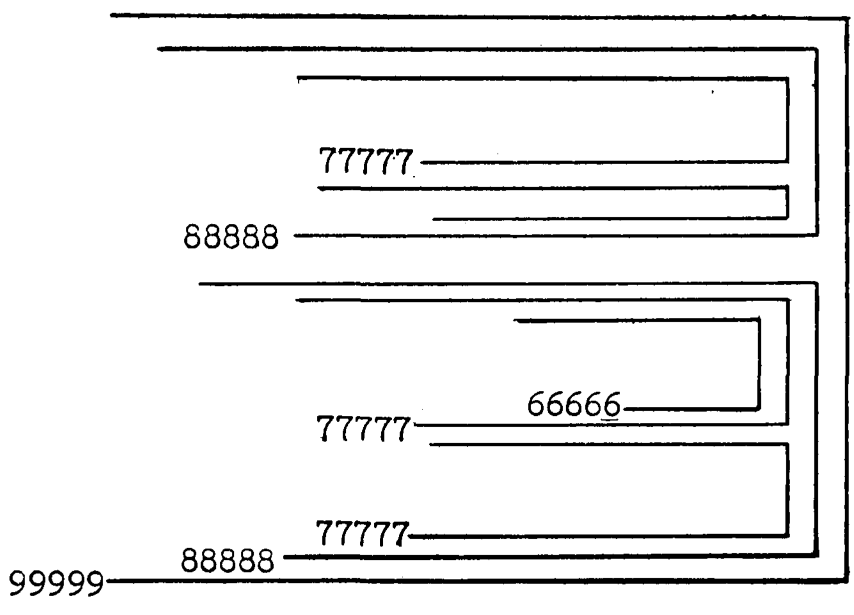


Figure 10 Example of Nested Card Data Set

1.3.7 Optional Data Sets from Card-Image Files

For each of the programs except SYMAP, card data sets may be taken from a disk or tape file instead of from cards. This feature minimizes the repetitive handling of large card data sets. To read in a package from a data set with reference number IC, punch IC in columns 13 through 15 of the keyword card. Any number from 1 to 99 may be used, with the exception of the following special data set reference numbers:

5 Card Reader

6 Printer

7 Punch

9 AQUIP run log file ('LOGDATA')

Above and beyond these reserved dataset numbers there are other datasets which are used by the programs for temporary storage. These units can be changed by the user if he so desires. The summary of datasets needed for each program is as below; default unit numbers are given, as are their DCB parameters.

Program Unit number	Dataset	DCB Parameters
LANTRAN		
5	Input data	card-image
6	Output	printer
9	Log	
11	Figures dataset (temporary)	RECFM=VBS,LRECL=448,
12	Selected points, seasonal emmissions (temporary)	card-image
MARTIK		
5	Input data	card-image
6	Output	printer

9	Log	
11	Source data, internal form (temporary)	RECFM=VSB,LRECL=64, BLKSIZE=1596

IMPACT

5	Input data	card image
6	Output	printer
9	Log	

SYMAP

1	Work dataset (temporary)	RECFM=VSB,LRECL=64, BLKSIZE=1596
2	Work dataset (temporary)	"
3	Work dataset (temporary)	"
5	Input data	card-image
6	Output	printer
9	Log	

If the data set is to be rewound before reading the package, punch the data set reference number as a negative number (-IC) in columns 13-15 of the keyword card. The entire package, including the keyword card, all data cards, comments cards and '99999' if required must appear as 80-column card images on the file. The utility program 'UPDATE' (program U2) has been provided for the purpose of creating and updating card-image file data sets in the proper format.

The following example (shown in Figure 11) represents a set of MARTIK runs using an initial program setup with default parameters, receptor data on unit 14, source inventories for summer, winter and annual seasons on unit 15, and meteorological data for the corresponding seasons on unit 16.

In this example, a total of 12 cards replace an input deck which could amount to a half-box of cards. This mode is only of value, of course, for card data sets which are not frequently modified, and which are used repetitively.

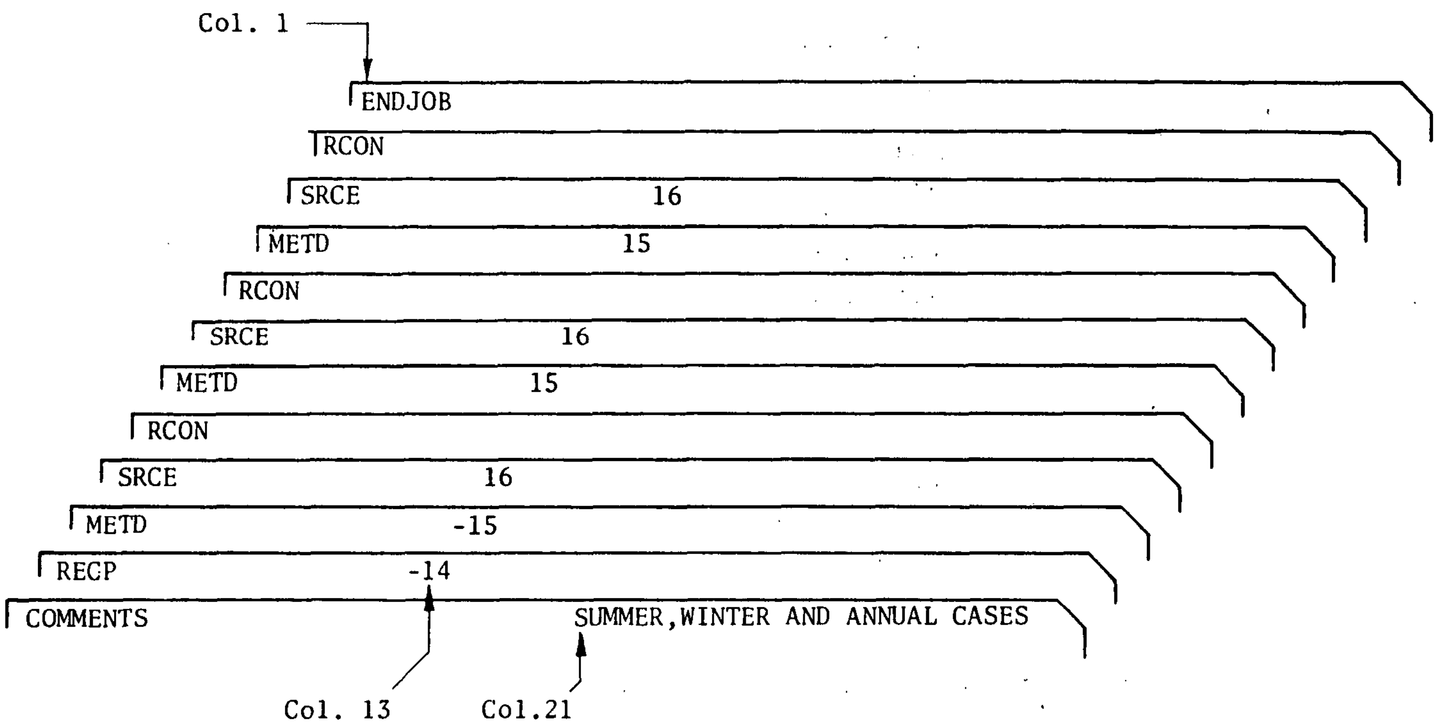


Figure 11 Example of a MARTIK Data Set

1.3.8 Numbered Error Messages

All programs have been designed to prevent, if possible, lengthy computations with faulty data. To this end, input data and control parameters are checked for completeness and self-consistency wherever possible. SYMAP has its own procedures for error-checking, and prints a diagnostic message when a problem is discovered. For the ERT programs, a numbered error-message system has been developed, whereby the detection of an error transfers control to subroutine ERRX (used by MARTIK, LANTRAN, and IMPACT which terminates execution with the printed message:

"EXECUTION TERMINATED DUE TO ERROR NO. XXXX IN YYYY"

where XXXX is a number and YYYY the name of the subroutine in which the error was detected. All errors terminate the run at the point where they are detected.

A list of conditions checked is given by routine, number, and cause in the discussion section for each program.

1.3.9 User-Written Subroutines FLEXIN and COMP

Each program in the AQUIP system makes use of a user-written (application-dependent) subroutine to perform special-purpose computations or to manipulate data sets in non-standard formats. For the SYMAP program, this routine has the name FLEXIN, and for the MARTIK, LANTRAN and IMPACT programs, it is called subroutine COMP. FLEXIN and COMP are similar in that they both provide the user the means for adapting a "standard" program to his "ad hoc" needs. They differ, however, in the way in which they are invoked. FLEXIN is called as an option by an input data package to read and/or manipulate data. COMP, however, is called as a keyword package with keyword

'COMPUTE', and hence is not necessarily associated with an input (or any other) phase of the program.

Since the "standard" programs are complicated in logical structure, it is generally not advisable to make ad hoc changes within them. Subroutines COMP and FLEXIN provide ideal means for isolating the application-dependent features and changes. In actual fact, many versions of COMP or FLEXIN may peacefully coexist, each representing a different application of the system with different conditions. At run time, the user includes his own COMP or FLEXIN in place of that supplied with the AQUIP system. Ambitious programmers who wish to make more extensive program changes may still confine them to their own COMP routine by replacing "standard" subroutines by entries into their own COMP subroutines, and then not including the "standard" routine at run time. An example of this procedure in application to the AQUIP system is given in the discussion of the MARTIK program, in which subroutine PRISE (which computes plume-rise) is replaced by an entry into subroutine COMP.

The essential functions of the routines are described as follows:

SUBROUTINE FLEXIN (IFORM,T,FIRST)

Used in:	SYMAP
Called by:	All input keyword packages except F-MAP if any of the columns 16-20 is non-blank.
Arguments:	
IFORM	An integer from 1 to 999 available to the routine to select among modes or options. This number is the first field on the option card, which follows the keyword card if any of the columns 16-20 is non-blank.
T	An array of variables returned to the calling routine. The dimension of T, and the variable designations depend upon the particular package.

FIRST — A logical variable, which is true the first time FLEXIN is called, and false thereafter.

Functions: — To read and preprocess as necessary the data elements required by the calling data package routine, or to manipulate data elements read in by the calling package routine (in standard format).

SUBROUTINE COMP (IC,IFORM)

Used in: — MARTIK, LANTRAN, and IMPACT

Called by: — The input processor routine whenever a keyword card 'COMPUTE' is encountered in the job stream. The parameters IC and IFORM are punched right-justified in columns 15 and 18 on the keyword card.

Arguments:

IC — Data set number for optional input (5 assumed unless overridden).

IFORM — An integer from 0 to 999 available to the routine to select among modes or options.

Functions: — Performs any computations desired by the user, making use of program parameters and intermediate program results through the set of labeled common blocks (listed separately in program discussions). Input-output operations may be performed. Certain subroutines normally used in the program may be replaced by "ad hoc" entries into subroutine COMP. In addition, a set of subroutines is available for use by the COMP routine for specific functions.

In writing new FLEXIN or COMP routines, or modification of existing ones, care must be taken if labeled common blocks are used or new subroutines generated (called by COMP). Operation errors will occur if the names of existing control sections (subroutine names or labeled common block names) are not used in a manner consistent with that in the main program.

1.4 Summary of Program Requirements

A summary of the storage, operation and system requirements of the AQUIP system programs appears in Table 1. This table is based on the assumption that only the four AQUIP programs, MARTIK, LANTRAN, IMPACT and SYMAP are executed from a disk-resident load module. The utility programs, which are less-frequently used, are assumed to be run from binary decks for the IBM 360/75.

The number of runs required is based on the minimum number of runs required for analysis of the Hackensack Meadowlands 1990 plan (for three seasons). Two MARTIK runs are assumed for each season (for: (1) point and gridded area sources, and (2) line sources). Single-run execution times are given as cpu time ranges. Of all the programs, only MARTIK is not I/O bound, and thus actual running times for the others are determined by the time required for printing.

Peripherals required by AQUIP system software are:

- 1 Card Reader
- 1 132-Character printer with program control over carriage spacing
- 1 Card Punch
- 1 2314 or equivalent disk for object-module storage (for programs to be executed from disk)
- 1 Sequential 2314 disk file for the AQUIP run log ("LOGDATA") file.
- 3 Sequential data files (tape or disk) for data sets.

Storage requirements for object modules and data sets are given in Table 1.

1.5 System Run-Log

All programs in the AQUIP system make use of a simple run-log procedure, built around subroutine HEADR and the disk file "LOGDATA". Although actually

TABLE 1

SUMMARY OF AQUIP PROGRAM REQUIREMENTS

Program Name	LANTRAN (P1)	MARTIK (P2)	IMPACT (P3)	SYMAP (P4)	METCON (U1)	UPDATE (U2)
COMPUTER	360/75	360/75	360/75	360/75	360/75	360/75
I STORAGE REQUIREMENTS						
A. Core-no overlays, k bytes	190	100	85	250	-	-
B. Core-with overlays, k bytes	115	52	60	85	-	-
C. Program Storage (disk), tracks	45	20	20	45	-	-
D. Deck size, cards	3500	1800	1500	5000	600	400
II OPERATING REQUIREMENTS						
A. Relative number of runs(1)	2	6	4	3	-	-
B. Single run cpu time, min(2)	1-2	15	.5-4	.25-2	1	1
C. Total cpu time per plan, min.	2-4	90	2-16	1-6	-	-
D. Single run print pages	150-300	15-25	10-75	10-50	10	3*
III DATA SET REQUIREMENTS						
A. Number of 2311/2314 Files	4	3	1	4	1	1*
B. Number of Tracks, total	37	4	1	16	1	1*
C. Additional: Tapes (max)	2	0	0	2	0	0*
Card punch?	Yes	Yes	Yes	No	Yes	Yes

(1) Minimum number of runs to analyze one Hackensack Meadowlands 1990 plan.

(2) Run times do not include wait state (print) time.

*Depends upon application of program.

a sequential file, the LOGDATA file is in effect a random-access file consisting of a table of up to 100 coded entries identifying (1) a program number, (2) version number, and (3) a sequential run number from 1 to 999. At the beginning of each run of a program, a call to HEADR reads the file from disk, searches the table for the appropriate program number and version number, increments the run number, writes the new table back out to the file, and prints a header message with the program name, date and run number. Run numbers for version 1 of a program lie in the range 1001-1999, those for version 2 in the range 2001-2999, etc. In this manner, each run with a given program, or version of a program is given a unique number, which is useful in cataloging the output of a series of runs. In addition, output card data sets are punched with a leader card giving the name, date and run number appearing in columns 73-76 of each card.

1.5.1 Run-Log Initialization

The run-log file LOGDATA must be previously initialized before any of the AQUIP programs may be run. As implemented, the file has been properly initialized for the New Jersey Department of Transportation computer facilities. The following discussion is therefore aimed at the eventual necessity of reinitializing the file.

A simple "one-shot" FORTRAN IV program called LOGGEN (program U3) has been provided and is listed in the Appendix. The program writes a table of 100 zero integers into the file, endfiles it and stops. Once the file has been reinitialized, all run numbers will of course begin again at N001 where N is the version number of the program.

Parameters for the LOGDATA file specified by the following OS/360 Job Control Language (JCL) statement are:

TABLE 2 Parameters for LOGDATA File

```
//DOGDATA DD DSN=LOGDATA,DISP=(NEW,KEEP),UNIT=2314,VOL=SER=000001
// DCB=(RECFM=VS,BLKSIZE=260),SPACE=(CYL,1)
```

1.5.2 Output-Formatting Routines Page and Lines

An additional feature of this system, used in all programs (partially in SYMAP) is output formatted with a standard header at the top of each page. This header contains the program number, run number, program name, version, level (date of the last modification to the program, expressed as an integer of the form YYMMDD), the current run date, and the page number. This page header is controlled by two system subroutines: PAGE and LINES (an entry in PAGE). These routines are described briefly:

SUBROUTINE PAGE

Used in:	All programs.
Called by:	Any routine performing printed output
Arguments:	None
Functions:	Spaces to the top of the next page and prints the "standard" header.

SUBROUTINE LINES (N,&S)

Used in:	All programs except SYMAP
Called by:	Any routine performing printed output.
Arguments:	
N	An integer representing the number of lines by which the line pointer is to be incremented.
&S	A FORTRAN statement number (S) to which control passes when a new page has been started.
Functions:	Initially, the line count is set to 4. Each call to LINES increments the line count by N. When the line count exceeds 57 (the maximum number of lines per page) a call to PAGE is effected, the line count again set to 4, and return is to statement S of the calling program.

1.6 Principles of Data Flow

The AQUIP system data definition involves the user directly in the determination of names, units and meanings of the variable used in the system. To a high degree, the user defines the data flow to fit the needs of the particular system application. The "meaning" of a data set is thus dependent upon the means of its creation (i.e., whether as a user created punched card input, or the output of a computation step passed from one program to another). This detailed control over the flow of data requires a thorough understanding of the functions and usage of each program in the AQUIP system, and at the same time, careful record-keeping to ensure that the parameters applicable to all programs are mutually consistent. Care must also be taken to ensure that computation results of one program step are correctly labeled to ensure for example that results for one season will be used with other data for the same season.

The AQUIP system data flow is based on using keyword controlled packages. Many of these packages, such as the POINTS package, use identical card formats. Using an interchangeable deck in several programs, the user can be certain that he is using identical data for each of the programs. This is useful for data such as POINTS where the receptor locations must be identical in the several programs using the same receptor oriented data (such as concentration at a receptor). Beyond the interchangeable datasets, the AQUIP system programs also create keyword packages of data. These packages may be either cards or card images on disk or tape. The keyword card format permits use of card image datasets on disk or tape, using the variable IC on the keyword card.

This interchangeability is based partly on the uniform card formats, and partly on the modular structure of the programs. The keyword structure enables the user to specify in significant detail the order of operations, and the meaning of the variables. There is no set order for input keywords or for keywords which perform calculations. Each keyword has a meaning, which is the same in any of the programs in the AQUIP system. The POINTS package specifies receptor locations; VALUES specifies receptor related values. The SRCE package provides source data for MARTIK, regardless of whether it is created by LANTRAN or by the user directly; it has the same format in either case. COMPUTE operations are performed at the point at which the package is encountered in the input data stream. There are, of course, cases where one operation must be performed before another; in LANTRAN, when using the optional COMPUTES to determine emissions, the first COMPUTE package must calculate heat/hour before the second can calculate the fuel that must be burned to provide the needed heat.

1.7 AQUIP Program Test Cases

In order to demonstrate explicitly the use of the AQUIP system, and at the same time to illustrate the operation of the programs, a sequence of "test cases" has been prepared. This sequence traces a hypothetical land-use configuration throughout each program step. The preparation of input and the resulting output for each computation step are described as a section in the discussion for each program.

The test cases include several examples of data decks created by one program for use in another. Specific examples are;

1) The emission 'SRCE' data calculated in LANTRAN and used in MARTIK;

2) The background 'VALUES' calculated in MARTIK for later use in other MARTIK runs;

3) The total air quality VALUES calculated in MARTIK for ALLOCATION by LANTRAN to a grid.

4) THE "gridded" air quality calculated by LANTRAN for use in IMPACT.

The basic data flow applicable to the AQUIP test cases is shown in Figure 12. This data flow is only one of many inherent in the system design. The discussion for each program includes data flow diagrams which indicate the types of data which are required as to the program, and the types of data which are output by the program. This information may be used to connect the programs in other meaningful ways to solve other problems. This flexibility places a heavier load upon the user in defining his dataflow to suit his problem; but it frees him to solve many more complex and varied problems that can be found while analyzing various land use alternatives. The AQUIP system has the flexibility to be used for new problems requiring new dataflows.

The dataflow shown in Figure 12 is the conceptual dataflow in the test cases that were run. The input data is not specified in the actual order input, but rather is grouped by meaning.

Project grid data is the information required by the program to define the coordinate system and gridding system being used by the particular project. This information specifies the same coordinates and grid for each of the program whenever runs are being made in the project. This information may be chosen differently for different projects, but remains the same within a project.

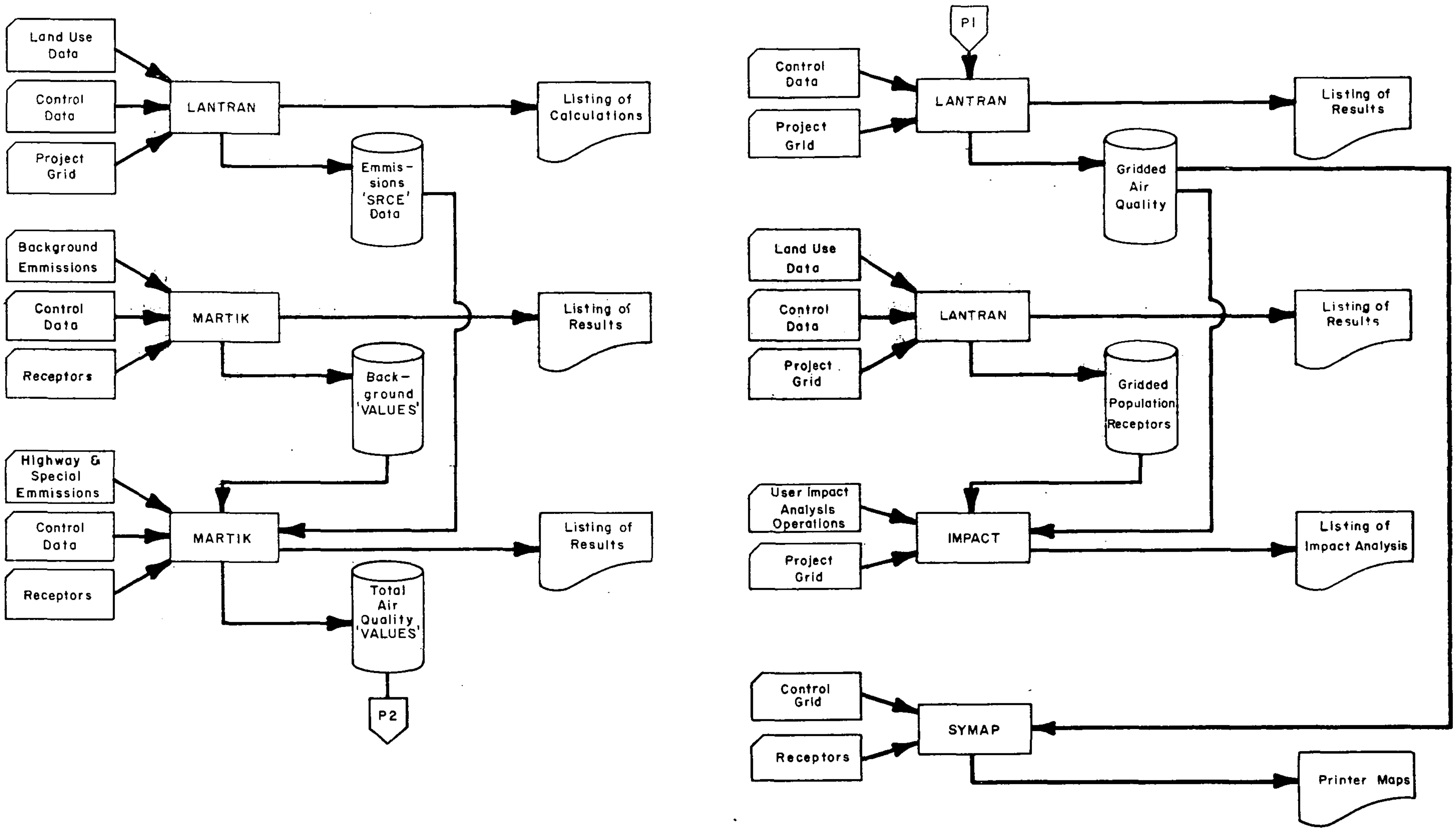


Figure 12 Test Case Flow Data

Land-use data is the same for all programs for each of the land use plans considered. It can of course vary from plan to plan.

The receptor locations must be the same for all programs used in the project. Data created with different receptors cannot directly be merged. Conversion by LANTRAN to a standard grid is the only method for properly merging values calculated for different receptor locations.

The non-universal datasets are: the control data, which controls program operation and varies from program to program. Within this category is also included the order in which data are given.

Highway and incinerator emissions must be specially calculated in addition to the LANTRAN output, for use as input to MARTIK, as explained in the Task 1 Report.

User impact analysis operations represent the control data for the IMPACT program. These operations determine the methodology by which the impact of the air pollution levels is assessed.

The structuring of inputs, data set descriptions and detailed data flow pertinent to the programs is given in the program discussion sections 2-5.

2. LAND-USE DATA TRANSFORMATION PROGRAM (LANTRAN) P1

2.1 Introduction

The purpose of the LANTRAN program is to convert land-use data to a rectangular grid system; to provide land-use statistics; to provide certain commonly used preprocessing procedures for land-use data; and, to establish data sets for use by other programs. This data may be separately calculated emissions data, or it may be land use data which will be converted into emissions data using the LANTRAN COMPUTES, or it may be some other data which is available on figures and is desired on a grid.

The program is organized around two basic forms of data: that related to land-use activities and represented by a set of geographically defined "figures" and that related to a grid system with its associated "cells". In LANTRAN the "figures" are the input and the grid system the output; i.e., the result of an allocation of activities defined on the figures to cells of the grid system. Internally, the two forms of data are represented by two large arrays. The first enables up to 18 different sets of data to be defined on up to 400 different figures, with each figure consisting of either: (1) a single point; (2) a broken line of up to 50 vertices; or (3) a polygon area of up to 50 vertices. The 18 "variables" are assigned symbolic names by the user at run time, making possible the manipulation of data by reference to the symbolic name. Examples of symbolic names which might be useful in land-use applications are 'POP-DENS' for population density of 'DU/ACRE' for density of dwelling units per acre of residential land.

The second array corresponds to the same 18 variables defined on a grid system of up to 400 cells. The grid system is specified by the horizontal and vertical coordinates of its "origin", the cell count in the horizontal and vertical directions, and the dimension of the grid cell in the horizontal and vertical directions. In addition, a scale parameter is specified to enable a convenient set of units such as kilometers or miles to be used for the coordinate system, and the physical height of the grid system is specified in meters.

In summary, the use of LANTRAN consists of (1) defining the set of FIGURES; (2) defining the variables associated with the figures and assigning VALUES for these variables to the figures; (3) performing an ALLOCATION which distributes selected variables among cells of the grid system; and, (4) creating an OUTPUT data set defined on the grid system, and putting this data set out either in punched-card form or as card images on a specified file.

In addition, the two basic forms of data represented by the figure-values or "FV" array and the grid-values or "GV" array may be manipulated before or after allocation using an application-specific subroutine (COMP) written by the user.

2.1.1 Allocation Modes

Any number of "allocations" may take place within one program run, with each allocation assigning up to six variables according to one of four modes:

1) Allocation by Extent

In mode 1, any point is allocated to the cell containing it. Partially contained lines or polygons are allocated in proportion to the length or area falling with a given grid cell. Internally, data assigned to either the FV or GV system are expressed as intensive variables. Thus, if an extensive variable is given for a figure variable (e.g., total population), it is first converted to intensive form by dividing by the figure area (or length). Variables allocated to the grid system are thus in the form of units per square scale unit and are therefore independent of the size of the grid cell chosen.

Examples:

a. Allocation of population density 'POP-DENS' given by county (polygon figures). After allocation, each cell of the grid system contains the mean population density (in the same units as those given for the counties).

b. Allocation of vehicle density 'VEH-DENS' given by highway (line figures). If the input data are given in terms of vehicles per linear scale unit the values allocated to grid cells will be in vehicles per square scale unit.

2) Allocation by Association

In mode 2, one of the variables of the FV system is selected as a "reference variable." Within any grid cell, the figure for which the total of the reference variable contained within the cell is maximum is said to be "predominant" for that cell. For each variable allocated by mode 2, the value assigned to the cell is that of the predominant figure for that cell.

Examples:

a. Allocation of effective stack height 'STK-HT' could be accomplished using mode 2 with stack volume 'STK-VOL' used as a reference variable. In this case the figure with the largest integrated stack volume within a cell would determine the value of the stack height assigned to the cell.

8315

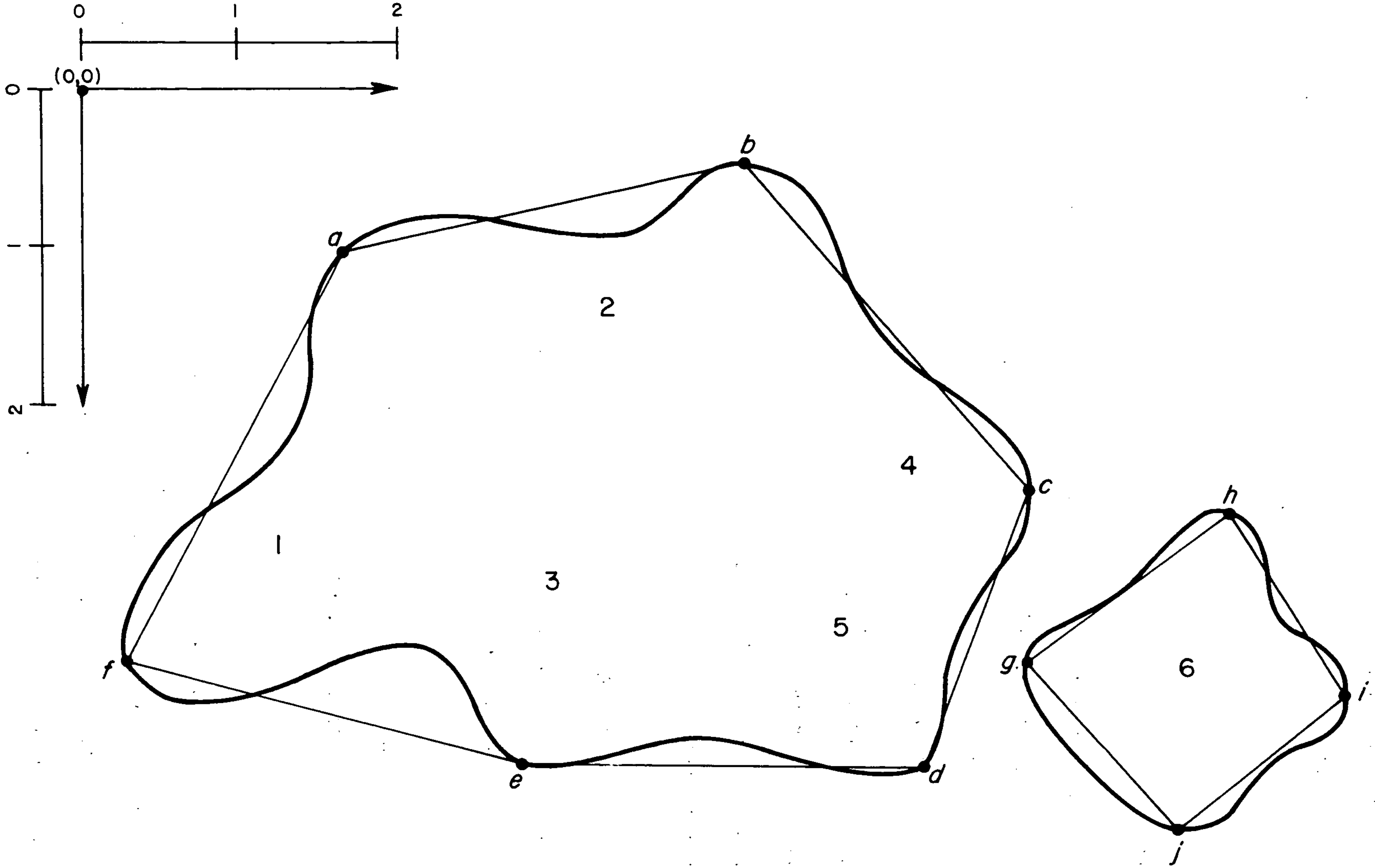


Figure 13 Contour Source Map

b. A variable representing water 'WATER' might be allocated using mode 2 with the reference variable being the area of a figure representing a body of water ('EXTENT' for a polygon figure), or land. For any cell in which the body of water is predominant, the value of 'WATER' is set to that of the body of water, and vice versa.

3) Allocation by Interpolation

In mode 3, the value assigned to a given cell is the result of a weighted average of figures with the weight for each figure determined by the inverse-square of the distance from the cell centroid to the figure centroid. In this mode, a number of figures may be used to produce a surface on the output grid system.

Examples

a. Allocation of pollutant concentrations given at selected points called "receptors" might best be done with mode 3. If 'HYDROC' is the symbolic name assigned to the hydrocarbon concentration at the set of point figures, allocation by mode 3 yields a surface and the value for each cell is thus the surface mean for that cell.

4. Allocation by Proximity

In mode 4, the value assigned to a given cell is that corresponding to the figure whose centroid lies closest to the cell centroid.

Examples

a. In determination of the influence of shopping centers upon a given cell, mode 4 would be used if the residents of a cell were assumed to to use the nearest shopping center. In this case a variable representing sales volume for shopping centers might be allocated to yield sales volume per square scale unit for each grid cell.

2.1.2 Keyword Package Summary

Program input is organized along the keyword package structure described in Section 1.3. In the AQUIP version of LANTRAN, the following keyword packages have been implemented:

PARAMETERS

This card directs the reading of a parameter namelist & INPUT in which all run options and computation parameters are specified. All parameters have defaults, and need be specified only when they are changed. Some internal program parameters are also accessible to the user through the &INPUT namelist. A list of currently implemented parameters appears in Section 2.2.1.

FIGURES

This card initiates the reading of land-use "Figures" in SYMAP A-CONFORMALINES format. Point, line or polygon area figures may be specified, with up to 50 vertices allowed for a single figure. The figures are transferred to data set #11 for allocation to a grid system via an ALLOCATION package.

POINTS

This card initiates the reading of point "Figures" in MARTIK format. Each card defines the horizontal and vertical coordinates of a single point. Each point thus defined is added to the Figures data set #11 just as if it had been read in with a FIGURES package.

VALUES

This card initiates the reading of values to be assigned to up to 400 figures. Up to 18 different sets of values may exist at any one time, each set identified by a symbolic name (e.g., 'BTU/HR') specified at run time. Up to six such variables may be defined and initialized in one VALUES package. Values, punched six to a card initialize the specified variables for one figure. Again, if values are to be changed, only those to be changed need be included in the VALUES package. Of the 18 variable sets, the first is permanently reserved for the figure "extent", which is the area of a polygon, length of a line and unit for a point figure. The name of this first variable is 'EXTENT.'

GRID

This card allows the grid systems which correspond to the 18 sets of variables to be initialized for (1) transformation or (2) manipulation using a COMP subroutine. Up to six variables may be defined or redefined in one GRID package. Each card initializes the specified variables for one single cell of the set. Up to 400 cells may exist in any single set of grids.

ALLOCATION

This card initiates a package which allocates the figures described by the FIGURES package to the specified grid system. The ALLOCATION package contains four allocation commands: (1) the mode command selects one of four allocation modes and allocates up to six variables to their corresponding grid systems; (2) the list command causes named grid system variables to be listed in F-format; (3) the plot command causes named grid variables to be plotted graphically using the GPLOT subroutine; and (4) the zero command sets named grid variables to zero.

ACTIVITIES

This card initiates the reading of a set of activity-dependent parameters which may optionally be assigned as values for land-use figures or control the assignment and allocation of values to figures or to a grid system. Each activity is coded by means of an 8-character word (e.g., 'S2036') which defines an entry in the activities table. In addition, each activity code carries another 8-character key word representing (if non-blank) the code of the activity whose parameters are to be applied to this activity (e.g., 'S2036' may use the parameters of 'S20'). Seven variables are given in the table for each activity, relating to such fundamental properties as population density, heat demand, etc.

OUTPUT

This card causes an output data set to be created in GRID format, with six named variables put out in card-image format on a specified data set.

CLEAR

This card clears the symbol table, and resets the number of variables to one ('EXTENT' is never deleted from the table). All grids are zeroed, as are all sets of figure values except 'EXTENT'.

COMMENTS

This card initiates the reading of a package designed for the convenience of annotating the output with comments. Any number of comments cards may follow, each with a carriage control character (blank, 0 or 1) in column 15, and the comments line in columns 21-70. A non-blank character in column 72 indicates that an additional comment card is to follow. Comments are read and printed until the last card read contains a blank in columns 71-72. An additional feature of the LANTRAN data set structure is that for most card data sets, comments may be imbedded in the data by punching a non-blank character in column 72 of the card read before the comments are inserted.

COMPUTE

This package has been provided to enable the LANTRAN program to be adapted easily to special cases in which user-designated calculations and data set manipulations are to be done at intermediate stages of a job. The COMPUTE card calls a user-written subroutine COMP, which may perform calculations, additional input-output, and manipulation of data sets as required by the specific program applications.

ENDJOB

This card causes termination of the program with the message "END OF PROGRAM".

These packages are discussed in detail in Section 2.2, with the exception of COMMENTS and ENDJOB which are discussed in Section 1.3, and COMPUTE which is covered in Section 2.3.

2.1.3 Program Output

The normal output of LANTRAN consists of:

1. Listing of figure data as read in, including the coordinates of the centroid and extent for each figures.

2. Listing of values for figures as read in, tabulated by variable.

3. Listing of the extent of figures as allocated to grid cells by mode 1.

4. Tabular listing of values assigned by allocation to grid cells, given by variable.

5. A graphical plot of each resultant grid using symbols representing up to 10 value levels with symbolism made up of four overprint characters.

6. For each grid-plot, a listing of the number of cells falling within each value range.

7. One or more output data sets of grid values in card-image format either as punched cards or as a disk or tape file.

2.2 Keyword Packages

2.2.1 PARAMETERS

The format of the LANTRAN PARAMETERS package is as given in Section 1.3.3. The name, type, dimension, default value and a brief description of meaning is given for each parameter currently accepted by the namelist &INPUT:

Name	Type	Dim.	Default	Meaning
SCALE	R4	1	1000	Coordinate scale unit, meters
JC	I4	1	0	Zero if no output data set; otherwise, the data set reference number of the output data set.
ORIGIN	R4	2	0.,0.	Horizontal (east-west) and vertical (north-south) coordinates of grid origin in scale units; (southwest corner of grid-cell with indices (1,1))
GX	R4	1	1.0	Horizontal dimension of grid cell, in scale units
GY	R4	1	1.0	Vertical dimension of grid cell in scale units.
NX	I4	1	0	Number of cells in the horizontal direction.

Name	Type	Dim.	Default	Meaning
NY	I4	1	0	Number of cells in the vertical direction.
RZRO	R4	1	1.0 E-4	Square of the distance R_0 within which points to be allocated by mode 3 are given equal weight.
NLEV	I4	1	10	Number of value levels for PLOT.
LEV	R4	10	*	The set of maximum values corresponding to each value range for PLOT.
SYMB	R4	10	*	The set of symbols corresponding to each value range for PLOT. Each symbol contains up to 4 characters to be combined by overprinting.
PRINT	L4	1	.TRUE.	False for partial print suppression.
REWIND	I4	10	10*0	Set to zero before reading namelist. Any non-zero data set number is rewound at this point.
HEADR	L4	1	.TRUE.	False to suppress output of SRCE card in output data set.

Default values for the plot parameters are given in the following table:

Level Number	Minimum Value	Maximum Value	Symbol
1	--	0.	' ' (blank)
2	0.	1.	'.'
3	1.	2.	'-'
4	2.	5.	'='
5	5.	10.	'+'
6	10.	20.	'X'
7	20.	50	'O'
8	50.	100.	'O-' (note overprint)
9	100.	200.	'OX'
10	200.	--	'OXAV'

*See list.

2.2.2 FIGURES

This package reads in the set of point, or polygon "figures" which define a land-use plan, and writes it to unit 11. A figure may consist of a single point (one vertex), a broken line (two or more vertices), or a closed polygon (four or more vertices with the last coincident with the first). Here a "vertex" is defined as a pair of coordinates (horizontal, vertical) measured in scale units, which locate a point. Within the FIGURES package, each "vertex" is described by a single card, and one figure may have up to 50 vertices. Up to 400 figures may exist at any one time in the LANTRAN program. Note that a FIGURES package may be read by a SYMAP A-CONFORMOLINES package (Section 5.2.2) for optional conformant-zone plotting of land-use data.

FIRST CARD - Keyword card 'FIGURES' in "standard" format (Section 1.3.2)

LAST CARD - Delimiter card '99999'.

INTERMEDIATE CARDS - Data cards (one or more for each figure):

FIRST CARD - Identification card (one for each figure)

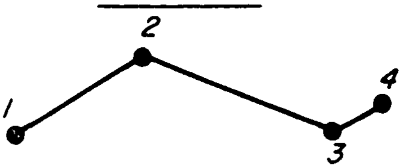
Columns	Variable	Format	Meaning
1-5	IREF	I5	Figure reference number. If zero, the figure is assigned the next number in the sequence.
10	JT	A1	'P', 'L' or 'A'
11-20	XX	F10.3	Horizontal coordinate of first vertex, scale units.
21-30	YY	F10.3	Vertical coordinate of first vertex, scale units
31-40	PLAN	A8, 2X	8-character code (for printing only).
41-50	CODE	A8, 2X	8-character activity reference code.
51-70	TITLE	5A4	20-character title for printing.

FOLLOWING CARDS -	One for each additional vertex.		
Columns	**Variable**	**Format**	**Meaning**
1-5			Must be blank.
6-9	IV	I4	Vertex number, beginning with 2 and increasing by one with each vertex. Must be in order, (proceeding in a clockwise direction for positive area).
10			Must be blank
11-20	XX	F10.3	Coordinate of vertex
21-30	YY	F10.3	Coordinate of vertex
31-70			Not used.

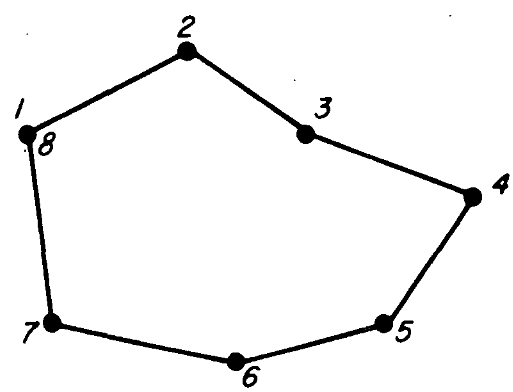
NOTE that for an area figure, the last vertex must be identical to the first; i.e., the figure must be closed. NOTE also that a maximum of 50 vertices are allowed, for any one figure.

The procedure for coding figures is shown below. The first example represents a line figure, the second a simple area figure, and the third an area with a "hole" in the center (coded counter-clockwise for negative area).

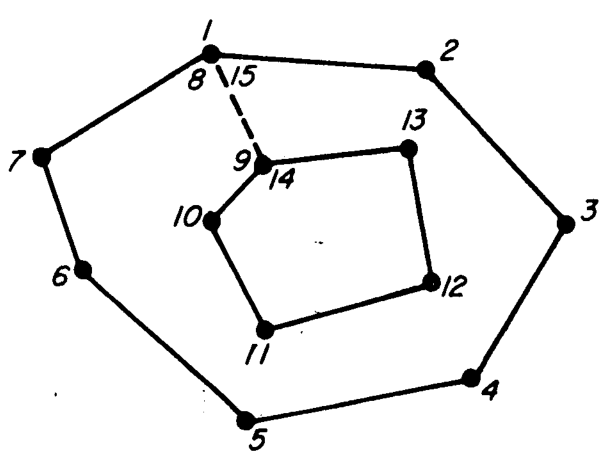
EXAMPLE #1



EXAMPLE #2



EXAMPLE #3



Procedures for Coding Figures with Examples for Line and Area Figures

2.2.3 POINTS

This package reads in the coordinates for a set of point figures in MARTIK format. These data are then added to the data set on unit 11 just as if read in a SYMAP 'B-DATA POINTS' package (Section 5.2.3) for optional plotting of land-use data.

FIRST CARD - Keyword card "POINTS' in standard format (Section 1.3.2).

FOLLOWING CARDS - One for each point figure.

Columns	Variable	Format	Meaning
1-7			Must be blank
8-10	IREF	I3	Figure reference number, with same conventions as for FIGURES.
11-20	XX	F10.5	Horizontal coordinate, scale units.
21-30	YY	F10.5	Vertical coordinates, scale units.
31-40	--	F10.5	Height, meters (not used by LANTRAN)
41-70	TITLE	7A4,A2	30-character name for printing.

LAST CARD - Delimiter card '99999'

2.2.4 VALUES

This package reads in the set of values for six named variables to be assigned to figures. Each card causes the values for the six variables to be assigned to one identified figure. Only those figures referenced by a VALUES package are modified. If the variable names given on the "name" card have been previously defined, values replace those previously assigned; otherwise the name is added to the list. A maximum of 18 variables, including 'EXTENT' are allowed. Note that the card format for 'VALUES' is identical to that used in MARTIK (Section 3.2.4), and that a 'VALUES' package may be read by a SYMAP 'E-VALUES' package (Section 5.2.5) for optional plotting of land-use data.

FIRST CARD - Keyword card 'VALUES' in standard format (Section 1.3.2).

SECOND CARD - Variable Name Card

Columns	Variable	Format	Meaning
1-10			Must be blank.
11-18	VN(1)	A8	Name of first variable
19-20	KT(1)	A2	Blank if variable is intensive as read in; if non-blank, values are divided by figure extent.
21-28	VN(2)	A8	Names and type codes for variables 2 through 6.
29-30	KT(2)	A2	
	. . .		
69-70	KT(6)	A2	

FOLLOWING CARDS - One for each figure to be initialized.

Columns	Variable	Format	Meaning
1-7			Must be blank
8-10	IFIG	I3	Reference number of figure to which values are to be assigned.
11-20	FVAL(1)	F10.5	Values for up to 6 variables.
	. .	. .	
61-70	FVAL(6)	F10.5	

LAST CARD - Delimiter card '99999'

NOTE that up to six variables may be assigned in one 'VALUES' package. If less than six are to be assigned, the name fields for the remaining are left blank.

2.2.5 GRID

This package defines a grid system and initializes a subset of the cells of that system with values for up to six variables. It is analogous to the 'VALUES' package except that it refers to cells of a grid system rather than to figures. In LANTRAN, a grid of up to 400 cells may be defined.

NOTE that a 'GRID' package may be read by a MARTIK 'SRCE' package (Section 3.2.7.)

FIRST CARD - Keyword card 'GRID' in standard format (Section 1.3.2).

SECOND CARD - Variable name card.

Columns	Variable	Format	Meaning
1-10			Must be blank.
11-20	VN(1)	A8,2X	Name of first variable (must be intensive as read)
21-30 . . 61-70	VN(2) . . VN(6)	A8,2X . . A8,2X	Names of variables 2-6.

THIRD CARD - Grid parameter card.

Columns	Variable	Format	Meaning
1-5	NX	I5	Number of cells in the horizontal direction.
6-10	NY	I5	Number of cells in the vertical direction.
11-20	ORIGIN(1)	F10.5	Horizontal coordinate of grid (southwest corner of cell (1,1), scale u.
21-30	ORIGIN(2)	F10.5	Vertical coordinate of grid origin, scale u.
31-40	GX	F10.5	Horizontal grid-cell dimension, scale units.

NOTE that up to six variables may be assigned in one 'GRID' package. If less than six are to be assigned, the name fields for the remaining are left blank.

Columns	Variable	Format	Meaning
41-50	GY	F10.5	Vertical grid-cell dimension scale units.
51-60	SCALE	F10.5	Scale unit, meters.
61-70	HH	F10.5	Height, meters
FOLLOWING CARDS	– One for each grid-cell to be initialized.		
1-5	IX	I5	Horizontal cell index.
6-10	IY	I5	Vertical cell index.
11-20	GVAL(1)	F10.5	Values for up to six variables.
.	.	.	
.	.	.	
.	.	.	
61-70	GVAL(6)	F10.5	
LAST CARD	- Delimiter card '99999'		

2.2.6 ACTIVITIES

This package reads in up to seven categories of data which can be linked to figures by means of the 'CODE' field punched in the 'FIGURES' package for each figure (see Section 2.2.2). These data are actually not used by any of the "standard" functions of LANTRAN, but instead form a data set for manipulation by a user-written COMP routine. The activity names, and the values assigned may thus be different in each application. A system of 'CODE' designations may be developed such that only those activity values which are different need be entered.

FIRST CARD - Keyword card 'ACTIVITIES' in standard format (Section 1.3.2).

SECOND CARD - Activity variable name card.

Column	Variable	Format	Meaning
1-10	AVNAM(1)	A8,2X	Activity variable names (up to seven)
.	.	.	
.	.	.	
.	.	.	
61-70	AVNAM(7)	A8,2X	

FOLLOWING CARDS - One or two cards per activity code (up to 100)

FIRST CARD - Activity code identification card (one for each code)

1-10	KEY	A8,2X	Key-activity code
11-20	ACT	A8,2X	Activity code
21-30	TITLE	12A4,A2	Activity name for printing.

SECOND CARD - Present only if ACT is blank on first card.

1-10	VALUE(1)	F10.5	Values for up to 7 activity variables to be assigned to this activity code.
.	.	.	
.	.	.	
.	.	.	
.	.	.	
61-70	VALUE(7)	F10.5	

LAST CARD - Delimiter card '99999'

The use of the 'KEY' and 'ACT' activity codes is as follows: If both the KEY and ACT fields are non-blank, the values (previously) assigned to the code KEY are assigned as well to code ACT. The second card doesn't exist in this case. If, however, only KEY is specified, then a second card does follow to supply values for assignment to that code.

As an example, consider a set of four basic sets of transportation codes T1, ...,T4. A unique set of values for the activity variables is to be assigned to codes T1 and T2, but codes T3 and T4 are to use those assigned to T1. Then the setup of the ACTIVITIES package would be:

KEY	ACT	TITLE
T1		(Title, code T1)
		(second card with T1 assignments)
T2		(Title, code T2)
		(second card with T2 assignments)
T1	T3	(Title, code T3)
T1	T4	(Title, code T4)
.	.	.
.	.	.
.	.	.

2.2.7 ALLOCATION

This package controls the allocation of figure values from the "FV" array to the grid system represented by the "GV" array. The package is made up of subsets, each controlling one of four functions:

1. MODE - perform an allocation according to a specified mode.
2. LIST - tabulate grid values for selected variables
3. PLOT - plot grid values for selected variables
4. ZERO - set grid values to zero

Each function sub-package consists of one or more control cards. The format of the first card of the sub-package is always the same, while that of additional cards (if any) depends upon the function. In this and all other data packages columns 71-72 are used to signal subsequent comments cards, and columns 73-80 are reserved for card sequencing.

FIRST CARD - (of ALLOCATION package) - Keyword card 'ALLOCATION' in standard format (Section 1.3.2)

INTERMEDIATE CARDS - Grouped in function subpackages.

LAST CARD - Delimiter card '99999'.

The format of the function subpackages is as follows:

FIRST CARD (of each function subpackage)

Columns	Variable	Format	Meaning
1-4	KEY	A4	'MODE'. 'LIST', 'PLOT' or 'ZERO'
5-7	N1	I3	Parameter N1
8-10	N2	I3	Parameter N2
11-20	NAME(1)	A8,2X	Names of variables
21-30	NAME(2)	A8,2X	
.			
.			
61-70	NAME(6)	A8,2X	

SECOND AND FOLLOWING CARDS - Format dependent upon function subpackage.

(1) MODE Function - FIRST CARD

N1 = mode to be used for allocation (1 to 4)

N2 = allocation option: 0 to allocate all figures
1 to allocate selected figures
2 to allocate all but selected figures

NAME refers to variables to be allocated.

If N = 2 (MODE 2), the second card of the subpackage must contain the name of the reference variable punched in columns 11-20. For MODES 1, 3 and 4, this second card is omitted.

Columns	Variable	Format	Meaning
1-5	IREF(1)	I5	Figure reference numbers.
5-10	IREF(2)	I5	
.	.	.	
.	.	.	
65-70	IREF(14)	I5	

If N2 = 0, no additional cards follow in the MODE function subpackage.

If N2 = 1, there are as many additional cards as required to list the figures to be allocated according to the above format. The list is terminated with the figure reference number 999.

If N2 = 2, there are as many additional cards as required to list the figures not to be allocated. Again, the list is terminated with the figure reference number 999.

EXAMPLE

```
0         1         2         3         4         5         6         7
01234567890123456789012345678901234567890123456789012345678901234567890

 ALLOCATION          EXAMPLE OF MODE FUNCTION SUBPACKAGE
 MODE   1    BTU/HR     DU/ACRE    OP-SCH
 MODE   2   1STK-HT
             STK-VOL
     1    8    17   999
 MODE   3   2POP-DENS   EMP-DENS   VEH-DENS
    32    33    41    57    62   999
 99999
```

In the example, the variables 'BTU/HR, 'DU/ACRE', 'OP-SCH' representing densities for heat consumption, dwelling unit density and plant operating schedule are allocated for all figures by extent. The stack height is determined using stack volume as a reference variable only for three figures, with reference numbers 1, 8 and 17. MODE 3 is used to allocate population density 'POP-DENS', employee density 'EMP-DENS' and vehicle density 'VEH-DENS' for all figures but those listed, with reference numbers 32, 33, 41, 57 and 62.

2. LIST Function (one card only)

N1, N2 not used. NAME refers to variables to be listed.

EXAMPLE

```
0         1         2         3         4         5         6         7
01234567890123456789012345678901234567890123456789012345678901234567890
 LIST      BTU/HR    STK-HT    POP-DENS  EMP-DENS  VEH-DENS
```

In the example, the variables 'BTU/HR', 'STK-HT', 'POP-DENS', 'EMP-DENS' and 'VEH-DENS' are tabulated by grid cell beginning with the top row (most northerly).

3. PLOT Function (first card)

N1 = PLOT option: 0 use previously determined symbols
1 input a new symbol set

N2 = PLOT option: 0 use previously determined levels
1 input a new set of levels
2 use variable range to set levels
NAME refers to variables to be plotted.

If both N1 and N2 are 0, no additional cards follow in the PLOT function subpackage. If N1 = 1, a card of the format follows the first:

Columns	Variable	Format	Meaning
1-5	NLEV	I5	Number of levels if non-zero.
11-15	ISYMB(1)	A4,1X	New symbol set
16-20	ISYMB(2)	A4,1X	
.	.	.	
.	.	.	
56-60	ISYMB(10)	A4,1X	

If N2 = 1 a card, or cards, of the following format follows:

1-5	NLEV	I5	Number of levels if non-zero.
11-20	VLEV(1)	G10.3	New values for levels 1-6.
21-30	VLEV(2)	G10.3	
.	.	.	
.	.	.	
61-70	VLEV(6)	G10.3	

(Continued beginning columns 11-20 with VLEV(7) if NLEV is greater than 6.)

EXAMPLE

```
0        1         2         3         4         5         6         7
1234567890123456789012345678901234567890123456789012345678901234567890

PLOT     BTU/HR    POP-DENS
PLOT  1  WATER
    2    .   OXAV
PLOT  1 1VEH-DENS  EMP-DENS  HYDROC
    5    .    -    0    0-   OXAV
         0.        5.        10.       50.       100.
```

In the example, the variables 'BTU/HR' and 'POP-DENS' are plotted using previously defined symbols and levels. The variable 'WATER' is plotted using previously defined level values but new symbols for a binary (two-level) plot. In the third case, 'VEH-DENS','EMP-DENS' and 'HYDROC' are to be plotted using 5 levels with both the symbols and levels defined. As given above, all values less than 0. are denoted by the symbol ".", those between 0. and 5. by "=", etc.

4. ZERO Function (one card)

N1, N2 not used. NAME refers to variables for which all grid cell values are to be set to zero.

EXAMPLE

```
0        1         2         3         4         5         6         7
1234567890123456789012345678901234567890123456789012345678901234567890

ZERO     POP-DENS  EMP-DENS
```

In the example, the variables 'POP-DENS' and 'EMP-DENS' are set to zero for each cell of the grid system. NOTE that prior to allocation by MODES 3 or 4 (which relate all grid cells to figures) the grid is automatically zeroed. For MODE 1, allocated values are added to those already assigned to the grid system. For MODE 2, values already assigned are unchanged unless at least one figure to be allocated "overlaps" a given cell.

Additional Considerations for Allocation Package

1. The special variable 'EXTENT' which represents the set of figure extents is stored as the first variable of the FV array. It may be treated as any other variable; i.e., it may be allocated or used as a reference variable with MODE 2. If a single figure is allocated by MODE 1, for example, the grid variable 'EXTENT' represents the extent to which each cell is contained in the figure (0. to 1.0). If 'EXTENT' is used as a reference variable for MODE 2, care should be exercised in mixing point, line and area figures within one allocation, since 'EXTENT' has a different physical meaning for each type of figure. Since the intensive variable associated with 'EXTENT' is unit density, the result of an allocation of 'EXTENT' by MODES 3 or 4 is to assign the value 1.0 to each cell of the grid system.

2. If total values rather than densities are desired in the gridded output (e.g., population per cell rather than population density within each cell) this result may be obtained by multiplying each cell value by the cell area GX*GY (scale units**2) or GX*GY*SCALE**2 (meters**2), using a COMP routine invoked after the allocation procedure.

2.2.8 OUTPUT

This package creates an output data set for up to six selected variables, and puts it out in card-image format, as a 'GRID' package. If the output unit specified is 7, a 'GRID' package is punched.

FIRST WORD - Keyword card 'OUTPUT' in standard format (Section 1.3.2)

SECOND CARD - Variable name card (last card)

Columns	Variable	Format	Meaning
1-10			Must be blank.
11-20	VN(1)	A8,2X	Names of variables to be output (up to six)
.	.	.	
.	.	.	
61-70	VN(6)	A8,2X	

NOTE that a '99999' card may be used with an 'OUTPUT' package, but is not required.

2.2.9 CLEAR

This single keyword card causes all variables except 'EXTENT' to be deleted from the symbol table. All figure and grid values are set to zero.

2.3 AQUIP System Implementation

2.3.1 LANTRAN COMPUTE Routines for AQUIP

The LANTRAN COMPUTE subroutines perform two functions: (1) generation of emissions by figure from land-use data (IFORM = 1,2,3 and 4); and (2) allocation of specified land uses or their derivative (e.g., number of school children per cell) selected for correlation with air-quality levels (IFORM = 5 and 6).

The general function of each subroutine is as follows:

IFORM = 1: Calculates the heating requirements per figure, based on planning data.

IFORM = 2: Calculates emissions per figure, based on heating requirements, fuel use and emission factors.

IFORM = 3: Compares emissions with size criteria, creates point sources separately, and prepares the remainder for allocation to gridded area cells.

IFORM = 4: Outputs point sources for the specified season. This is a general input-output routine; it may also be used if computations are to be done step by step, or if none of the listed output is desired except the final results.

IFORM = 5: Allocates specified land-uses or derivatives for impact analysis correlation (creates the correlation data set).

IFROM = 6: A functional route for deleting a certain number of values without necessarily deleting all -- useful when interested in more than 17 land uses.

Data Preparation for LANTRAN COMPUTE

To aid in the understanding of the datasets, needed by the COMPUTEs, the following two sections describe the conversion of irregular land-use areas into "figures," and the determination of land-use values for these figures. The first section illustrates the techniques used in taking the shapes that are found on the land-use base map and finding the vertices of the polygons that will be input to the program in the FIGURES package. The methods used to determine the emissions from a figure are best described by using the sections of the Task 1 Report and its appendix that describe how they were specified for this study. The values given for the variables are not fixed values, but instead represent variables selected for evaluation by planners and scientists.

Figure 13 illustrates the method used to obtain a polygonal figure from an irregular shape. The vertices are chosen to correspond to the locations that best define the shape. Comparison of the straight line approximation to the sides of the shape indicates that some parts of the shape have been lost while other areas outside the shape are included in the polygon. More vertices could be chosen to get a closer fit to the shape if this fit is insufficiently accurate, or when the areas lost and gained are small they could be ignored as not significant errors.

With the vertices of the approximating polygon chosen, the user then determines the coordinates of the vertices in the coordinate system being used, and creates data cards in accordance with the FIGURES package description, Section 2.2.2.

The following discussion has been taken from the Task 1 Report of the Hackensack Meadowlands study, to illustrate the use of the LANTRAN program in application to that study.

Figure 14 shows the flow of information from activities to emissions. The first step involves the land use figures with their associated activity codes. The specific activity or land use codes used in the Hackensack Meadowlands study are shown in Figure 15. This table is discussed in detail in Section 4.1 of the Task 1 report, and included here for completeness of the present discussion.

The numerous land use categories were aggregated into six major categories for purposes of analysis. These are open space, institutional, residential, commercial, industrial and transportation as shown in Figure 14. Emissions from open space were considered negligible on an annual average basis and not treated in the analysis. Emissions from institutuional, residential and commercial were considered to be only fuel-use related, whereas emissions from industrial sources included both fuel and process emissions.

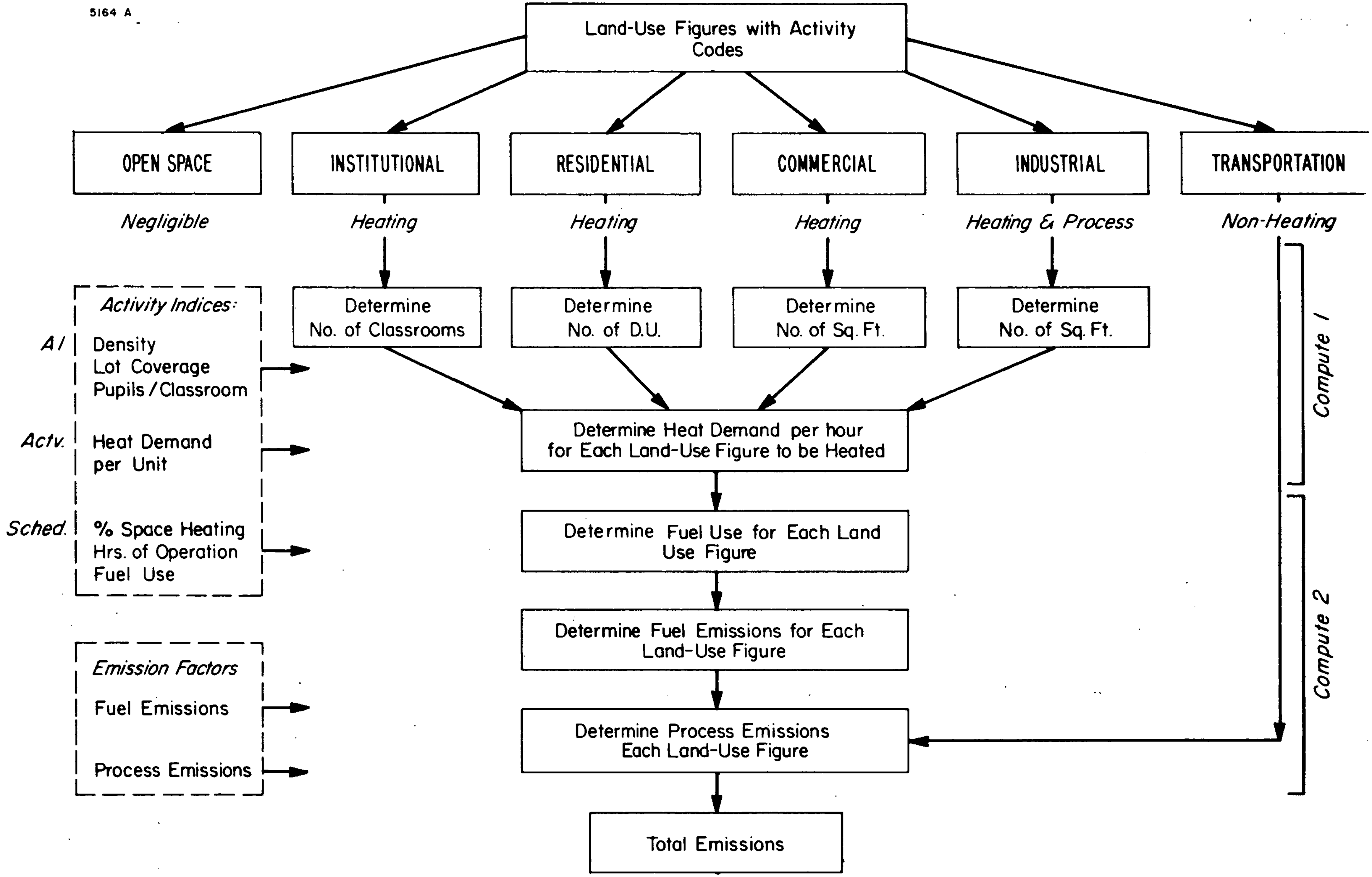


Figure 14 Flow of Information from Activities to Emissions as Used in the Hackensack Meadowlands Study

Figure 15

Land Use Plan Activities Used in the
Hackensack Meadowlands Study
(Task 1 Report, Section 4.1)

Category	Code	Plan 1	1A	1B	1C
Residential					
low density (10 du/acre)	R01	X	X	X	X
medium density (20 du/acre)	R21		X		
medium density (30 du/acre)	R31			X	
high density (50 du/acre)	R32			X	
high density (80 du/acre)	R22		X		
island resid. (50 du/acre)	R11	X			
parkside resid. (50 du/acre)	R12	X			
Commercial					
business-neighborhood	C11	X			
business-community	C12	X	X	X	
business-Berry's Creek Center	C31	X		X	
hotel & highway	C21	X	X	X	X
Institutional					
primary schools	I11	X	X	X	
secondary schools	I12	X	X	X	
cultural center	I71	X			
special uses	I90	X	X	X	
Industrial					
manufacturing	S20xx-S39xx	X	X	X	X
distribution	S42	X	X	X	
research	S89	X			
Transportation					
transportation center	T10	X			X
airport	T20	X	X	X	X
stadium parking lot	T30	X	X	X	X
Open Space					
conservation	Z11	X			
parks	Z12	X	X	X	X
water	Z20	X	X	X	X
commercial recreation	Z31	X	X	X	X

Notes:

Code pertains to the land use activity codes as used with the LANTRAN program; the above is the complete list used in the study. Four-digit SIC codes (2000-3999) were used for manufacturing activities. Other codes were developed for this study and do not correspond to any published classification system. The activity indices and emission factors used with the Meadowlands Plans are referenced to this activity code list.

In the Hackensack Meadowlands study, transportation emissions were divided into several categories. Discussions with the Meadowlands planners indicated that all highway emissions should be treated as line sources separately from the plans. Railroad emissions were considered negligible since most propulsion involves electric engines. Emissions from water transportation vehicles were considered negligible as well. The airport was handled as a non-fuel burning source with emissions related directly to the number of flights. A further refinement could have involved the specification of terminal areas as separate fuel-burning sources, but these were considered to be negligible in the regional scale annual average case. The parking lots for the sports stadium were also treated as separate non-fuel burning sources of emissions related to the number of vehicles idling at any one time. Actual transportation centers (similar to a bus terminal) were treated like any other commercial fuel-burning land use.

For each land use a heating requirement had to be determined in terms of BTUs per dwelling unit, classroom or square foot. Accordingly, as shown in Figure 14, it was necessary to determine the number of classrooms, dwelling units, or square feet for the respective categories of use. The activity indices such as density, lot coverage, and pupils per classroom were used to convert the land use data into the number of classrooms, dwelling units, and square feet. Once this information is known activity indices for heat demand per unit of activity can be used by COMPUTE 1 to determine the heat demand per hour for each land use figure that is to be heated.

Next, COMPUTE 2 is used to incorporate the fuel use information, including the schedule, percent process heat, and fuel use propensity into the analysis to determine the fuel used for each land use figure, as shown on the fifth line of Figure 14. The final step in determining the fuel emissions involves the incorporation of the appropriate fuel emission factors.

Process emissions for each land use figure that involved industrial sources are calculated by use of the process emission factors. Similarly, process type emission factors for transportation, the airport, and parking lots are used to determine the transportation related emissions. The summation of fuel and process emissions yields the last line in Figure 14, representing the total emissions for each land use figure.

The following sections describe in more detail each of the steps required in this process.

Each of the land use activities appropriate to the study was assigned an "activity code." These are listed in Figure 15, grouped according to the six land use categories shown in Figure 14. There are seven possible categories of residential land use although no more than three occur in any one plan. In the Hackensack Meadowlands study, these are generally low, medium and high density residual use, with densities defined by the Meadowlands planners. However, in the study Plan 1, the Master Plan, no distinction is made between medium and high density; rather, the distinction is between island and riverside development called "island residential" and "parkside-residential," respectively.

The four commercial categories are distinguished by their relationship to residential land use. Neighborhood and community business are generally directly related to residential use. The fourth category (hotel and highway commercial) contains separate commercial development.

Institutional land use is generally reserved for primary and secondary schools. In all cases these are directly related to the residential areas they serve.

The industrial category is subdivided into manufacturing, distribution, and research parks. The manufacturing land use category is further subdivided into four-digit SIC categories.

The transportation category is subdivided into the transportation center (treated similarly to a distribution activity), the airport, and the stadium parking lot; roadways were handled as separate line sources and, therefore, not coded for use with the LANTRAN program.

Four categories of open space were identified: conservation, parks, water and commercial recreation. None of these were thought to have significant emission levels. However, they are important "receptors" of the air quality calculated.

Residential sources may be large areas of single family homes with individual heating or they may be clusters of island residential apartment towers all heated from a central facility. Similarly, commercial establishments may be separate stores or hotels with individual heating systems, large shopping centers with a central system, or neighborhood stores heated by the central residential heating system. Schools were all assumed to be built as individual buildings; however, the amount of space involved is a function of the residential area served.

Distribution is generally considered to be a land use zone with homogeneous heating requirements served by individual systems. It is, therefore, characteristic of an area-wide source. For simplicity, cultural centers, most special uses, the transportation centers, and research activities were assumed to behave in a similar manner as distribution. All manufacturing activity was specified as a function of individual 10-acre lots. However, where adjacent lots are of the same four-digit Standard Industrial Classification Code (SIC), this implies a large facility of 20, 30, 40 or more

5165

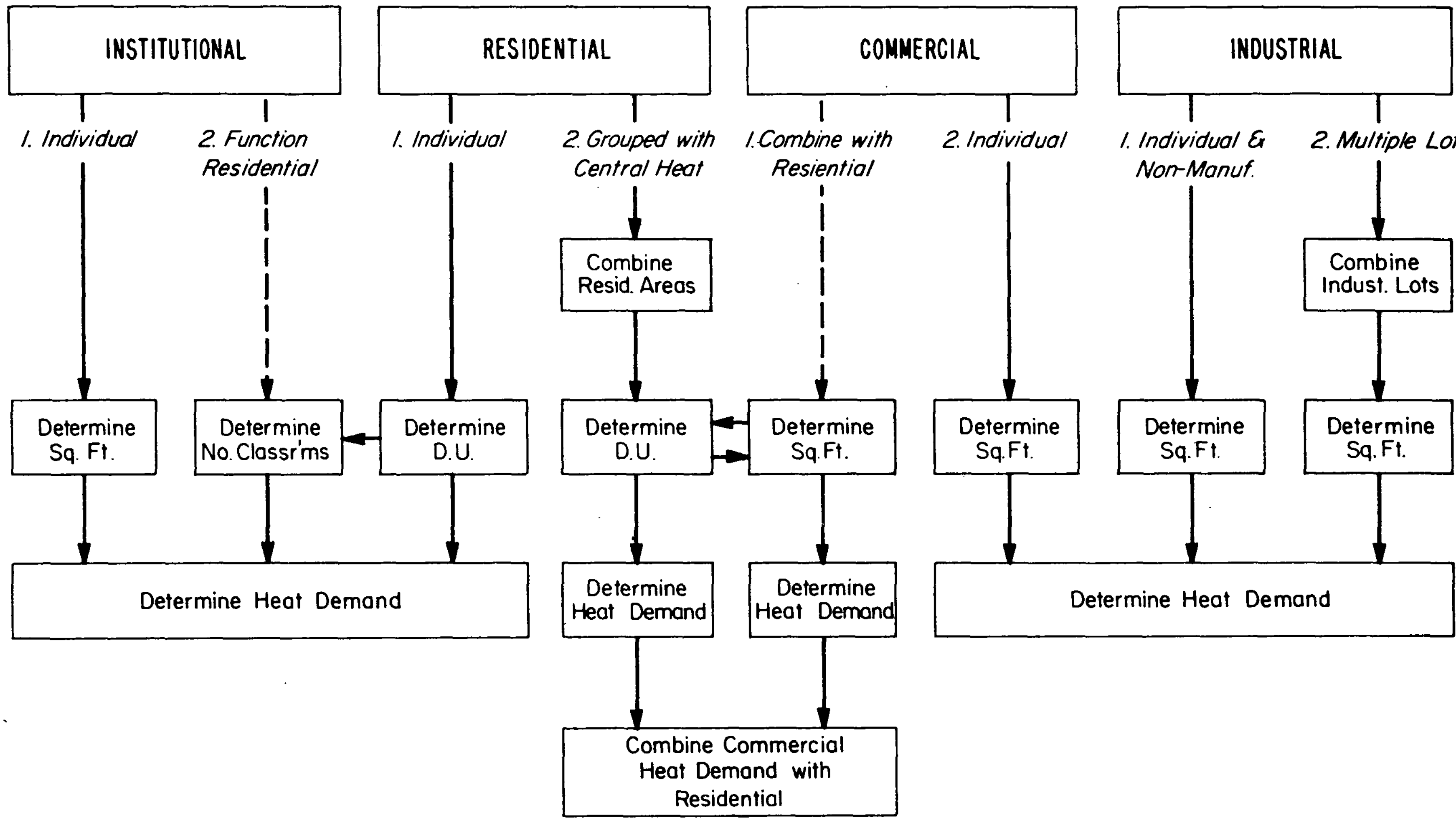


Figure 16 Decisions Affecting Heating Demand

acres with a single heating system. The airport was assumed to be an area-wide source; emissions were not allocated to individual runways. Because of the uncertainty as to where parking lots will be in the stadium complex, a single point source was used to represent the idling emissions from automobiles in the parking lots.

It became apparent that the particular ways in which each of the four plans would be built and have their heating requirements satisfied required a complex procedure for determining heating demand. The steps in the procedure developed are shown in Figure 16 for each of the four major categories of fuel-related emissions: institutional, residential, commercial and industrial. Each of these will be discussed in detail.

Institutional

The few cases of institutional land use in the Hackensack Meadowlands Study that were to be treated on an individual basis (the cultural center and special uses) involve only one step to determine the number of square feet heated as a function of the area of the land use zone. Since the cultural center was to be treated similarly to a distribution source, it is listed in that table under "distribution." The percent lot coverage and the floor area ratio are necessary to perform the calculation. The number of acres of land use, and the percent lot coverage tell us how many square feet of the lot will be built upon; the floor area ratio (as used here) shows how many floors will exist in the building. Figure 17 shows the actual numbers assigned to these parameters in the ACTIVITIES package used for COMPUTE 1 and used in the Hackensack Meadowlands Study, counter Example No. 1, activity code I-71 (the code for cultural center) and we read across to the columns labeled A-1 and A-2 we see the number 40 (the percent lot

EXAMPLE NO.		KEY-ACTIVITY	ACTIVITY	ACTIVITY NAMES ACTV	A1	A2	A4
2,3	Low Density	R01		18750,000	10,000	1,500	0,0
4,5	Mid Density	R11		7500,000	50,000	0,500	1500,000
		R12		7500,000	50,000	1,000	2000,000
		R21		13750,000	20,000	1,000	0,0
		R22		4000,000	80,000	0,500	0,0
		R31		8750,000	30,000	1,000	0,0
		R32		7500,000	50,000	1,000	0,0
5	Neighborhood Commercial	C11		16,250	0,500	1,000	0,0
		C12		16,250	1,500	1,000	0,0
		C21		16,250	35,000	0,750	0,0
6	Berry's Creek	C21	C31	16,250	35,000	0,750	0,0
2	Primary School	I11		15000,000	25,000	0,450	0,0
		I12		15000,000	30,000	0,200	0,0
1	Cultural Center	I71		12,500	40,000	1,000	0,0
		T10		12,500	40,000	1,000	0,0
		T20		0,0	0,0	0,0	0,0
		T30		0,0	0,0	0,0	0,0
7	Distribution	S42		12,500	30,000	1,000	0,0
		S42	190	12,500	30,000	1,000	0,0
9	Manufacturing	S39		27,500	40,000	1,000	0,0
		S39	S2031	27,500	40,000	1,000	0,0
		S39	S2032	27,500	40,000	1,000	0,0
		S39	S2033	27,500	40,000	1,000	0,0
		S39	S2034	27,500	40,000	1,000	0,0
		S39	S2304	27,500	40,000	1,000	0,0
		S39	S2307	27,500	40,000	1,000	0,0
		S39	S2041	27,500	40,000	1,000	0,0
		S39	S2043	27,500	40,000	1,000	0,0
		S39	S2045	27,500	40,000	1,000	0,0
		S39	S2051	27,500	40,000	1,000	0,0
		S39	S2052	27,500	40,000	1,000	0,0
		S39	S2082	27,500	40,000	1,000	0,0
		S39	S2086	27,500	40,000	1,000	0,0
		S39	S2087	27,500	40,000	1,000	0,0
		S39	S2095	:			

Figure 17 Activity Indices Used in the Hackensack Meadowlands Study (See Task Report, Section 4.2)

S39	S2295	27,500	40.000	1,000	0,0
S39	S2661	27,500	40.000	1,000	0,0
S39	S2721	27,500	40.000	1,000	0,0
S39	S2815	27,500	40.000	1,000	0,0
S39	S2816	27,500	40.000	1,000	0,0
S39	S2818	27,500	40.000	1,000	0,0
S39	S2819	27,500	40.000	1,000	0,0
S39	S2831	27,500	40.000	1,000	0,0
S39	S2833	27,500	40.000	1,000	0,0
S39	S2834	27,500	40.000	1,000	0,0
S39	S2842	27,500	40.000	1,000	0,0
S39	S2843	27,500	40.000	1,000	0,0
S39	S2844	27,500	40.000	1,000	0,0
S39	S2851	27,500	40.000	1,000	0,0
S39	S2992	27,500	40.000	1,000	0,0
S39	S3275	27,500	40.000	1,000	0,0
S39	S3291	27,500	40.000	1,000	0,0
S39	S3292	27,500	40.000	1,000	0,0
S39	S3431	27,500	40.000	1,000	0,0
S39	S3433	27,500	40.000	1,000	0,0
S39	S3551	27,500	40.000	1,000	0,0
S39	S3552	27,500	40.000	1,000	0,0
S39	S3554	27,500	40.000	1,000	0,0
S39	S3555	27,500	40.000	1,000	0,0
S39	S3561	27,500	40.000	1,000	0,0
S39	S3562	27,500	40.000	1,000	0,0
S39	S3566	27,500	40.000	1,000	0,0
S39	S3567	27,500	40.000	1,000	0,0
S39	S3573	27,500	40.000	1,000	0,0
S39	S3581	27,500	40.000	1,000	0,0
S39	S3582	27,500	40.000	1,000	0,0
S39	S3585	27,500	40.000	1,000	0,0
S39	S3589	27,500	40.000	1,000	0,0
S39	S3613	27,500	40.000	1,000	0,0
S39	S3635	27,500	40.000	1,000	0,0
S39	S3636				

Figure 17 (contd.)

coverage) and the number 1 (the floor area ratio).

Having determined the number of square feet assigned to the cultural center we can multiply by the BTU per square foot to calculate the heat demand. The appropriate number for BTUs per square foot is found in the first column of Figure 17 labeled ACTV; the value is 12.5.

The majority of institutional land uses are the schools; their heat demand is a function of the number of classrooms. The number of classrooms is related to the number of pupils per classroom, the number of pupils per dwelling unit, and the number of dwelling units in the residential area which the school serves.

Two of these parameters (the number of dwelling units and the pupils per dwelling unit) are activity indices related directly to the residential area. If the school serves a single family, low density area we would look in Figure 17 under the activity code R-01 (Example No. 2). The value (10.) in the column labeled A-1 is the number of dwelling units per acre and the value (1-5) in the column labeled A-2 is the number of pupils per dwelling unit. Therefore, each acre of low density land has 15 pupils assigned to the school serving that area. Since both primary and secondary schools exist it is important to know what percentage of the eligible pupils go to each of the different types of schools. If we are interested in the heat demand for a <u>primary</u> school, we would look in Figure 17 under the activity code I-11. The column labeled A-2 contains the number .45 which means that 45% of the school children would be going to the primary school.

Finally, using the value in column A-1 of 25 pupils per classroom we can determine the total number of classrooms necessary in primary schools to serve the particular residential area. If we have 100 acres of low density residential land, this would yield 1500 pupils, 45% of which is 675 primary school pupils; at 25 pupils per classroom this yields 27 classrooms. Multiplying by the BTUs per classroom found in the first column, 15,000, would yield the heat demand for that school.

Residential

Residential land uses have two sub-categories similar to institutional: individual heating and heating provided by central facilities. In the case of the individual heating (found in low-density housing) the heat demand is a direct function of the number of dwelling units. In Figure 17 for Example No. 3, under activity R-01 (low density residential), the column labeled A-1 shows 10 dwelling units per acre. Multiplying this times the BTU per dwelling unit value of 18,750 would yield the heat demand for an acre of low-density residential land use.

Most of the medium and high density development in the Meadowlands Master Plan and alternative Plans 1-A and 1-B would be satisfied by central facilities. A more complicated process is therefore required. First of all, it is necessary to determine which residential land use zones should be grouped together to be heated by a particular central system. The grouping results in a total number of dwelling units to be heated, assigned to a particular heating facility. This is accomplished by summing the acreage of all the affected land use zones and multiplying times the dwelling units per acre.

For instance, for island residential with a code of R-11, Figure II-34 Example no. 4, shows a value of 50 dwelling units per acre in column A-1. Because the average dwelling unit size in high density development is smaller and the efficiency of a central heating system is greater the BTU per dwelling unit value is only 7500 for this land-use category. When the total heat demand is determined it is assigned to the location of the central facility.

Commercial

Community and neighborhood shopping facilities are entirely a function of the residential land uses they serve. In the Meadowlands Master Plan these are the island and parkside residential areas. First of all, the actual square footage of commercial development must be determined as a direct function of the number and size of the dwelling units in the residential area; this procedure is depicted in Figure 16. Neighborhood shopping with a code of C-11 (Example No. 5) has a BTU per square foot demand of 16.25 as shown in Figure 17. The number in the column labeled A-1 tells us that 0.5% of the square footage of the residential development will be assigned to commercial use; this is the number specified in the Hackensack Meadowlands zoning regulations. But, for an island residential area with a code of R-11, how do we determine what the total square feet of residential area is? Figure 17, column A-4, gives us a value of 1500 square feet per dwelling unit. When this is multiplied by the number of dwelling units, we obtain the total residential square feet. Once the heating demand in BTUs per hour is determined for this commercial use it must be added to the heat demand for the residential area since all heating will be taken care of by the central facility.

Certain commercial facilities such as the Berry's Creek shopping center in the Meadowlands Master Plan will be heated individually. The number of square feet is a function of the lot coverage and the floor area ratio.

For example, the code for Berry's Creek (C-31) does not appear in the left column of Figure 17 (Example No. 6); it is indented and the code C-21 for hotel and highway appears in the left column. This indicates the assumption that Berry's Creek will be heated according to the same parameters as hotel and highway (C-21). Column A-1 gives us the lot average, and Column A-2 the floor area ratio. Multiplying the number of square feet times the value of 16.25 BTUs per square foot yields the total heat demand per hour. Some of the special facilities such as Berry's Creek may consist of more than one land use zone with a central heating facility. In this case, the procedure is similar to the island residential. The commercial areas are combined before the activity indices are applied to the total acreage.

Industrial

Most industrial land uses are handled in a similar manner to the separate commercial facility. All distribution, research, and individual 10-acre lots are heated separately. In the case of a large distribution area this would take the form of homogeneous area-wide emissions from numerous distribution facilities. In the case of a 10-acre manufacturing lot this would probably mean emissions from a single facility. In Figure II-34, columns A-1 and A-2, respectively, give the percent lot coverage and floor area ratio for Example no. 7, distribution (S-42), Example no. 8, research (S-89), and Example no. 9, manufacturing (S-39). All four-digit SIC code manufacturing activities are assumed to behave in a similar manner as S-39 for the purposes of heating. This assumption was made simply because of the available information.

Where adjacent 10-acre industrial lots have the same SIC code and are, therefore, to be combined as a single facility, the total acreage is added together and assigned to a single central heating system, at a point. Then the same procedures are used to calculate BTUs per hour.

	KEY-ACTIVITY	ACTIVITY	ACTIVITY NAMES SCHED	PROC	R-OIL	D-OIL	N-GAS	PROC1	PROC2
Residential	R01		10 D.U. 8760.000	10.000	0.0	0.0	1.000	0.0	0.0
	R11		ALL MULTI-RES. 8760.000	10.000	0.0	1.000	0.0	0.0	0.0
	R11	R12	8760.000	10.000	0.0	1.000	0.0	0.0	0.0
	R11	R21	8760.000	10.000	0.0	1.000	0.0	0.0	0.0
	R11	R22	8760.000	10.000	0.0	1.000	0.0	0.0	0.0
	R11	R31	8760.000	10.000	0.0	1.000	0.0	0.0	0.0
	R11	R32	8760.000	10.000	0.0	1.000	0.0	0.0	0.0
Commercial	C11		ALL COMMERCIAL 3000.000	0.0	0.0	1.000	0.0	0.0	0.0
	C11	C12	3000.000	0.0	0.0	1.000	0.0	0.0	0.0
	C11	C21	3000.000	0.0	0.0	1.000	0.0	0.0	0.0
	C11	C31	3000.000	0.0	0.0	1.000	0.0	0.0	0.0
Institutional	I11		ALL SCHOOLS 1600.000	0.0	0.0	1.000	0.0	0.0	0.0
	I11	I12	1600.000	0.0	0.0	1.000	0.0	0.0	0.0
Transportation	T20		AIRPORT-FLIGHTS/YEAR 1.000	0.0	0.0	0.0	0.0	0.0	1.000
	T30		PARKING LOTS- VEHICLES/YR 1.000	0.0	0.0	0.0	0.0	1.000	0.0
Miscellaneous Distribution	S42		DISTRIBUTION 3600.000	0.0	0.0	1.000	0.0	0.0	0.0

Notes: sched = schedule (hours per year for fuel burning)
proc = percent of fuel for non-space heating purposes.
R=oil = percent of heat demand satisfied by residual oil (1.0 = 100%)
D=oil = percent of heat demand satisfied by distillate oil (1.0 = 100%)
N-Gas = percent of heat demand satisfied by natural gas (1.0 = 100%)
Proc1 = percent of process rate applying to first process (1.0 = 100%)
Proc2 = percent of process rate applying to second process (1.0 = 100%)

Figure 18 Fuel Use Allocation Data Used in the Hackensack Meadowlands Study (Task 1 Report Section 4.3)

Research	S89		RESEARCH 2000.000	0.0	0.0	1.000	0.0	0.0	0.0
Transportation Center	T10		TRANSP. CTR 8760.000	0.0	0.0	1.000	0.0	0.0	0.0
Cultural Center	I71		CULTURAL CTR. 1000.000	0.0	0.0	1.000	0.0	0.0	0.0
Special Uses	I90		SPECIAL USES 3600.000	0.0	0.0	1.000	0.0	0.0	0.0
<u>Manufacturing</u>	S39		MANUF- GEN. 3600.000	75.000	0.950	0.0	0.050	0.0	0.0
	S20		8760.000	90.000	0.750	0.0	0.250	0.0	0.0
	S39	S3551	3600.000	75.000	0.950	0.0	0.050	0.0	0.0
	S39	S3552	3600.000	75.000	0.950	0.0	0.050	0.0	0.0
	S39	S3554	3600.000	75.000	0.950	0.0	0.050	0.0	0.0
	S39	S3555	3600.000	75.000	0.950	0.0	0.050	0.0	0.0
	S39	S3561	3600.000	75.000	0.950	0.0	0.050	0.0	0.0
	S39	S3562	3600.000	75.000	0.950	0.0	0.050	0.0	0.0
	S39	S3566	3600.000	75.000	0.950	0.0	0.050	0.0	0.0
	S39	S3567	3600.000	75.000	0.950	0.0	0.050	0.0	0.0
	S39	S3573	3600.000	75.000	0.950	0.0	0.050	0.0	0.0
	S39	S3581	3600.000	75.000	0.950	0.0	0.050	0.0	0.0
	S39	S3582	3600.000	75.000	0.950	0.0	0.050	0.0	0.0
	S39	S3585	3600.000	75.000	0.950	0.0	0.050	0.0	0.0
	S39	S3589							

Figure 18 Continued

Other Categories

Since no heat demand is assumed to occur for the transportation sources, they are not involved in this part of the analysis.

Parameters are necessary to translate heat demand in BTUs per hour into quantities of fuel used for both space heating and process heating purposes. These are contained in the ACTIVITIES package for COMPUTE 2 and contain: the schedule (number of hours of operation per year), the percent fuel used for process heat, and the percent of fuel demand satisfied by each of the fuels. These parameters are the same for all land uses. The actual values used are shown in Figure 18.

The column labeled SCHED gives the number of hours per year of operation assumed for each land use code. The column labeled PROC gives the percent of fuel used for process heat. The next three columns show the portion of total fuel demand assigned to residual oil, distillate oil, and natural gas.

Sufficient information existed to divide four-digit manufacturing SICs into two categories for these parameters. One is coded S-20 and the other S-39; all industrial lots are assigned to one of these two categories. S-20 represents heavier industry, operating almost continuously throughout the year and using 90% of the fuel for process heat. S-39 represents 12-hour per day operation, 6 days a week with only 75% of the fuel used for process heat. S-39 type industries are much more apt to use oil, as evidenced by existing point sources in the current inventory.

The emission factors used by COMPUTE 2 in conjunction with the Meadowlands plans are shown in Figure 19 for each activity code and fuel used by that activity. Emission factors for each of the five pollutants are shown in the same units used in Figure I-30 of the Task 1 report. Fuel

		TSP	SO_2	CO	HC	NO_x	
Residential	R11		RES. FUEL BURNING				
	*********	FUELNAME NOT FOUND IN AVNAM(LOCATIONS 3 TO 7).					FUEL IS B-COA
	D-OIL	10.0000	6.5000	0.2000	3.0000	4.8000	
	N-GAS	19.0000	0.6000	20.0000	8.0000	5.0000	
Commercial & Institutional	C11		COMMERC. FUEL BURNING				
	*********	FUELNAME NOT FOUND IN AVNAM(LOCATIONS 3 TO 7).					FUEL IS A-COA
	*********	FUELNAME NOT FOUND IN AVNAM(LOCATIONS 3 TO 7).					FUEL IS B-COA
	R-OIL	23.0000	40.0000	0.2000	3.0000	24.0000	
	D-OIL	15.0000	11.0000	0.2000	3.0000	24.0000	
	N-GAS	19.0000	0.6000	20.0000	8.0000	8.0000	
Manufacturing	S39		INDUST. FUEL BURNING				
	*********	FUELNAME NOT FOUND IN AVNAM(LOCATIONS 3 TO 7).					FUEL IS A-COA
	*********	FUELNAME NOT FOUND IN AVNAM(LOCATIONS 3 TO 7).					FUEL IS B-COA
	R-OIL	23.0000	24.0000	0.2000	3.0000	18.0000	
	D-OIL	15.0000	6.0000	0.2000	3.0000	18.0000	
	N-GAS	18.0000	0.6000	0.4000	40.0000	140.0000	
Airport	T20		AIRPORTS- 1=COMMERC, 2=GEN. AVIATION				
	PROC1	8.0000	2.0000	6.0000	4.0000	3.5000	
	PROC2	0.2000	2.0000	6.0000	0.7000	0.2000	
Parking Lot	T30						
	PROC1	4.3000	4.4000	12.2000	2.7000	0.9000	
	S2031						
	R-OIL	23.0000	24.0000	0.2000	3.0000	18.0000	
	D-OIL	15.0000	6.0000	0.2000	3.0000	18.0000	
	N-GAS	18.0000	0.6000	0.4000	40.0000	140.0000	
	PROP	10.0000	0.0	0.0	200.0000	0.0	
4-Digit SIC Manufacturing	S2041						
	R-OIL	23.0000	24.0000	0.2000	3.0000	18.0000	
	D-OIL	15.0000	6.0000	0.2000	3.0000	18.0000	
	N-GAS	18.0000	0.6000	0.4000	40.0000	140.0000	
	PROP	25.0000	0.0	0.0	0.0	0.0	
	S2051						
	R-OIL	23.0000	24.0000	0.2000	3.0000	18.0000	
	D-OIL	15.0000	6.0000	0.2000	3.0000	18.0000	
	N-GAS	18.0000	0.6000	0.4000	40.0000	140.0000	
	PROP	10.0000	0.0	0.0	0.0	0.0	
	S2082						
	R-OIL	23.0000	24.0000	0.2000	3.0000	18.0000	
	D-OIL	15.0000	6.0000	0.2000	3.0000	16.0000	
	N-GAS	18.0000	0.6000	0.4000	40.0000	140.0000	
	PROP	10.0000	0.0	0.0	100.0000	0.0	
	S2095						
	R-OIL	23.0000	24.0000	0.2000	3.0000	18.0000	
	D-OIL	15.0000	6.0000	0.2000	3.0000	15.0000	
	N-GAS	18.0000	0.5000	0.4000	40.0000	140.0000	
	PROP	25.0000	0.0	0.0	25.0000	0.0	
	S2295						
	R-OIL	23.0000	24.0000	0.2000	3.0000	18.0000	
	D-OIL	15.0000	6.0000	0.2000	3.0000	18.0000	
	N-GAS	18.0000	0.6000	0.4000	40.0000	140.0000	
	PROP	10.0000	0.0	0.0	200.0000	0.0	
	S2661						
	R-OIL	23.0000	24.0000	0.2000	3.0000	18.0000	
	D-OIL	15.0000	6.0000	0.2000	3.0000	18.0000	
	N-GAS	12.0000	0.6000	0.4000	40.0000	140.0000	
	PROP	25.0000	0.0	0.0	0.0	0.0	
	S2843						
	R-OIL	23.0000	24.0000	0.2000	3.0000	18.0000	
	D-OIL	15.0000	6.0000	0.2000	3.0000	18.0000	
	N-GAS	18.0000	0.5000	0.4000	40.0000	140.0000	
	PROP	25.0000	0.0	0.0	0.0	0.0	
	S2851						
	R-OIL	23.0000	24.0000	0.2000	3.0000	18.0000	
	D-OIL	15.0000	6.0000	0.2000	3.0000	15.0000	
	N-GAS	18.0000	0.6000	0.4000	40.0000	140.0000	
	PROP	10.0000	0.0	0.0	0.0	0.0	
	S3275						
	R-OIL	23.0000	24.0000	0.2000	3.0000	18.0000	
	D-OIL	15.0000	6.0000	0.2000	3.0000	18.0000	
	N-GAS	18.0000	0.6000	0.4000	40.0000	140.0000	
	PROP	10.0000	0.0	0.0	0.0	0.1	
	S3292						
	R-OIL	23.0000	24.0000	0.2000	3.0000	18.0000	
	D-OIL	15.0000	6.0000	0.2000	3.0000	18.0000	
	N-GAS	18.0000	0.6000	0.4000	40.0000	140.0000	
	PROP	10.0000	0.0	0.0	0.0	0.0	
	S3691						
	R-OIL	23.0000	24.0000	0.2000	3.0000	18.0000	
	D-OIL	15.0000	6.0000	0.2000	3.0000	18.0000	
	N-GAS	18.0000	0.6000	0.4000	40.0000	140.0000	
	PROP	0.0	25.0000	0.0	0.0	0.0	

Figure 19 Emission Factors Used in the Hackensack Meadowlands Study (Task 1 Report, Section 4.4)

Figure 19 Continued

C11	I12
C11	I71
C11	I90
C11	T10
C11	S42
C11	S89

(Other Codes Linked to above Factors)

R11	R01
R11	R12
R11	R21
R11	R22
R11	R31
R11	R32
C11	C12
C11	C21
C11	C31
C11	I11

S39	S2032
S39	S2033
S39	S2034
S39	S2[illegible]4
S39	S23[illegible]7
S39	S2043
S39	S2045
S39	S2052
S39	S2086
S39	S2087
S39	S2098
S39	S2771
S39	S2731
S39	S2815
S39	S2816
S39	S2818
S39	S2819
S39	S2931
S39	S2833
S39	S2834
S39	S2842
S39	S2844
S39	S2992
S39	S3291
S39	S3431

burning was aggregated into residential, commercial and industrial.

For the airport the names PROC 1 and PROC 2 were used respectively, for commercial and general aviation emissions. In Figure 18 for activity T-20 the last two columns show values of 0. for PROC 1 and 1.0 for PROC. 2. This means that all aircraft assigned to the airport are of the general aviation (PROC 2) category. For T-30 in Figure 19 the emission factors assigned to PROC 1 represent automobile idling. These factors were developed independently of the emission factor analysis and solely for the purposes of the parking lot emissions. This was done because the emission factor analysis had been concluded prior to the identification of the stadium and its parking lots as a land use. The most current information on idling emission rates was obtained from EPA as a part of another study. Lacking further information, it was assumed that the same percent reduction in urban vehicle speed emission factors from 1969 to 1990 would apply to the idling emission factors. This produced the numbers shown in Figure 19 in pounds per thousand hours of vehicle idling time.

Each of the four-digit industrial codes for the Meadowlands Plans was analyzed as to its propensity to produce process emissions. Twelve 4-digit SIC categories were identified as significant process sources; these are shown in Figure 19. Because no specific information was available, the process emission factors were determined as proportionate to fuel emissions. They are labeled PROP in Figure 19. The fuel emission factors for these SICs are the same as those given for industrial fuel burning. Emissions from the airport and the parking lot were calculated as a direct function of the activity (number of aircraft flights per year, and thousand hours of automobile idling per year).

The procedures discussed produced total emissions by season for each of the land use figures. The figures consisted of both land use zones, such as distribution areas or low density residential areas, and individual point locations, including manufacturing sources, schools, and central heating systems for large residential areas. For these point sources it remained to be determined by COMPUTE 3 which ones should be treated as separate point sources for modeling and which should be aggregated into the area source grid cells.

The size criterion established for point source status was 25 tons per year of any one pollutant. For each plan most of the industrial sources resulting from zones greater than 10 acre lots became point sources, as did several of the large residential areas.

Figure 20 shows the information flow for allocating the emissions to point and area sources, based upon the size criteria. In the case of the point sources stack parameters had to be assigned. The default numbers in Figure 15 were used and the information formatted for input to the model. No emission control regulations for New Jersey sources could be quantified for testing. In the case of the area sources, the land use figures were assigned to the grid cells in terms of emission densities, using the LANTRAN allocation procedures, and the data formatted for direct input to the model.

In addition to the line sources resulting from the regional highway network in and around the Meadowlands, each of the four land use plans contained additional through and local streets to which figures for total vehicle miles per year were assigned. LANTRAN does not use this data; it is user-calculated and input directly to MARTIK.

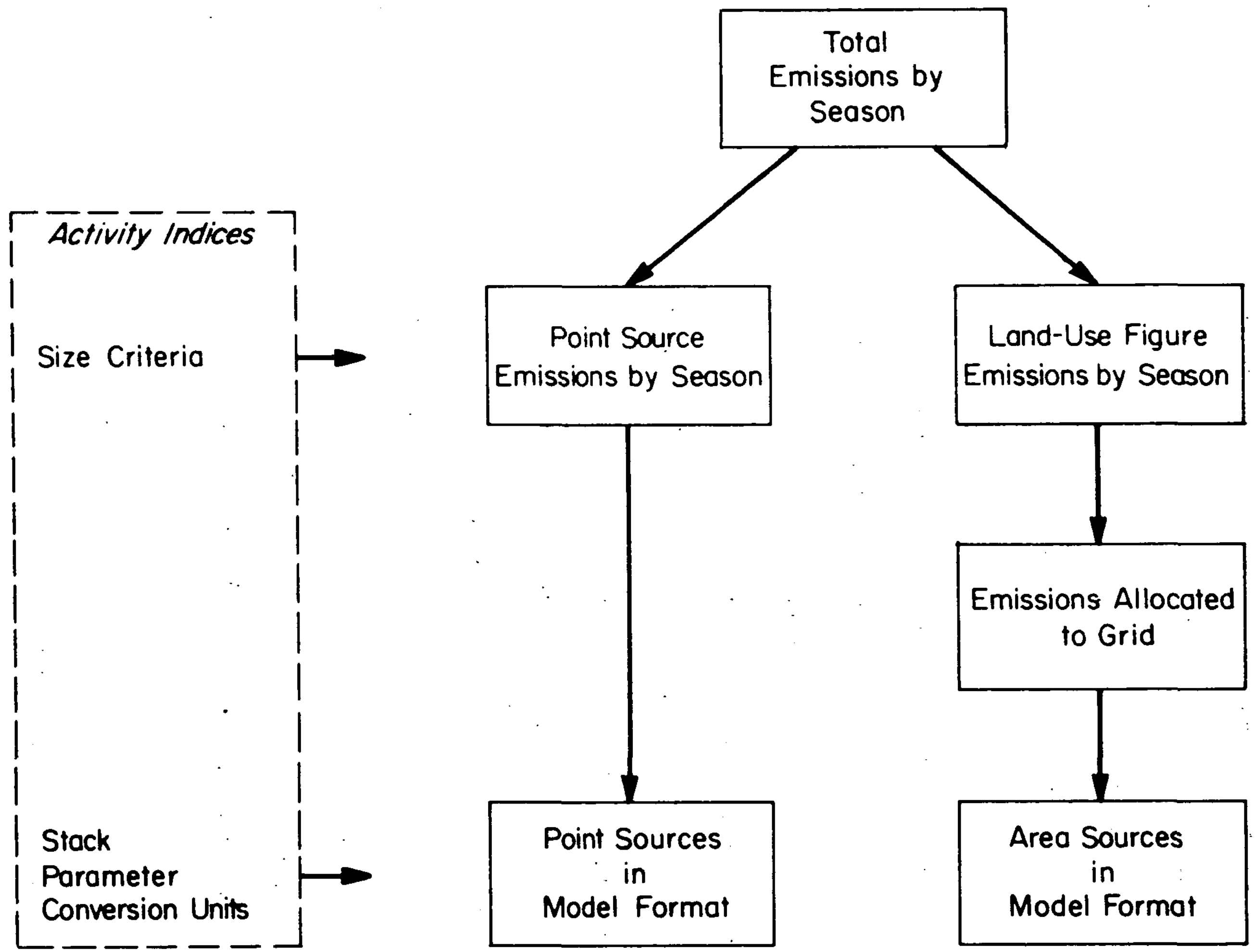


Figure 20 Allocation of Emissions to Point and Area Sources in the LANTRAN program (Hackensack Meadowlands Study, Task 1 Report, Section 4.5)

Each call to compute must be followed by a namelist (&COMPIN) which can consist of any of the following variables (if desired):

Variable	Type	Direction	Default	Description
IFVIN	I*4	1	0	Input file for FV array (VALUES) if not equal to 5.
IFVOUT	I*4	1	0	Output file for FV array VALUES) if ≥ 7
DDW	R*4	1	2780. 191.	Degree days, winter season
DDA	R*4	1	4859. 1365	Degree days, annual season
DFPRHT	R*4	1	90.	Default percent process heat
NAM	R*8	7		Array of names
CONST	R*4	7	*	Array of constants
IFORM	I*4	1	0	Suppress listed output if 0 (not related to IFORM on package keyword card)
PLAND	L*4	1	False	Allows punching of point sources without generating listed output
SEASON	R*8	1	'ANNUAL'	'ANNUAL', 'SUMMER', 'WINTER'
JUNIT	I*4	1	= JC	Output unit for point source concentrations by season (=JC in PARAMETER namelist &INPUT)
UNIT	I*4	1	12	Temporary output unit on which all point sources are stored, regardless of season
IPUNCH	L*4	1	True	Controls saved output

The array CONST is used to hold conversion constants or control constants. The meanings and defaults depend on the COMPUTE routine being used.

IFORM = 1:

CONST(1) Area Conversion - Default (Sq/Ft/Acre)

CONST(2) Area Unit Conversion - Default (Converts km^2 to Acres)

IFORM = 2:

CONST(1) Conversion factor for emission units - Default (converts lbs to tons, 2000 lbs/ton)

IFORM = 3: No Defaults

CONST(1) Unit conversion factor for point source emissions

CONST(2) Unit conversion for default stack height and plume rise

CONST(3) Wind speed factor for multiplying default plume rise

CONST(4) Scale conversion of centroid coordinates

CONST(5) Transfer of origin along X axis

CONST(6) Transfer of origin along Y axis

CONST(7) Unit conversion factor for non-point source emissions

IFORM = 5:

CONST(1) Number of groups to be conglomerated

CONST(2) - (7) Number of land uses in each group being conglomerated

IFORM = 6:

CONST(1) Number of the beginning name to be deleted - Default 2

CONST(2) Number of the last name to be deleted - Default 18

For land-use analysis, COMPUTE is designed to proceed with three COMPUTE packages (IFORM = 1,2,3). If it is desired to stop the calculation at an intermediate point, the results can be saved by specifying IFVOUT in namelist &COMPIN. This will output the results (the FV array) on cards

(IFVOUT = 7) or an unformatted file (with logical record length of 1604 bytes and block size of 6420 bytes).

Computations can be picked up by specifying IFVIN.

Example

To stop calculation after COMPUTE (IFORM=1), specify IFVOUT in namelist &COMPIN. Values will be output after calculations.

If after the examination of listed output, computation is to continue, specify IFVIN for a COMPUTE (IFORM=2) package.

COMPUTE 1 calculates the BTU demand of the figures provided for land use. It also can introduce the level of usage for non-heating figures. The COMPUTE requires the figures be input, VALUES be associated with each activity, and the activities defined with an ACTIVITIES package. Each figure has had an activity associated with it in the FIGURES package.

The following discussion describes the required usage of the COMPUTE 1 package.

The FIGURES package for a given plan contains information on the spatial location and activity code for each point, line, or area type land use zone. Examples of area sources are residential zones and the airport, and of point sources, and schools. The first (or only) card for a figure contains the figure number (IREF), the vertex number, an "A" or "P" for area or point, the X and Y coordinates for the first vertex in kilometers referenced to the U.T.M. Grid System, the plan number, the activity code (CODE), and a descriptive name for identification purposes. Remaining cards for an area type figure contain successive vertex numbers and the corresponding X and Y coordinates; the last card must repeat the first vertex to "close the polygon."

Following the FIGURES package is the VALUES package. Each VALUES package may have six parameters specified, in addition to the figure number (IREF). As used with COMP these parameters were: KFORM, KLINK, KRCODE, XFACTR, A3, and X. Each of these provides information as to how a figure should uniquely be treated for heating and related purposes; decisions related to the activity code rather than the individual figure are specified in the ACTIVITIES package.

The purposes of each parameter are as follows:

KFORM - The basic parameter governing how a figure is treated in COMPUTE 1 where heating demand is calculated:

= 10. A non-residential zone, heated individually

= 15. A residential zone, heated individually

= 19. A residential or non-residential zone, to be added to a central system and then dropped; the central system location would carry a KFORM = 15, however

= 20. Non-heating source, such as the airport

= 30. Manufacturing 10-acre lot, to be heated individually

= 39. Manufacturing 10-acre lot to be combined with others at new location and then dropped; new centralized location for 20, 30, 40, etc. acre lot would carry a KFORM = 30, however

= 59. Local commercial facility whose heat requirements will be determined as a function of the residential area served, then combined with the residential central heating system, and dropped from further consideration.

= 60. School, where heat requirements will be determined as a function of the residential area served

= 80. For any source to be set equal to another source for heating purposes; used when two central systems serve one large residential area

KLINK The parameter governing the figure number (IREF) of the residential zone to which commercial areas (KFORM = 5X) or schools (KFORM = 6X) are "linked" to determine their heating demands.

KRCODE The parameter governing the figure numbers (IREF) of central heating system locations to which the areas of residential and non-residential zones (KFORM = 19) and manufacturing 10-acre lots (KFORM = 39) are added for heating purposes; the original zones have a KFORM ending in "9" and are excluded from further consideration after they are "recoded" to the central system location; also governs the figure number for the residential central heating system to which local commercial heating demand (KFORM = 59) is added.

XFACTR The parameter governing the assignment of a portion of the calculated heating demand to a location, as when three schools serve a residential area and each one is assigned 1/3 of the heat demand.

A3 The parameter governing the activity level (or process rate) of non-heating sources; used for the airport (number of flights/year) and stadium parking lot (thousand vehicle hours of idling per year).

X The parameter governing the calculated heat demand (BTU/hour) for each figure; it is the major output parameter from COMPUTE 1, together with A3 which passes through unaltered.

The ACTIVITIES packages contain the conversion factors catalog - the activity indices and emission factors - which translate the land use plan activities data into emissions according to the type of land use or activity code. The parameters and their use are discussed extensively in the body of the Task 1 Report.

COMPUTE 1 translates activity data into heating requirements for each figure. Accordingly, the ACTIVITIES package for COMPUTE 1 contains such information as dwelling units per acre and BTU/d.u./hr. for residential sources which, when multiplied by the number of acres of the residential zone (as determined by LANTRAN from the FIGURES package), yields the BTU/hr heating requirement for that figure. The listing of the COMPUTE 1 activities package is shown in Figure A-5 of Appendix A of the Task 1 Report and the output of this package as printed by LANTRAN is shown in Figure 17. There is a separate entry for each activity code used in the study. The first card for each activity code contains the land use designation (CODE) which conforms to the codes shown in Figure II-33 in the body of the Task 1 Report.

If default parameters are to be used the first activity code represents the key-activity code and the second indicates the activity code of concern to which the default parameter values will be assigned; in this case there is only one card. Otherwise, a second card contains the specific values for up to six parameters. As used in COMPUTE 1 the parameters are:

<u>ACTV</u> The heating requirement parameter: BTU/d.u./hr, BTU/sq ft, or BTU/classroom

<u>A1,A2, A4</u> Activity related indices:

A1 = D.U./acre for residential uses, percent of residential square footage in commercial use for C11 and C12, numbers of pupils per classroom for schools, and percent lot coverage for all other codes;

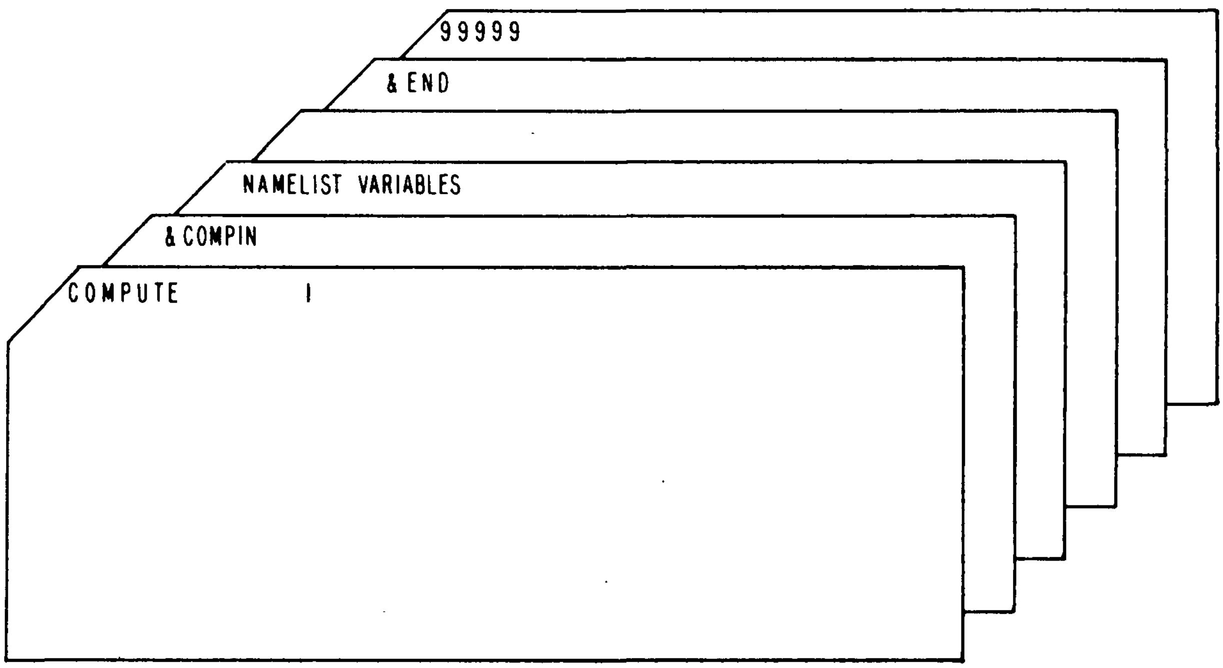


Figure 21 Deck Set-Up for LANTRAN Compute IFROM = 1,3,4,5,6

A2 = Pupils/d.u. for residential, not used for C11 and C12, percent of total pupils primary or secondary for schools and the floor area ratio for all other codes;

A4 = Used only for island and parkside residential, where it is the number of square feet per dwelling unit. (A5 is the population per dwelling unit and is used only with COMPUTE 5 to produce population distributions for IMPACT analysis.)

COMPUTE 2 uses the BTU demand per hour, together with schedule and fuel use information provided in an ACTIVITIES package and in emissions packages to calculate the emissions from each figure. NOTE: LANTRAN, as used in AQUIP for the Hackensack Meadowlands Study, is not capable of handling highways. These emissions sources must be defined by the user and input directly to MARTIK.

COMPUTE 2 translates the heating requirements for each figure into fuel related emissions; it also determines non-fuel emissions where applicable. Up to seven parameters may be specified using the same two card (or one card with default) format as with COMPUTE 1. The parameters are as follows:

<u>SCHED</u> Number of hours of operation per year for fuel burning activities; for non-fuel burning, converts units to annual basis for activities specified for other time periods (such as flights/<u>day</u> for the airport)

<u>PROC</u> Percent of fuel used for process heating or non-space heating purposes

R-OIL, D-OIL, N-GAS — Abbreviations used for residual oil, distillate oil and natural gas; the values are the portions of total fuel demand satisfied by the particular fuel (generally 1.0 or 0.).

PROC 1, PROC 2 — Names similar to R-OIL and D-OIL for non-fuel sources, such as for proportions of commercial aviation versus general aviation aircraft at the airport. If more than three fuels exist their names could occupy these slots; in that case "dummy" fuel names are specified for the non-fuel sources, such as using the R-OIL column for the PROC 1 proportion of commercial aircraft. This procedure was not necessary in our study since a maximum of three fuel types and two non-fuel types were assigned at any time.

COMPUTE 2 reads in the emission factors package. For each activity code there is a separate card for each fuel or process specified, containing the emission factors for the five pollutants for that fuel and activity code; the sixth pollutant field can be used to specify a unique fuel constant (BTU/gal oil, etc.) for any fuel desired. Default values are included in COMPUTE 2. The fuel names must conform to the parameter abbreviations in the COMPUTE 2 ACTIVITIES package. For manufacturing sources were process emissions proportional to fuel emissions are to be used, the process name "PROP" is used and the factors are percentage adjustments. (10 - add 10% to fuel emissions for that pollutant). Emissions will be calculated for the annual case and the summer and winter seasons, depending upon the pollutant name cards immediately preceding the emission factors. The order of the pollutants and the abbreviations must be the same for each season.

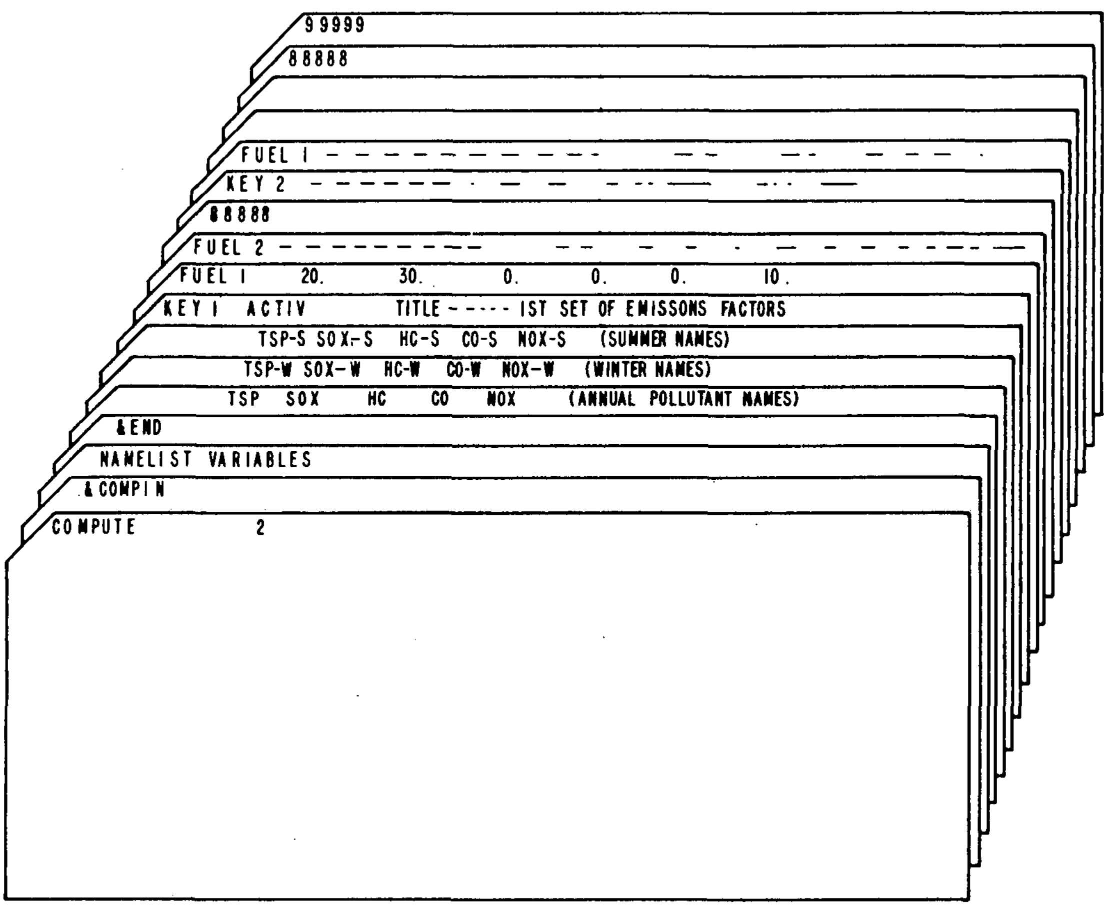


Figure 22 Deck Set-Up for LANTRAN Compute IFORM = 2 (with emission factors)

5163

FIRST CARD of Emissions Factors package: Pollutant names for annual season (up to 5)

Columns	Variable	Format	Meaning
11-20	POLNM(1)	A8,2X	Name of first pollutant (8 characters or less)
.	.	.	
.	.	.	
.	.	.	
.	.	.	
51-60	POLNM(5)	A8,2X	

SECOND CARD - Pollutant names for winter season (format identical to first card)

THIRD CARD - Pollutant names for summer season (format identical to first card)

followed by:

FOURTH CARD - First card of emission-factor data set in 'ACTIVITIES' format (no keyword card)

Columns	Variable	Format	Meaning
1-10	KEY	A8,2X	Key activity code
11-20	ACTIV	A8,2X	Activity code to which emissions factors are to be assigned, or blank if second card follows
21-70	TITLE	12A4, A2	Title for printing.

FOLLOWING CARDS - If ACTIV is blank on first card of 2-card set; otherwise, this card is skipped)

Columns	Variable	Format	Meaning
1-10	FUEL	A8,2X	Fuel name as appears in ACTIVITIES #2.
11-60	QPOL	5F10.4	Up to 5 emission factors,for this fuel,for this activity,in the same order as pollutants.
61-70	FCON	F10.4	Fuel constant - BTU's per fuel unit (*10^6. NOTE: These should be input only once for each fuel - not dimensioned to activity).

LAST CARD (of emissions-factors package) - Delimiter card '88888'.

LAST CARD (of COMPUTE package) - Delimiter card '99999'.

COMPUTE 3 tests the emission levels against size criterion for each pollutant and assigns point figures exceeding the criterion for any one pollutant to point source status for modeling purposes; all other figures are assigned to area source grid cells by the LANTRAN allocation procedure. In addition to the point source criteria for the five pollutants, each activity code can be assigned a representative stack height and plume rise factor. Since no differentiation between activity codes could be made in the study, a master code of "ZOO" was defined to which all other activity codes default.

COMPUTE 3 also outputs to JUNIT the beginning of the SRCE package, provided HEADR = .TRUE.. The point sources selected will be output, for the present season. The other season's point sources will be saved on UNIT. The remainder of the sources are left ready for OUTPUT.

COMPUTE 4 is used to output selected point sources for seasons other than the season when COMPUTE 3 was run. COMPUTE 4 is used with the SEASON and possibly JUNIT changed. It will access the selected point sources saved on UNIT and output them together with the SRCE header card, to JUNIT.

COMPUTE 5 translates activity data into the form used by the IMPACT program for comparison with predicted air quality levels; it is not used directly in the emissions generation procedures. As described in the Task 3 Report comparisons between alternative land use plans can be made in terms of the impact of air quality on specific distributions including total population, school children, open space area, and employment-related areas. The ACTIVITIES package for COMPUTE 5 is the same as that used for COMPUTE 1. It contains such information as: (1) the dwelling units per acre (A1) and population per dwelling unit (A5), used together with area (extent) to determine the number of people in each land use zone; and (2) the dwelling units per acre (A1-residential) and pupils per dwelling unit (A2-residential) for each residential zone assigned to a school, together with the percent of pupils of primary or secondary school age (A2-schools), used with residential area (extent) to determine the number of school children at any school location. Receptor information for the various land use codes is directly a function of area (extent).

LANTRAN allocates the specified land uses or derivatives (such as population or school children) to gridded area cells for use with the IMPACT program. The desired land use categories are specified as variable names in the VALUES package in conjunction with COMPUTE 5. The land use categories specified can be any of the existing activity codes not beginning with "S"; in addition, the variable names "POP", for population, "SCHOOLS", for number of school children, and "S", for the aggregation of all manufacturing activity codes can be used; this includes all codes which begin with "S" except "S42" (distribution) and "S89" (research).

For any of the land use categories called for by a variable name in the VALUES package, COMPUTE 5 will assign a value of 1.0 to each of the appropriate area figures or land use zones. (Point figures are ignored.) When the variable is to be allocated to grid cells by the LANTRAN allocation procedure, the value of 1.0 is multiplied by the portion of the total area of the figure (land use zone) that is actually contained in each grid cell. Thus, after allocation, the value determined for any land use activity code specified for grid cell is the actual area (in km^2) within that cell which is assigned to that particular land use.

When the variable name "POP" is specified, the population density for each land use zone is determined; this is converted into the total residential population per grid cell during allocation. Similarly, the value determined for the variable "SCHOOLS" is density of school children per land use zone; this is converted to the number of school children per grid cell during allocation.

The aggregate manufacturing land use category "S" is treated much the same as other land uses with one exception: manufacturing point figures are treated as area figures and assigned an area of ten acres each.

To calculate the population and school children densities when the variables "POP" and "SCHOOLS" are specified, COMPUTE 5 uses the same activity indices (ACTIVITIES package) used by COMPUTE 1; the variable "A5" -- population per dwelling unit -- is used by COMPUTE 5 but not by COMPUTE 1. Other than the variable names specified in the VALUES package, this is the only parameter not used in COMPUTE 1.

COMPUTE 5 can also be used to sum the areas of two or more land use activity codes, as directed by the CONST and NAM arrays in &COMPIN. In this way the areas of all employment-related activity categories (commercial, "CXX", distribution, "S42", research, "S89", manufacturing, "S", transportation centers "T10", and special uses, "I90", can be treated in the aggregate as a receptor.

CONST(1) is the number of groups to be merged 1, 2, 3. If only the summing is desired, without the normal COMPUTE 5 manipulations, CONST(1) should by multiplied by 10, 20, or 30. The remaining constants tell the number of land uses in each group to be merged.

The NAM array contains the names of the land uses to be merged.

EXAMPLE

1) If the total residential land use for Plan 1 is desired, the arrays must be specified in &COMPIN as follows:

CONST = 1., 3.,

NAM = 'R01', 'R11', 'R12',

This has the effect of summing one group of land uses, consisting of three individual land uses. Thus, the values for 'R01', 'R11', and 'R12' would be summed, and the result placed in 'R01'.

2) If the total residential land use is again desired, but also the total commercial land use, the arrays would be:

CONST = 2., 3., 2.,

NAM = 'R01', 'R11', 'R12', 'C11', 'C12',

There are two groups to be merged. The first has three elements, the second two.

3) If the same conglomeration as (2) is desired, but the manipulations have been done in a previous step, the arrays would be:

CONST = 20., 3., 2.,

NAM = 'R01', 'R11', 'R12', 'C11', 'C12',

4) If the total residential land-use is desired without losing any of the original information, a dummy residential variable ('R-TOT') could be created with a VALUES package. The &COMPIN arrays would then be:

CONST = 1., 4.,

NAM = 'R-TOT', 'R01', 'R11', 'R12',

This sums the residential, placing the result in the previously empty 'R-TOT'.

5) For example, for plan 1-B, an aggregated industrial and commercial land use was required, consisting of nine land uses. Since CONST and NAM are both dimensioned to seven, two COMPUTE packages (IFORM = 5) were required:

FIRST COMPUTE: CONST = 1., 7.,

NAM = 'S', 'S42', 'C21', 'C31', 'T10', 'I71', 'S89',

SECOND COMPUTE: CONST = 10., 3.,

NAM = 'S', 'I90', 'T20',

COMPUTE 6 deletes names from the variable list. Names are added by the VALUE packages. The first name is EXTENT, which is permanently present for each figure. The remainder of the names are present in the order given in the VALUES. The first name in a VALUES package will be added directly behind the last name on the previous VALUES package. There are only 18 spaces available for names, and sometimes variables that are no longer needed must be deleted to make space for new names.

COMPUTE 6 will delete the variables beginning with number CONST(1) and ending with CONST(2). CONST(1) defaults to 2, CONST(2) defaults to 18, so if COMPUTE 6 is used without specifying either, all the variables except EXTENT will be deleted for each figure.

The following is a summary of the variables used in the LANTRAN COMPUTE'S:

Figures Package - For each plan contains information on the spatial location and activity code for each point, line, or area type land use zone.

IREF - Figure number

---- - X coordinate of each vertex of figure

---- - Y coordinate of each vertex of figure

CODE - Land use activity code applicable to the figure

EXTENT - Area of each figure in $Km.^2$, calculated from the vertices input in the Figures package.

Values package (COMP 1 thru 3) - Each VALUES package may have six parameters specified, in addition to the figure number (IREF). As used with COMP 1-3 these parameters were: KFORM, KLINK, KRCODE, XFACTR, A3, and X. Each of these provides information as to how a figure should uniquely be treated for heating and related purposes. The following values are required for each figure in the Figures package.

IREF - Figure number

KFORM - The basic parameter governing how a figure is treated in COMP 1 where heating demand is calculated; must be present for all figures.

= 10. A non-residential zone, heated individually

= 15. A residential zone, heated individually

= 19. A residential or non-residential zone, to be added to a central system and then dropped; the central system location would carry a KFORM =15, however.

= 20. Non-heating source, such as the airport

= 30. Manufacturing 10-acre lot, to be heated individually

= 39. Manufacturing 10-acre lot to be combined with others at new location and then dropped; new centralized location for 20, 30, 40, etc. acre lot would carry a KFORM =30, however.

= 59. Local commercial facility whose heat requirements will be determined as a function of the residential area served, then combined with the residential central heating system, and dropped from further consideration.

= 60. School, where heat requirements will be determined as a function of the residential area served.

= 80. For any source to be set equal to another source for heating purposes; used when two central systems serve one large residential area.

KLINK - The parameter governing the figure number (IREF) of central heating system locations to which the areas of residential and non-residential zones (KFORM =19) and manufacturing 10-acre lots (KFORM =39) are added for heating purposes; the original zones have a KFORM ending in "9" and are excluded from further consideration after they are "recoded" to the central system location; also governs the figure number for the residential central heating system to which local commercial heating demand (KFORM =59) is added.

XFACTR - The parameter governing the assignment of a portion of the calculated heating demand to a location, as when three schools serve a residential area and each one is assigned 1/3 of the heat demand.

A3 - The parameter governing the activity level (or process rate) of non-heating sources; used for the airport (number of flights/year) and stadium parking lot (thousand vehicle hours of idling per year).

X - The parameter governing the calculated heat demand (BTU/hour) for each figure; it is the major output parameter from COMP 1, together with A3 which passes through unaltered.

Values package (COMPS) The land use categories desired for correlation with air quality are specified as variable names in the VALUES package in conjunction with COMP 5. The land use categories specified can be any of the existing land use activity codes not beginning with "S"; in addition, the variable names "POP", for population, "SCHOOLS", for number of school children, and "S", for the aggregation of all manufacturing activity codes can be used; this includes all codes which begin with "S" except "S42" (distribution) and "S89" (research).

√ No values are required for each figure.

Activities package (COMP 1) - The ACTIVITIES packages compromise the conversion factors catalog used to translate activities into emissions according to the land use activity code specified in the Figures package and the unique figure characteristics specified in the VALUES package for use with COMP 1 thru 3.

√

√ The COMP 1 ACTIVITIES package contains the activity indices to translate the activity data into heating requirements for each figure.

ACTV - The heating requriement parameter: BTU/d.u./hr, BTU/sq. ft., or BTU/classroom.

A1 - d.u./acre for residential uses, percent of residential square footage in commercail use for C11 and C12, numbers of pupils per classroom for schools, and percent lot coverage for all other codes;

A2 - pupils/d.u. for residential, not used for C11 and C12, percent of total pupils primary or secondary for schools, and the floor area ratio for all other codes;

A4 - Used only for island and parkside residential in Plan 1 where it is the number of square feet per dwelling unit.

A5 - population/d.u.; used only with COMP 5 to produce population "receptor" data sets for IMPACT analysis.

ACTIVITIES package (COMP 2) - The COMP 2 ACTIVITIES Package contains the activity indices to translate heating requirements into emissions.

SCHED - Number of hours of operation per year for fuel burning activities; for non-fuel burning, converts units to annual basis for activities specified for other time periods (such as flights/day for the airport).

PROC - Percent of fuel used for process heating or non-space heating purposes.

R-OIL, D-OIL, N-GAS - Abbreviations used for residual oil, distillate oil and natural gas; the values are the portions of total fuel demand satisfied by the particular fuel (generally 1.0 or 0.).

PROC 1
PROC 2 - Names similar to R-OIL and D-OIL for non-fuel sources, such as for proportions of commercial aviation versus general aviation aircraft at the airport. If more than three fuels exist their names could occupy these slots; in that case "dummy" fuel names are specified for the non-fuel sources, as described in the Task 5 Report, such as using the R-OIL.

COMP 2 reads in the pollutant names for the three seasons; annual, winter and summer; the names used are user-dependent.

COMP 2 also reads in emission factors package. For each activity code there is a separate card for each fuel or process specified, containing the emission factors for the five pollutants for that fuel and activity code in the order of the above pollutant names; the sixth pollutant field can be used to specify a unique fuel constant (BTU/gal. oil, etc.) for any fuel desired

TSP,TSP-W, BP-S
SOX, SOX-W,SOX-S
CO,CO-W,CO-S
HC,HC-W,HC-S
NOX,NOX-W,NOX-S - Pollutant names for particulates, sulfur dioxide, carbon monoxide, hydrocarbons, and nitrogen oxides, respectively, for the annual, winter, and summer seasons, respectively.

A-COA
B-COA
R-OIL
D-OIL
N-GAS - Fuel names for anthracite coal, bituminous coal, residual oil, distilate oil and natural gas used in emissions factors for each fuel and pollutant (in the order of the above annual pollutant names) for each acitivity code.

PROP - For manufacturing sources where process emissions proportional to fuel emissions are to be used, the name "PROP" is used and the values are percentage adjustments (10 = add 10%) to the fuel emissions for that pollutant).

ACTIVITIES package (COMP 3) - The COMP 3 ACTIVITIES package contains the size criteria for the testing point sources for each pollutant, on the order of the above pollutant names.

ZOO - An activity code Zoo was used to which all other activity codes default when data by activity code are not known.

ACTIVITIES package (COMP 5) - The COMP 5 ACTIVITIES package contains the activity indices to translate activity data into receptor data for use with IMPACT. The COMP 5 ACTIVITIES package is the same as the COMP 1 ACTIVITIES package.

The following summarizes the function of the COMPUTES and their subsections:

COMPUTES	- Used in LANTRAN to correctly associate the conversion factors catalog with the land use figure according to land use activity code for input to MARTIK or land use information for input to IMPACT to determine emissions receptor.
COMP 1	- Used to determine heat demand in BTU/hr. for each figure; translates activity data into heating requirements for each figure.
Subroutine NORM	- Calculates heat demand based on area of figure.
Subroutine LINK	- "Links" school and commercial figures to residential ones and calculates heat demand based on area of residential figure.
Subroutine RECODE	- "Recodes" area of residential, commercial, or manufacturing zones to the point location of the appropriate central heating system; also recodes heat demand for a local shopping center to the appropriate residential central heating system.
COMP 2	- Used to calculate fuel emissions based on heat demand and process emissions as appropriate, summing to total seasonal emissions;
COMP 3	- Used to test the emission levels against size criterion for each pollutant and assign point figures exceeding the

criterion for any one pollutant to point source status for modeling purposes; all other figures are assigned to area source grid cells by the LANTRAN allocation procedure for input to MARTIK.

Subroutine LARGE - Outputs point figures to be treated as separate point sources in MARTIK format.

Subroutine REGS - Tests emissions against applicable emission control regulations. (none were applicable in the study)

COMP 5 - Used to translate activity data into the form used by the IMPACT program for comparison with predicted air quality levels.

2.3.2 Data Flow for Emissions Preparation

The purpose of this and the next two sections is to relate the LANTRAN functions to the overall AQUIP system as shown schematically in Figure 1-2 of Section 1.1. The analogous schematic data flow system for emissions preparation is shown in Figure 23. The same conventions have been used in naming of input data sets (I), model data sets (M), computed data sets (C), and programs (P). Each box of Figure 2 has been detailed to represent the card decks (keyword packages) which make it up. First the data sets are described in some detail and then a typical deck setup is discussed.

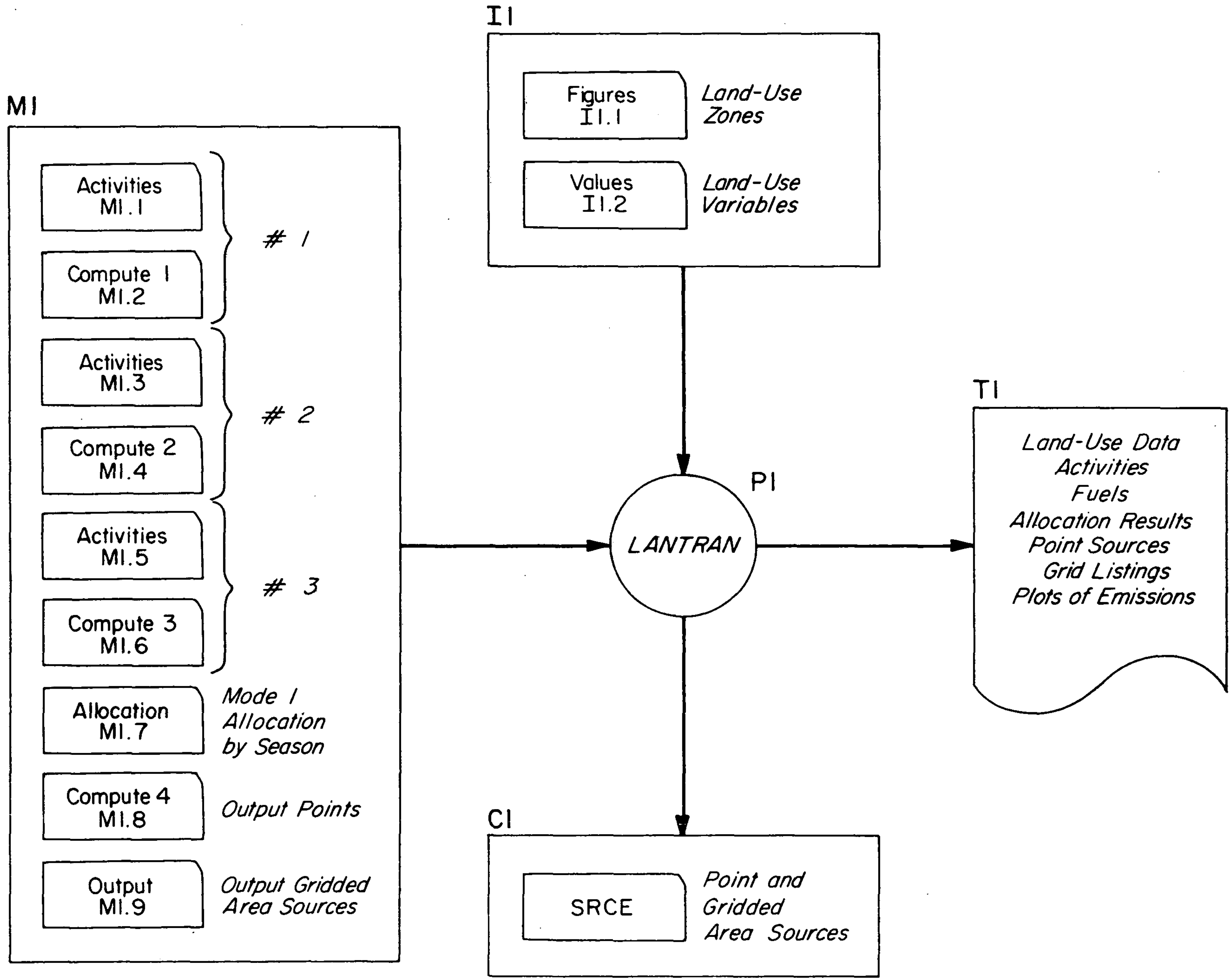


Figure 23 Data Flow for Emission Preparation

I1 Input Data Set

I1.1 FIGURES - all figures for a given plan coded in standard format.

I1.2 VALUES - initial values, specified by figure for a given plan in standard format. The expected variable names are 'KFORM', 'KLINK', 'KRCODE', 'XFACTOR', 'A3' and 'X'.

A detailed explanation of the use of variables can be found in the TASK 1 Report Appendix and has been summarized in Section 2.3.1. Use of these variables is optional (they can be omitted) with the following exceptions:

1. KFORM - tells which manipulations are to be performed on each figure.
2. X - is the number of BTU's per hour which is to be calculated.

The VALUES package must consist of at least 'KFORM' and 'X'.

M1 Model Parameter Data Set

This data set consists of three ACTIVITIES packages and three COMPUTE packages. The ACTIVITIES packages are in standard format (see Section 2.2.6). For a detailed explanation of the use of the variables in the ACTIVITIES packages, see the TASK 1 report (Appendix A).

M1.1 ACTIVITIES - First ACTIVITIES package. Consists of activity variables 'ACTV','A1','A2', and 'A4', specified by activity code.

M1.2 COMPUTE 1 - First COMPUTE package (IFORM=1). The format for this package is as described above in Section 2.3.1 and illustrated in Figure 13.

M1.3 ACTIVITIES - Second ACTIVITIES package. The activity variables are 'SCHED', 'PROC', and all the relevant fuel names.

M1.4 COMPUTE 2 - Second COMPUTE package (IFORM = 2). The namelist &COMPIN is following by an emission factors package as described above in Section 2.3.1 and illustrated in Figure 22.

M1.5 ACTIVITIES - Third ACTIVITIES package. The variable names are the pollutant names for the annual season. Activity values are the size criteria for point sources. These may be input for each activity code, but a default code (Z00) has been provided in the event that many of the criteria are the same.

M1.6 COMPUTE 3 - Third COMPUTE package (IFORM = 3). Format identical to the first.

M1.7 ALLOCATION - This and the following packages are required for each season. Allocation by MODE 1, in standard format.

M1.8 COMPUTE 4 - Fourth COMPUTE package (IFORM = 4) used to output point sources for the specified season prior to allocation to gridded area sources.

NOTE: That this has already been done for whatever season has been specified in the third COMPUTE package (Data Set M1.6), and need not be done again for that season.

M1.9 OUTPUT - Creates an output data set consisting of gridded area sources in 'GRID' package format for input to MARTIK.

C1 - Point and Gridded Area Sources

A keyword 'SRCE' package for a single land-use plan. The package is made up of 'POINT' sources generated by LANTRAN COMPUTE routines, and a

'GRID' package representing the area-source densities for the study-area system. These densities are expressed as rates per square scale unit, and are converted to g (scale unit)$^{-2}$ sec^{-1}.

T1 - Tabulated Emissions Data Output

Listing of all input data sets (FIGURES, VALUES, ACTIVITIES and emissions factors), detailed itemization of all manipulations performed by LANTRAN COMPUTE, listing of point source and gridded area source values for all pollutants for all seasons, and display maps of gridded area source values for all pollutants for all seasons.

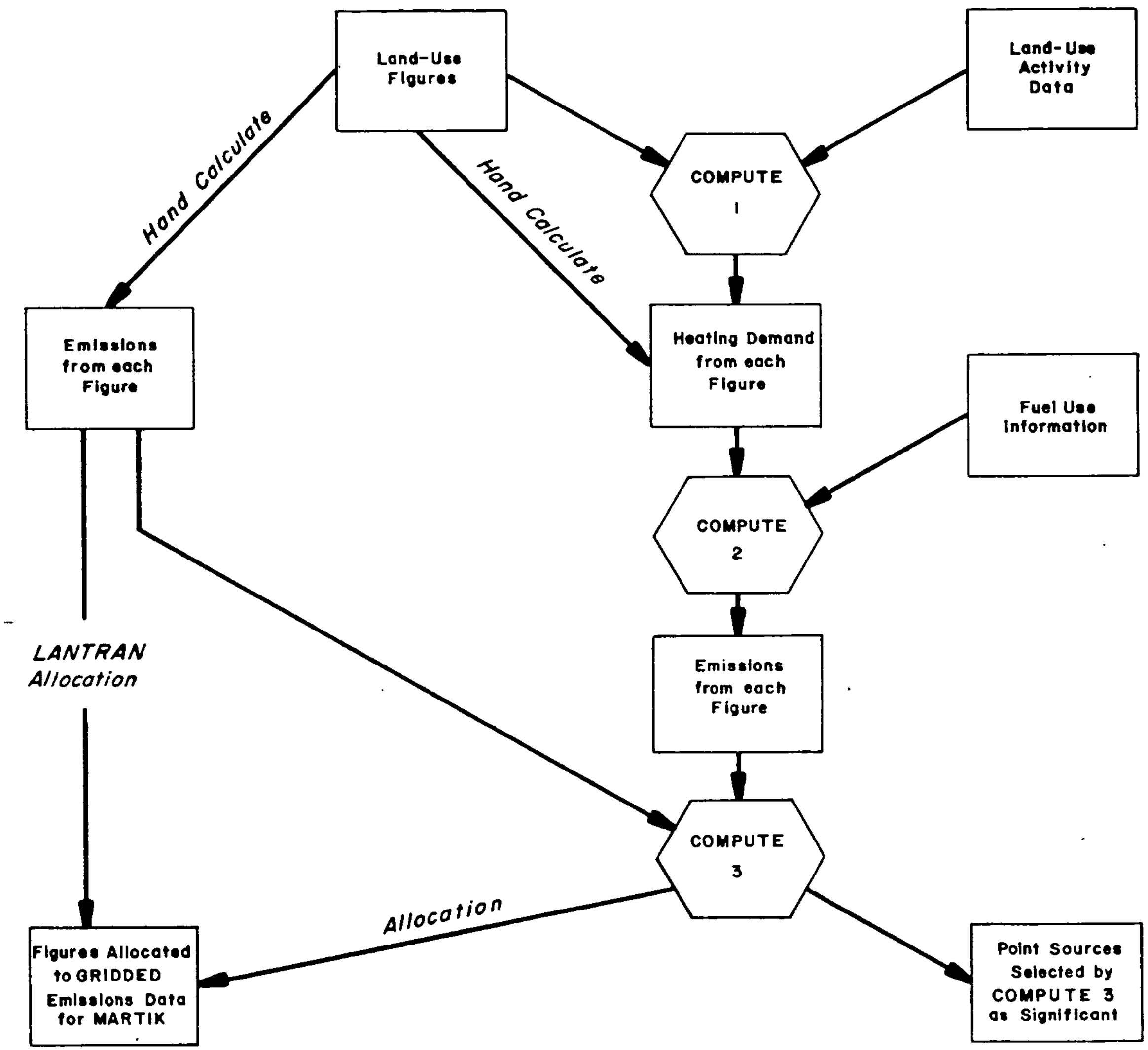
Deck Set-up for Emissions Preparation

Since the procedure for land-use analysis using the present LANTRAN COMPUTE is nearly invariant, we will give as a single example a typical deck used in the Hackensack Meadowlands Study.

Starting with information on land use, fuel use and emission factors, LANTRAN generates a set of point sources and gridded area sources for each of the three seasons. The deck setup is as follows:

PARAMETERS	Initialize variables
FIGURES	data set I1.1
VALUES	data set I1.2
ACTIVITIES	data set M1.1
COMPUTE 1	data set M1.2 calculates heating requirements by figure
ACTIVITIES	data set M1.3
COMPUTE 2	data set M1.4 inputs emission factors and calculates emissions by figure

8968


Land-Use Figures
Land-Use Activity Data
Hand Calculate
Hand Calculate
COMPUTE 1
Emissions from each Figure
Heating Demand from each Figure
Fuel Use Information
COMPUTE 2
LANTRAN Allocation
Emissions from each Figure
COMPUTE 3
Allocation
Figures Allocated to GRIDDED Emissions Data for MARTIK
Point Sources Selected by COMPUTE 3 as Significant

ACTIVITIES	data set M1.5
COMPUTE 3	data set M1.6 sorts point and area sources for all seasons and outputs 'ANNUAL' point sources.
ALLOCATION	Allocates to gridded area cells, 'ANNUAL' pollutants by names input in emissions factors (M1.4).
OUTPUT	Outputs allocated variables
ALLOCATION	Allocates to gridded area cells 'SUMMER' pollutants
COMPUTE 4	Outputs 'SUMMER' point sources
OUTPUT	Outputs gridded area sources for 'SUMMER'
ALLOCATION	Allocates to gridded area cells 'WINTER' pollutants
COMPUTE 4	Outputs 'WINTER' point sources
OUTPUT	Outputs gridded area sources for 'WINTER'
ENDJOB	End of program

For additional information and a detailed description of these functions, See Task 1 Report: Appendix and the summary description in Section 2.3.1.

2.3.3 Data Flow for Impact Analysis

The schematic diagram representing the data flow system for generation of the correlation data set is shown in Figure 25. Data sets and typical deck set-ups are discussed as follows:

Data Sets

I1 Input Data Set (see above, Section 2.3.2)

I4 Land-Use Data for Correlation

I4.1 ACTIVITIES

The first ACTIVITIES package from the land-use analysis (identical to data set M1.1) consisting of variables 'ACTV', 'A1', 'A2', 'A4', 'A5'. NOTE that this package is used in conjunction with the VALUES package I1.2. These packages are only needed for calculation of population ('POP') and number of school children per grid cell ('SCHOOLS').

I4.2 VALUES

A keyword 'VALUES' package containing names of land-uses for correlation. These can be an activity code not beginning with S, except that it can be S42 or S89, or the special names for industrial land uses ('S'), population ('POP') or number of school children ('SCHOOLS').

I4.3 COMPUTE

A compute package (IFORM = 5) with format as per Section 2.3.1 (Figure 21). NOTE that additional VALUES and COMPUTE packages can be added as required.

I4.4 ALLOCATION

Allocation by MODE 1 to gridded area cells of desired variables, in standard format.

I4.5 OUTPUT

Control card package to select variables for output data set C4.

C4 Correlation Data Set

A keyword 'GRID' package for use as input to IMPACT for analysis of

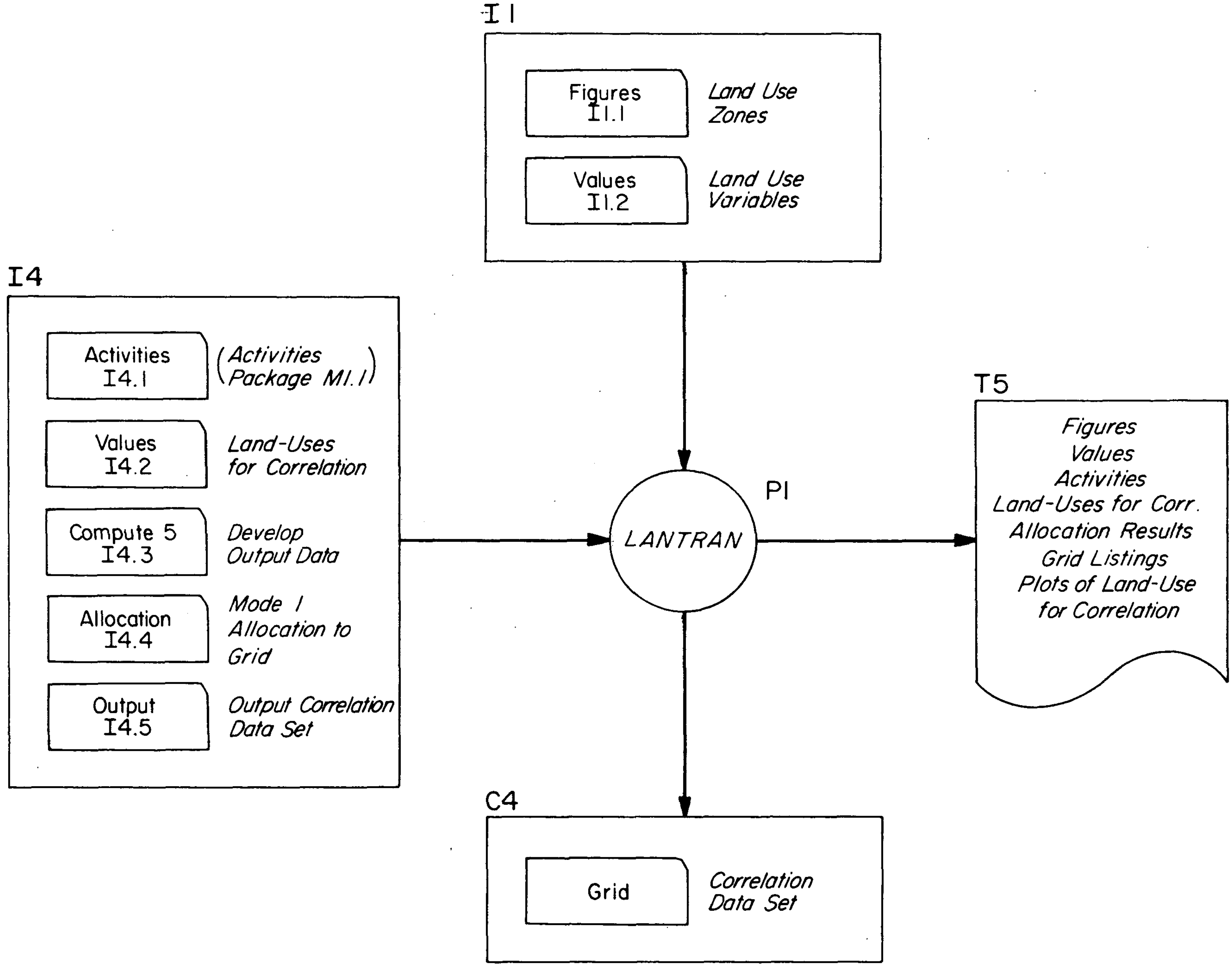


Figure 24 Data Flow for Impact Analysis

and correlation with the gridded air quality data set C3 (see Section 4.3.2).

T5 Tabulated Land-Use Data Output

Listing of all input data sets (FIGURES, VALUES and ACTIVITIES), itemization of manipulations performed by LANTRAN COMPUTE, listing of gridded area land-uses, and display maps of gridded area land-uses.

Deck Set-up for Impact Analysis

For a simple example, let us assume we are interested in population ('POP'), number of school children ('SCHOOLS'), industrial land-use ('S') and allresidential land use ('R01' + 'R11' + 'R12') as land uses for correlation.

These correlation variables can be allocated to grid cells by way of the following deck setup:

PARAMETERS	Initialize variables
FIGURES	data set I1.1
VALUES	data set I1.2
ACTIVITIES	data set I4.1
VALUES	data set I4.2, consisting only of the names of desired variables; i.e., 'POP','SCHOOLS','S','R01','R11', and 'R12'.
COMPUTE 5	data set I4.3, does required manipulations, including the summing of 'R01','R11', and 'R12'.
ALLOCATION	data set I4.4, allocation of desired variables: 'POP','SCHOOLS','S', and 'R01'.
OUTPUT	data set I4.5, output of allocated variables.
ENDJOB	End of program.

A more complicated example is the actual manipulations that have been used in the Hackensack Meadowlands Study for Plan 1-B. Here variables of interest were 'POP', 'SCHOOL'; total residential, being 'R01' + 'R31' + 'R32'; and an augmented industrial land use, being 'S' + 'S42' + 'S89' + 'C21' + 'C31' + 'T10' + 'I71' + 'I90' + 'T20'. A possible deck setup could be:

PARAMETERS	Initialize variables
FIGURES	data set I1.1
VALUES	data set I1.2
ACTIVITIES	data set I4.1
VALUES	Names of the variables 'R01', 'R31', 'R32'.
COMPUTE 5	Does manipulations for residential land-use and sums.
COMPUTE 6	Deletes last two variables, 'R31' and 'R32'.
VALUES	Names of the variables 'POP','SCHOOLS', 'S', 'S89','S42','C21'.
VALUES	Names of the variables 'C31','T10', 'I71', 'I90','T20'.
COMPUTE 5	Does all manipulations and sums 'S', 'S89','S42','C21','C31','T10','I71'.
COMPUTE 5	Sums 'S', 'I90' and 'T20'.
ALLOCATION	of desired variables by MODE 1 - 'POP','SCHOOLS','R01', and 'S'.
OUTPUT	of allocated variables
ENDJOB	End of program.

2.3.4 Data Flow for Conversion of MARTIK Output

The schematic diagram representing the data flow system for conversion of air-pollution concentrations specified by receptor, to air-quality defined

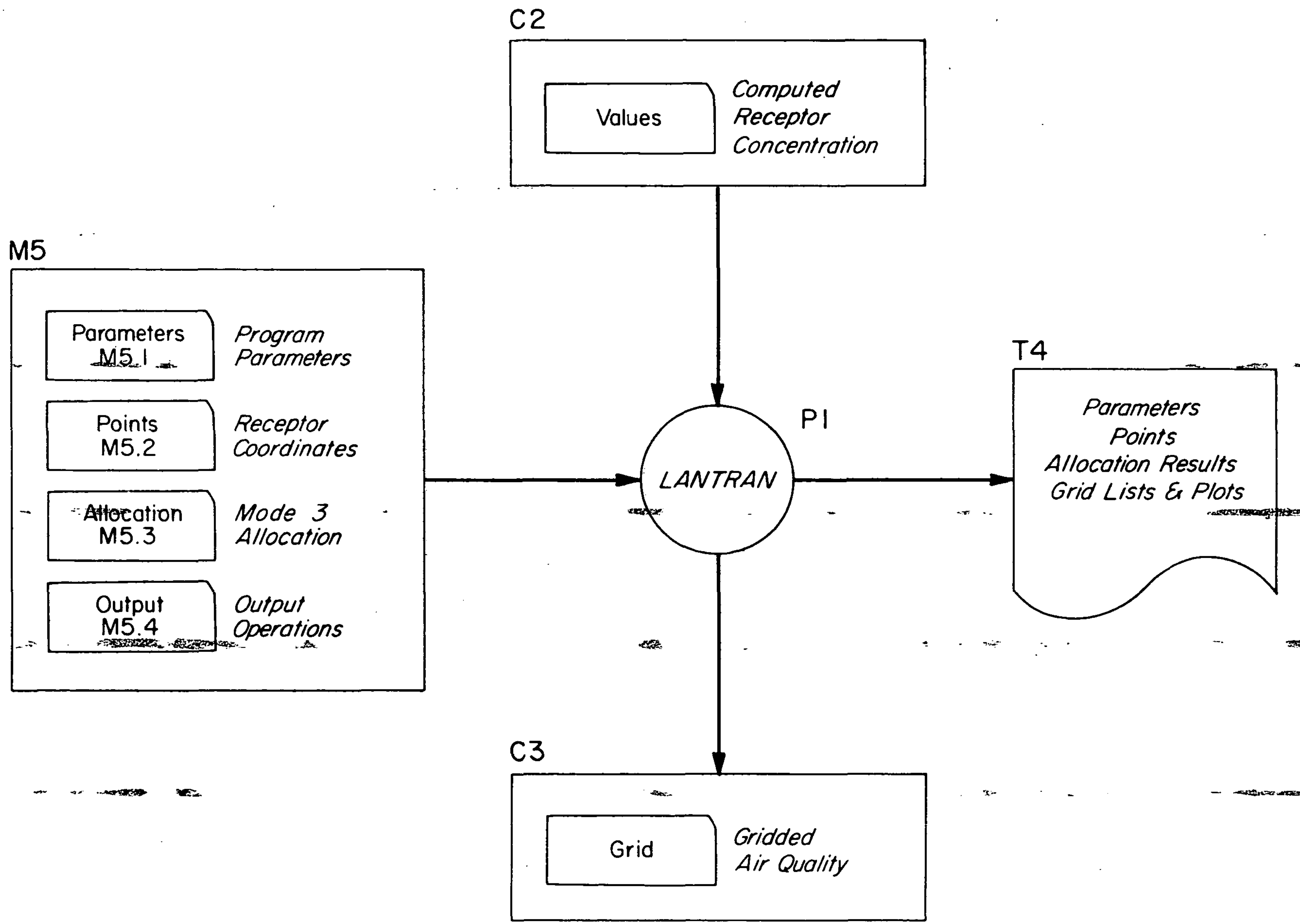


Figure 25 Data Flow for Conversion of MARTIK Output

on the grid system is shown in Figure 25. Data sets and typical deck set-ups are discussed as follows:

Data Sets

M5- Allocation Option Data Set

M5.1 PARAMETERS

A standard PARAMETERS package, with variables assigned as in Section 2.3.5.

M5.2 POINTS

Receptor coordinates identical to MARTIK input data set M3.2 (Section 3.3.4). For the Hackensack Meadowlands study, this is the "Hackensack Meadowlands 1-km receptor grid" shown in Figure 20.

M5.3 ALLOCATION

Each receptor concentration is distributed among cells of the grid system by interpolation (MODE 3) with weights determined as the inverse square of the distance of the receptor point from the cell center.

M5.4 OUTPUT

Control card package to select variables (pollutant names) for output to data set C3 (gridded air quality).

C2 Computed Receptor Concentrations

A keyword 'VALUES' package created as an output data set by MARTIK, containing the total arithmetic mean pollutant concentrations for the chosen plan and season (Section 3.3.4).

C3 Gridded Air Quality

A keyword 'GRID' package produced by LANTRAN for input to IMPACT (Section 4.3.2).

T4 Tabulated Output

Printer output of parameters, receptor coordinates as read in, receptor concentrations as read in, allocation results, and listings and plots of concentrations after allocation to the grid system.

2.3.5 Parameters for the Hackensack Meadowlands

PARAMETERS Package

The following variables must be specified in namelist &INPUT:

GX = X cell dimension

GY = Y cell dimension

NX = No. of cells across

NY = No. of cells down

SCALE = Unit conversion factor

ORIGIN = X_o, Y_o - coordinates of grid origin

JC = Output data set

The actual values for the PARAMETERS used in the present study are as follows:

PARAMETERS

&INPUT

SCALE = 1000.,

```
GX = 1., GY = 1.,
NX = 12, NY = 14,
ORIGIN = 572.0, 4510.0
JC = 7,
&END
```

2.3.6 LANTRAN and the Planning Process

The above discussions have been concerned with the mechanics of setting up the data sets and specification of the program options for LANTRAN. This section reviews the role played by LANTRAN in the planning process. Several types of analysis are summarized with examples. In each case, the data flow pattern follows the form of one of the Figures 23 through 25.

A. Allocation of Emissions to a Grid-Cell System

This is the predominant role of LANTRAN in AQUIP, brought about by the fact that in any planning area, the number of small discrete sources is so large that allocation to area sources is essential. Since MARTIK requires rectangular area sources, a grid system is indicated, and LANTRAN makes the essential transition from figure-based data to grid-based data. In principle, the COMPUTE routines would not be required. Land-use figures would be entered using a FIGURES package, and emission densities for each of the five pollutants entered in a corresponding VALUES package. The function of the COMPUTE routines is thus to incorporate the methodology for transforming <u>activity</u> data into <u>emissions</u> data.

B. Allocation of Land-Use Data to a Grid-Cell System

This role is similar to (A) but instead of allocation of emissions, it involves simply the allocation of any data defined on the original land-use figures to the desired grid cell system. This is the role played in development of the "correlation data set" used for air-quality impact analysis, for example. Again, no COMPUTE routines are essential to this role. The function of the COMPUTE 5 keyword package would be replaced by a manual selection and generation of densities to be associated with the land-use figures and these values would be coded and punched in a VALUES package for allocation as desired.

C. Conversion of Point-Values to Grid-Cell System

This is the role played in the conversion of MARTIK output concentrations--defined by receptor--to mean air quality per grid-cell of the chosen grid-system. In performing this transformation, LANTRAN constructs a mean surface through the data points, and then assigns to each cell the surface value corresponding to the cell center. This step could be eliminated if receptor points were always chosen to lie at cell centers, but since this could be restrictive, it was decided to allow the choice of grid-cell system used for impact analysis to be completely independent of the receptor grid used in computation of air quality. By choosing the grid-cell larger than the spacing of the receptors, the computed data is effectively smoothed, and conversely, if a smaller grid size is used, values corresponding to points between the receptors are inferred by interpolation. Finally, if the two-grid-systems are shifted (so that receptor sites are displaced, say to the corners of the cells), each cell is assigned a weighted average of the nearby receptor values. Several runs with LANTRAN, using the same receptor concentrations, allow the effects of smoothing and/or interpolation to be readily demonstrated through successive changes in the grid parameters.

D. Mapping of Point Data

This is an added role of LANTRAN made possible by the 'PLOT' function in the ALLOCATION package. Although not designed as a replacement for the SYMAP program, LANTRAN may be used for "quick-look" plotting of point-based data. This is accomplished by allocation using either mode 3 or 4 followed by a grid plot of the result, producing coarse-resolution "isopleth" or "proximal" maps respectively. This procedure is most useful for following the results of complicated computations through a series of runs.

2.4 Numbered Error Messages

The following table constitutes the set of conditions checked in the present level of implementation of the program, listed by routine, number and cause.

OUTS

15 Variable to be output has not been allocated

25 No given variables to be output

30 Output unit (JC) equals 0

900 Unexpected end of file on input unit (IC)

INAC

100 Over 100 activities to be input

900 Unexpected end of file on input unit (IC)

INFIGS

260	figure type not 'P','L', or 'A'
296	more than 400 figures to be input (occurred within a 'FIGURES' package.
370	vertices of line or area figure not consecutively numbered
410	too many vertices (more than 50)
430	line does not have at least two vertices
440	line length equals zero
500	area does not have at least four vertices
510	last vertex of area does not coincide with first vertex
520	area of figure equals zero
800	unexpected end of file

LTRANS

20	input file (IC) equals 6 or 7 or the file of LOGDATA
80	unidentifiable keyword

INPTS

213	over 400 figures to be input (occurred within a 'POINTS' package)
800	unexpected end of file on unit 11 (figures unit)
900	unexpected end of file on input unit (IC)

EVALS

130	over 18 variables (VALUES) present
300	figure number out of range (IFIG < 1 or IFIG > NFIG)
305	figure extent (previously calculated) found to be less than or equal to zero (area coded counter-clockwise)
900	unexpected end of file on input unit (IC)

INGRDS

30 over 18 gridded variables present (ALLOCATION variables plus grid variables)

65 grid indices out of range (NX,NY) or inconsistent grid dimensions (GX,GY) for grid cell input

70 inconsistent grid origin (ORIGIN(2)) for grid cell input

80 inconsistent scale factor (SCALE) for grid cell input

900 unexpected end of file on input unit.

FGRID

15 undefined keyword within ALLOCATION package

50 Allocation mode out of range (MODE < 1 or MODE >4)

55 Allocation variable unlocatable (as a VALUE)

70 less than one variable to be allocated

186 undefined variable (as a VALUE) to be manipulated, following MODE 2 card

455 undefined variable to be plotted

510 undefined variable to be zeroed or listed

900 unexpected end of file on input unit

INPAR

25 unit to be rewound (REWIND) equals 5,6, or 7

110 OUTGF specified .TRUE. -- not implemented in present version

210 OUTGL specified .TRUE. -- not implemented in present version

800 Namelist input error

900 unexpected end of file on input unit (IC)

COMP (AQUIP)

2 undefined SEASON (must be 'ANNUAL', 'SUMMER', or 'WINTER')

2.5 LANTRAN Test Cases

These test cases are a selection of LANTRAN program runs which demonstrate creation of emissions data sets, and land-use analysis for air quality impact analysis, as performed by the AQUIP system. Other capabilities inherent in the design of the system but not actually used in the Hackensack Meadowlands study are also illustrated by additional test cases.

The format of the test cases is carried throughout the entire discussion of the individual AQUIP system programs, LANTRAN, MARTIK, SYMAP and IMPACT. These cases make use of a hypothetical planning region depicted as the "base-map" for the study area in Figure 26. Data for the test cases are taken from land use figures shown on the base map in the form of coordinates measured from the map. Several test cases are used to demonstrate the following processes:

1. The creation and allocation of emissions data using LANTRAN allocation Mode 1, using a limited set of land-use zones in order to permit greater detail in package descriptions.

2. Creation and allocation of emissions for the full study area (to be carried through the analysis with the other programs).

3. Calculation of the population distribution within the study area, for use in air quality impact analysis.

4. Use of the "Mode 2" allocation procedure (not used in the Hackensack Meadowlands Study).

5. Assignment of receptor-based computed air quality to the grid-system chosen for the study area.

6. Use of the "Mode 4" allocation procedure (not used in the Hackensack Meadowlands Study).

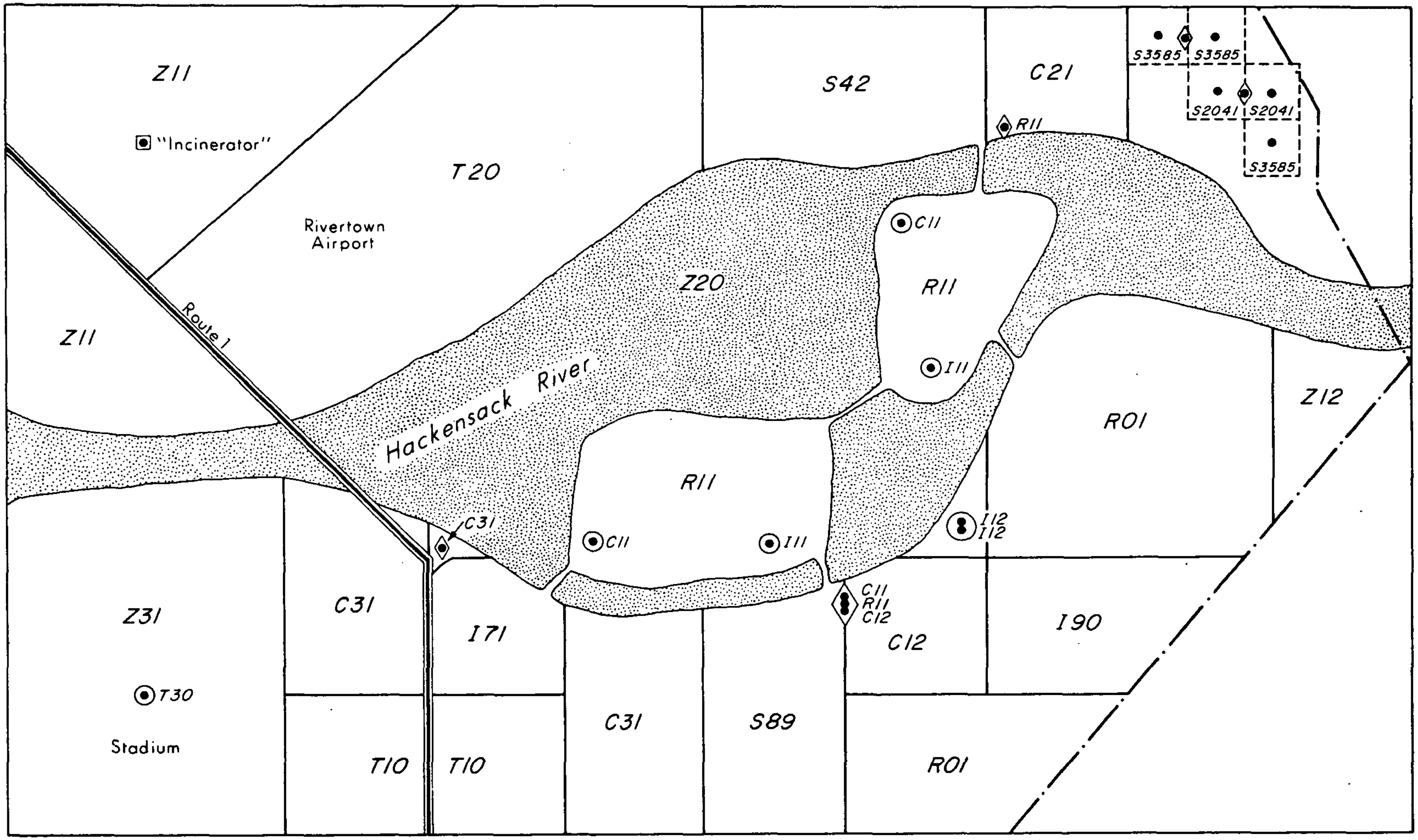


Figure 26 Test Case Base Map

Data preparation for the test cases begins with the base map of Figure 26. First, the land use zones are defined, as described in Section 2.3.1, and the "vertices" of each zone or "figure" indicated on an overlay to the base map (Figure 27). Next, the coordinate system to be used is defined, and the coordinate grid lines drawn for extraction of coordinate information from the maps as shown in Figure 27. For convenience, the grid is set with coordinates referred to the "origin" in the lower left (southwest) corner of the grid. The actual coordinates of this origin are determined, entered into the program, and added to the displacements for computation of absolute coordinates. Finally, the set of land use "values" defining the activities, rates, and the conversion processes to be used for each are assigned to each land use zone as described in Section 2.3.1.

The data corresponding to the land-use zone boundaries are coded on cards as a "FIGURES" package, using the measured coordinates of the figure vertices. Similarly, the data corresponding to the land use activity values are coded on cards on a "VALUES" package. The operations performed in each test case are determined by (1) the program options and parameters; (2) the order of the data packages; and (3) the COMPUTE routines which are invoked.

The discussion of the test cases covers first the check setup, and then discusses the program output. The discussion includes a card-by-card description of the IBM 360/65 Job Control Language (JCL) statements required to run the program at the ERT computer facility; it is evident that these statements are similar but different with each IBM 360/370 installation. Each of the data packages used in the test cases is described with respect to content (i.e., card-by-card or parameter-by-parameter) and the output produced. The output produced by the program is lengthy, and much of the information is printed only for assistance in error checking. It is

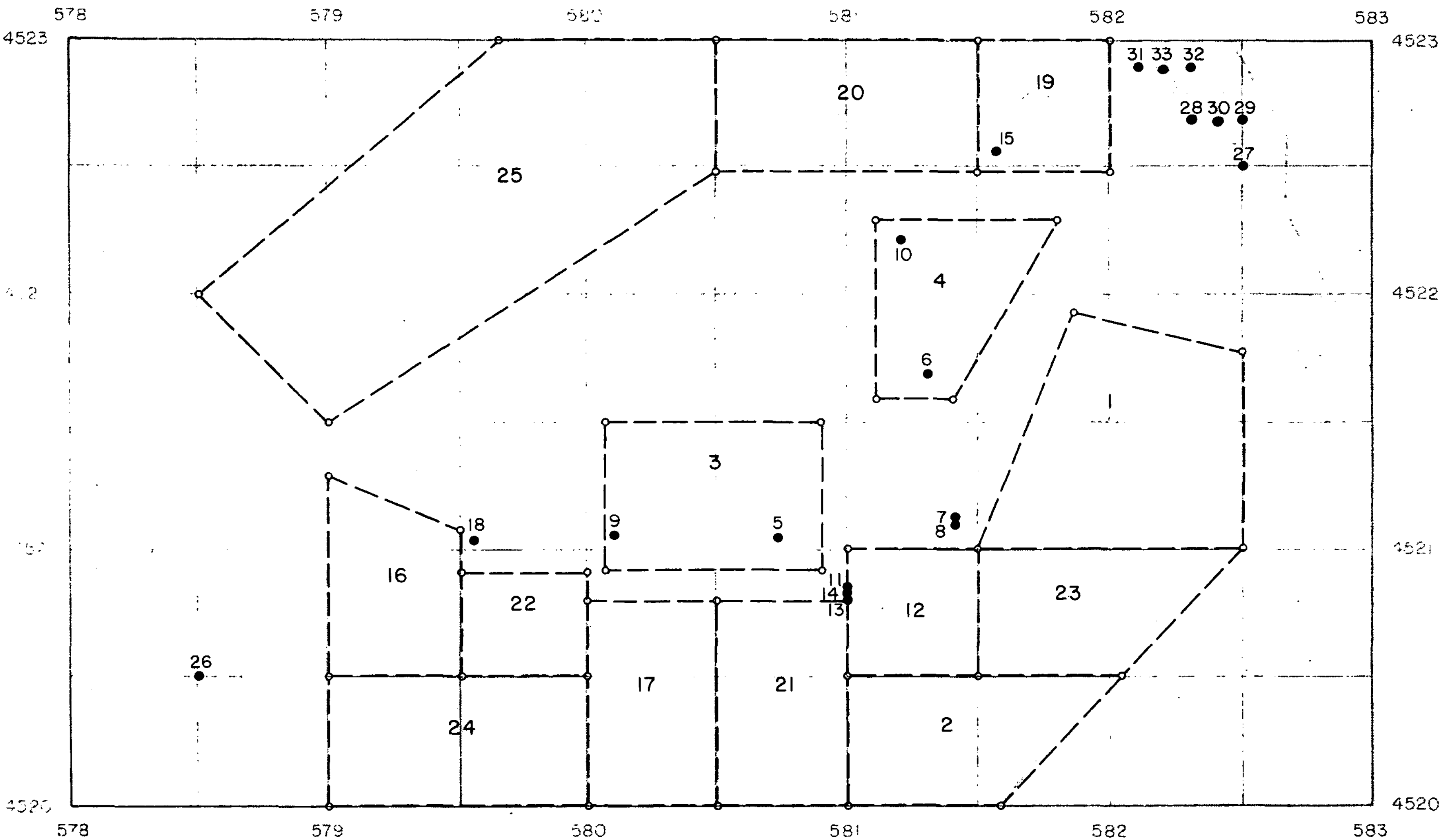


Figure 27 Test Case Base Map, With Figures and Grid Overlay

important to note that this error checking must be performed at each step in the computation process, since errors in input data may otherwise pass unnoticed through the system.

2.5.1 Test Case 1: Mode 1, Emissions Allocation

Job Control Language

The first two JCL cards are job cards which are specific to the computer center. The PARMS card was used to obtain 3 copies of each of the runs. The LANTRAN program resides on a linkage-library, and the next cards are used for linkage-editor control. There is a duplicate name (INPUT) which is referenced as READER by LANTRAN MAIN. The two CHANGE cards take care of this problem. The members INPUT, INE, etc. reside on the data set described by the DD LKED.ERT. The other LANTRAN modules are in the data set described by the DD LKED.LAN.

The FT07, card output, was DUMMY'ed to avoid unnecessary production of cards. If the cards had been desired FT07 could have been otherwise described. GO.FT09F001 is the log file for run accounting.

The data set GO.FT11F001 is an internal temporary data set used by FIGURES and POINTS. It should have the attributes RECFM=VB or VBS and LRECL=448. The space requirement is 1 cylinder. Blocksize can be specified for most efficiency depending on the device used.

The data set GO.FT12F001 is used by COMPUTE to hold point sources. It should have the record form, logical record size, and space allocation shown. The blocksize, etc. may be varied to make the best use of the device chosen.

The data set GO.FT13F001 and GO.FT14F001 are card images which are created by LANTRAN for further use in other runs.

Card input is from FORTRAN unit 5, GO.FT05F001.

Keywork Package input

The first package used is a PARAMETERS package to set the program parameters. The number of cells in X is set to 5, the number in Y to 3. The ORIGIN of the grid is set to 578. in X by 4520. in Y. The scale unit defaults to 1 km, so that this corresponds to setting the grid origins to be at the UTM coordinates (578., 4520.). The output unit, JC, is set to 7 so that cards are produced. Finally the levels to be used for the PLOT function are set. They are 0.0001, 0.001, 0.01, 0.30,..., 0.5, 1.0. There are ten levels, so the default value for the number of levels could be used, as can the default symbols.

The LANTRAN print-out corresponding to the PARAMETERS package is on page 1. After the page header, the keyword, and the comment portion of the keyword are printed. This run is the "LANTRAN MODE 1 EMISSIONS ALLOCATION TEST." Some pertinent information is also printed. The scale unit, which is used in all input coordinates, is 1000 m, i.e. 1 km. This is default value. The GRID definition is echoed; the origin is at (578., 4520.), the grid dimension is 5 cells by 3 cells, and each cell is 1 scale unit (default). The output unit number is echoed as 7. The minimum radius squared used in mode 3 allocation is the default value: 10^{-4} km^2.

The PARAMETERS package is terminated by &END.

Following the PARAMETERS package is a FIGURES package to input the detailed description of the shape of the figure being used for this case. A FIGURES package is described in Section 2.2.2. This test casd has two figures in it. The first figure is given a reference number 4, is an area, is a plan type 1A, has an activity code ROL, and has the title "AREA 4-RESIDENT." This information, as well as the coordinate of the first vertex, is on the first card. The following cards for the figure each contain the coordinates for another vertex on the polygon 'AREA 4-RESIDENT'.

The last card gives the same vertex as the first card, thus closing the polygon (as required for an area, 'A'). The second figure, "AREA 7-RESIDENT', follows the first figure and is input in the same format. It has been given the reference number 8.

The FIGURES package responds to this input by saving the data in an internal data set on unit 11. This unit was defined earlier in the JCL. On page 2 of the output, the information entered is echoed so that the user knows exactly what was input. In addition, it tabulates names, codes, vertices, and numbers. LANTRAN also calculates and outputs the centroid of the figure, and its area. This information is directly below the tabulation of vertices. Note that if the figure vertices are given in a counter -- clockwise direction it results in a negative area. Negative areas are used for holes in figures, as seen in Section 2.2.2. After printing the figures input, the program indicates that it has written an end of file to terminate the data on Unit 11 by printing **** END OF FILE. UNIT 11 ****.

After the FIGURES have been defined, values are associated with them using the VALUES package described in Section 2.2.4. The first data card specifies the variable names for the associated values: KFORM, KLINK, KRCODE, XFACTR, A3, and X.

Figure 4 has a KFORM of 15, and the remaining variables are 0. This means that figure 4 is a residential zone, heated individually, as explained in Section 2.3.1 and in Appendix A.2 of the Task 1 Report. This information is echoed on the print-on Page 3. Figure 8 also has a KFORM of 15, and this is echoed on Page 3.

The ACTIVITIES package is then used to associate activities of different kinds with the activity codes for the figures, as described in Section 2.2.6. The activities in this sample are those used in COMPUTE 1. The activity variables are ACTV, A1, A2, and A4, specified on the first data card. Then the activity code R01 is given for specification. Associated with R01 are the values: 18,750, ACTV, 10.A1, 1.5 A2, and 0.A4. This information is returned in tabular form on Page 4 of the test case. The meaning of the variables is explained in Section 2.3.1, and in Appendix A.3 of the Task 1 Report.

The COMPUTE 1 package is then executed. All default values for COMPUTE1 are being used, so the NAMELIST COMPIN is empty. The format for the COMPUTE card, and the values for NAMELIST are explained in Sections 1.3.9 and 1.3.3.1 NOTE: the COMPUTE namelist is &COMPIN, not &INPUT.

The COMPUTE 1 package generates BTU/hr for each figure, using the data provided by the VALUES and ACTIVITIES packages, see Section 2.3.1 and Section A4 of Task 1 Appendix. Listing the present values of the control parameters on Page 5, it begins its print. Page 6 is a listing of any RECODES where sources have their heat loads connected (see Section 2.3.1). Page 7 gives the final BTU output, and the information used to get it for the figures. Page 8 shows the LINK's between residential zones and, commercial zones and schools. Page 9 is further RECODE information where BTU loads have been merged. The final output is on Page 10.

The next ACTIVITIES package inputs the card data for use in COMPUTE 2. Although the variable names are different, and the associated values are different, the format is the same as before and a new set of variables and values have been associated with R01. This time a title "10 D.U." (10 dwelling units per acre density) is printed along with the R01. The output on on Page 11 tabulates the input information.

For an explanation of the variable's meanings see Section 2.3.1 and Section A.2 of the Task 1 Report Appendix.

COMPUTE 2 is used to generate pollution emissions from the BTU demand. The cards input specify no changes to the &COMPIN parameter list; the emissions factor package, described in Section 2.3.1, follows the &COMIN, &END. Emissions factors for pollutants, and heat contents, for B-COA, D-OIL, and N-GAS are set.

COMPUTE 2 uses the scheduled hours of operation, SCHED, the percent of fuel used for non-space heating, PROC, and the proportional use of different fules from the ACTIVITIES data; the heat requirements calculated for each figure in COMPUTE 1; and the emissions factors input with COMPUTE 2 to calculate the pollutant emissions for each season. See Section 2.3.1 for a discussion of how emissions factors are chosen.

The output on pages 12-14 gives the results of the calculations. Page 12 gives the basic parameter and emission factor information. There was no B-COA in ACTIVITIES fuel names so the emissions for B-COA are flagged and not printed. Then on Page 13 the total fuel use (in this case only N-GAS was used) and the resulting annual emissions rate for each pollutant are shown. Page 14 gives the ANNUAL, WINTER, and SUMMER pollutant emission rates; together with EXTENT information for each figure.

The next ACTIVITIES package gives the information needed by COMPUTE 3. Using the ACTIVITY "ZOO" the criteria for significant point sources is input (see Section 2.3.1). The emission rate for each pollutant, above which the point source will be pulled out and listed separately, is set. Also the default height (DFHT) in meters and default plume rise factor (DFPL) must be set. These will be used to define the stack parameters for the selected point sources. In the example any point source with an emission rate above 50 tons/yr for any pollutant, will be selected. The default stack height is 100 ft, plume rise of 60 ft^2/sec.

After the criteria have been set COMPUTE 3 is begun. It requires the array CONST be input as shown. These values are used for conversion constants. It examines all the point sources and selects out the points exceeding any criteria. The selected point sources are output in 'POINT' format acceptable to a MARTIK 'SRCE' package on the unit JUNIT.

The ALLOCATION package uses the control cards input to it, and performs calculations. The first control card specified a mode 1 allocation of CO, and NOX, from the figure variable description, FV array, the gridded variable description, and the GV array. The internal data is in terms of CO or NOX /(SCALE UNIT)^2. A mode 1 allocation is described in Section 2.1.1. In the allocation of values from the figure to grid related variables, the ALLOCATION package prints the output on Page 18. Variables being allocated are indicated by the line:

VARIABLE NAME(S): CO NOX.

Then, for each figure, the extent of the figure in the grid cells, and the corresponding weighted value of CO and NOX in the cell, due to the figure, is listed. Also, a total is given. Note that extent varies from 0 to 1. as the fraction of the cell contained in the figure.

After the MODE 1 allocation, the next control card specifies a LIST of CO and NOX, using the control card format shown in Section 2.2.7 for LIST. Pages 19, and 20 have the resulting output. The variable being listed is specified and the value in each cell is printed. Note that only 2 places are given after the decimal point; 0.00 indicates a value less than 0.005.

The values are then plotted on the printer using the PLOT control word. These plots are on pages 21, and 22. The values in each cell are symbolically represented. The meaning of each symbol is given below the plot, with the maximum and minimum for each class. Again, note that only 2 places are available after the decimal point. The default symbols were used, and the levels changed from the default in the initial PARAMETERS package rather than using the option to change values with cards following the control card.

The ALLOCATION package is terminated with a '99999' card.

The OUTPUT package is used to punch the gridded values onto cards, in a 'GRID' format.

JC was left = 7 in the initial PARAMETERS, and has not been changed, so the output is a unit 7. The second card of the package specifies the variables to be output, CO, and NOX, in the format specified in Section 2.2.8. The SEASON is still the initial default, 'ANNUAL', so the GRID oupput is annual values.

The package indicates the variables which have been punched in GRID form, CO, NOX, the unit number, 7, and the beginning sequence number 10340030. This will permit identification of the output when necessary. The GRID format is described in 2.2.5. All cards (including the keyword card 'GRID') will be punched by OUTPUT.

After this OUTPUT package has run, both the isolated point sources, extracted by COMPUTE 3 for 'ANNUAL', and the gridded annual area sources have been punched.

The COMPUTE 4 is then used to output the point sources for 'WINTER'. SEASON has been changed to 'WINTER' in the &COMPIN namelist. COMPUTE 3, and extracts and punches the 'WINTER' point sources. On page 24, the values of critical parameters are listed, together with the indication that 'COMPUTATIONS HAVE BEEN PERFORMED BY ROUTINE 4'. UNIT is still 7 so cards are being punched.

Next, after punching point sources, an ALLOCATION package is used to allocate CO-W, and NOX-W, the 'WINTER' variables. A MODE 1 allocation to the same grid, a LIST, and a PLOT are performed on CO-W, and NOX-W. The output from this package, Pages 25-29, is the same as for the previous ALLOCATION, except that now the values are for the winter variables rather than the annual variables.

With the ALLOCATION complete, another OUTPUT package is used to output the winter variables CO-W, and NOX-W. These values are punched in the GRID format, on cards (unit 7) beginning with sequence number 10340140. The Page 30 output indicates the execution of the OUTPUT.

The run was terminated with an ENDJOB card; which is indicated by the 'END of PROGRAM' on Page 30.

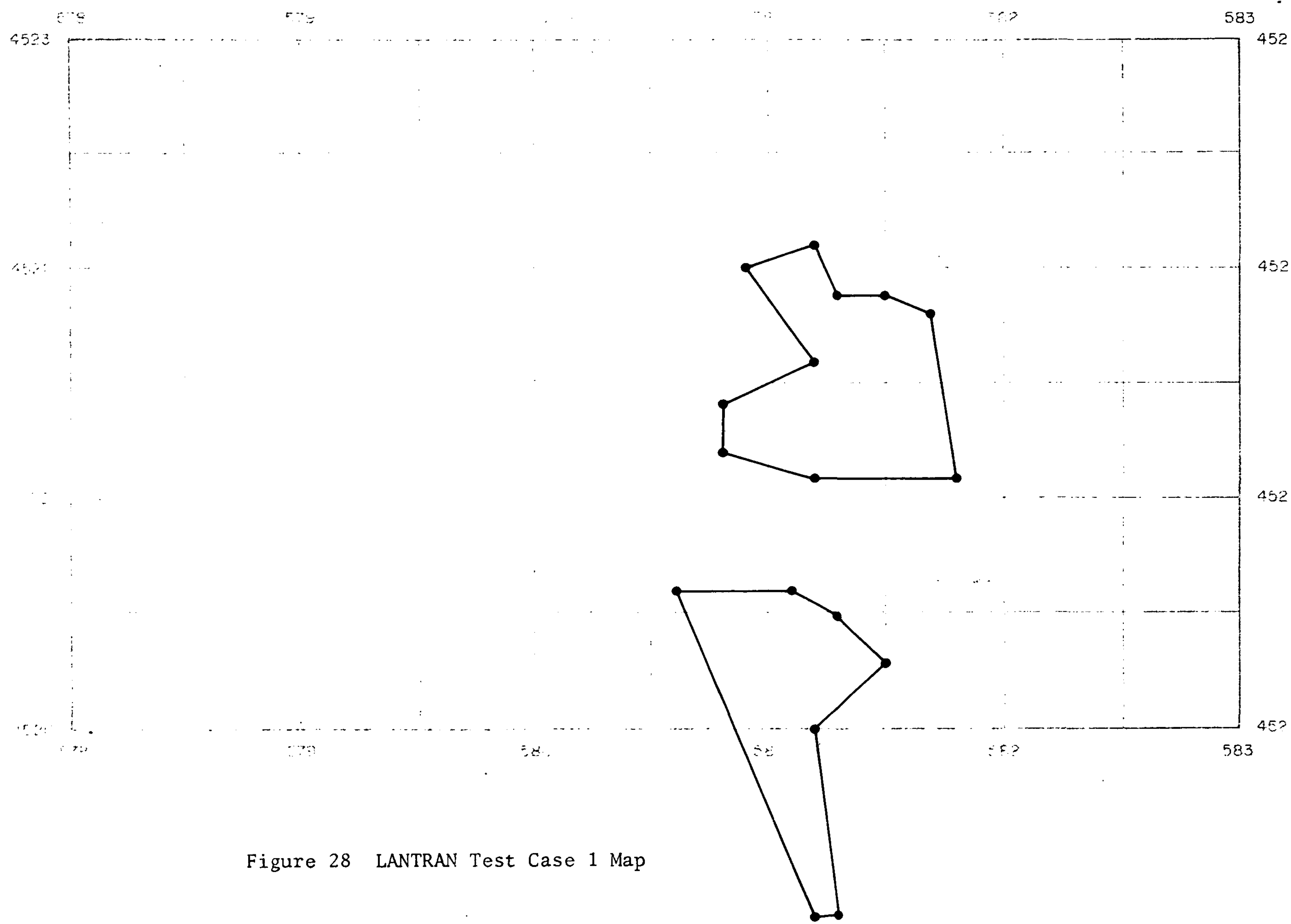


Figure 28 LANTRAN Test Case 1 Map

```
...,4A10),XX,X
// MSGLEVEL=1
/*PARMS  COPIES=03
// EXEC FORTHLG,PARM.LKED='LET,MAP,LIST',REGION.GO=198K,TIME.GO=2
//LKED.SYSLIN DD *
 CHANGE INPUT(READER)
 INCLUDE ERT(INPUT,INE,HEADR,ERRX,SEQNO,TXLOC,GTABU,ICHAR,GPLOT)
 CHANGE INPUT(READER)
 INCLUDE LAN(MAIN,BLOCK,INPARM,INFIGS,INPTS,EVALS,FGRID,INGRDS)
 INCLUDE LAN(COMP,INAC,OUTS,PLANIM,PERIM,ALLOCF,ASEG)
/*
//LKED.ERT DD DSN=ERT4610.P9990000,ERTLIB,DISP=SHR
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//LKED.LAN DD DSN=LANTRAN,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO.FT07F001 DD DUMMY
//GO.FT09F001 DD DSN=C461002,ER701.LOGDATA,DISP=SHR,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AVCU16)
//GO.FT11F001 DD UNIT=SYSDA,SPACE=(CYL,1),
// DCB=(RECFM=VSB,LRECL=448,BLKSIZE=4484)
//GO.FT12F001 DD UNIT=SYSDA,SPACE=(CYL,1),
// DCB=(RECFM=FB,LRECL=80,BLKSIZE=4800)
//GO.FT13F001 DD DSN=EMIS81,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO.FT14F001 DD DSN=EMIS82,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO.FT05F001 DD *
PARAMETERS          LANTRAN MODE 1 EMISSIONS ALLOCATION TEST
 &INPUT
 NX=5,NY=3,ORIGIN=578.0,4520.0,
 JC=7,
 LEV=0.0001,0.001,0.01,0.03,0.05,0.1,0.15,0.25,0.5,1.0,
 &END
FIGURES             LANTRAN MODE 1 TEST CASE #1
    4   1A 580.8     4521.2        1A     R01        AREA 4-RESIDENT
         2  580.8     4521.4
         3  581.2     4521.6
         4  580.9     4522.0
         5  581.2     4522.1
         6  581.3     4521.8
         7  581.5     4521.8
         8  581.7     4521.7
         9  581.6     4521.1
        10  581.2     4521.1
        11  580.8     4521.2
    8   1A 580.6     4520.7        1A     R01        AREA 7-RESIDENT
         2  581.1     4520.7
         3  581.3     4520.6
         4  581.5     4520.3
         5  581.2     4520.0
         6  581.3     4519.2
         7  581.2     4519.1
         8  580.6     4920.7
99999
VALUES              LANTRAN MODE 1 TEST CASE #1
        KFORM       KLINK      KRCODE     XFACTR     AS        X
       4 15.
       8 15.
99999
ACTIVITIES          ACTIVITY CODES TO BE USED BY COMP1(#1)

ACTV      A1         A2         A4
R01
 18750.    10.        1.5
99999
COMPUTE            1  COMP1
 &COMPIN
 &END
ACTIVITIES          ACTIVITIES TO BE USED BY COMP2  (#2)
SCHED     PROC       R-OIL      D-OIL      N-GAS      PROC1      PROC2
R01                  10 D.U.
    8760.      10.0                              1.02
99999
COMPUTE            2  COMP2
 &COMPIN
 &END
         TSP         SOX        CO         HC         NOX
         TSP-W       SOX-W      CO-W       HC-W       NOX-W
         TSP-S       SOX-S      CO-S       HC-S       NOX-S
R01                  RES. FUEL BURNING
H-COA          20.       7.6       90.0       20.        3.0
D-OIL          10.       6.5        0.2        3.        4.8
N-GAS          19.       0.6       20.0        8.        5.0
99999
ACTIVITIES          TEST FOR COMP3  (#3)
TSP       SOX        CO         HC         NOX        DEHT       DPPL
200
 50.       50.        50.        50.        50.        100.       60.
99999
COMPUTE            3  COMP3
 &COMPIN
 CONST=0.0287,0.305,4.0,0.,0.,0.,0.0287,
 &END
ALLOCATION          ANNUAL SOURCE CONCENTRATIONS
MODE  1   CO         NOX
LIST      CO         NOX
PLOT      CO         NOX
99999
OUTPUT              WRITES ANNUAL GRID PACKAGE
          CO         NOX
99999
COMPUTE            4  OUTPUT WINTER POINT SOURCES
 &COMPIN SEASON='WINTER' &END
ALLOCATION          WINTER SOURCE CONCENTRATIONS
MODE  1   CO-W       NOX-W
LIST      CO-W       NOX-W
PLOT      CO-W       NOX-W
99999
OUTPUT              WRITES WINTER GRID PACKAGE
          CO-W       NOX-W
99999
ENDJOB
/*EOF
**
```

Figure 29   LANTRAN Test Case 1 Deck Set-Up

```
//ERTHACK3 JOB (88202440000,ERT**,101,***,MKEEFE,219**********,4610),XX,X JOB  90
// MSGLEVEL=1
***PARMS COPIES=03                                                       ACCEPTED
// EXEC FORTHLG,PARM.LKED='LET,MAP,LIST',REGION.GO=198K,TIME.GO=7
XX          PROC PR=A                                                    00000010
XXLKED EXEC     PGM=IEWL,PARM='MAP,LET,LIST',                           X00000020
XX              REGION=100K                                              00000030
XXSYSPRINT DD  SYSOUT=&PR,DCB=(LRECL=121,BLKSIZE=1573),                 X00000040
IEF653I SUBSTITUTION JCL - SYSOUT=A,DCB=(LRECL=121,BLKSIZE=1573),
XX              SPACE=(1573,(24,48))                                     00000050
XXSYSLIB   DD  DSNAME=SYS1.FORTLIB,DISP=SHR                             00000060
XX         DD  DSNAME=SYS1.DOUBLEP,DISP=SHR                             00000070
XXSYSUT1 DD UNIT=SYSDA,SPACE=(CYL,(2,1))                                00000080
XXSYSLMOD  DD  DSN=&GOSET(FHXXMAIN),UNIT=SYSDA,DISP=(,PASS),            00000090
XX              SPACE=(CYL,(15,,1))                                      00000100
//LKED.SYSLIN DD *
//LKED.ERT DD DSN=ERT4610.P9990000.ERTLIB,DISP=SHR
//LKED.LAN DD DSN=LANTRAN,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
IEF236I ALLOC. FOR ERTHACK3 LKED
IEF237I 080   ALLOCATED TO SYSPRINT
IEF237I 256   ALLOCATED TO SYSLIB
IEF237I 257   ALLOCATED TO
IEF237I 253   ALLOCATED TO SYSUT1
IEF237I 253   ALLOCATED TO SYSLMOD
IEF237I 061   ALLOCATED TO SYSLIN
IEF237I 255   ALLOCATED TO ERT
IEF237I 101   ALLOCATED TO LAN
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS1.FORTLIB                                   KEPT
IEF285I   VOL SER NOS= ACS101.
IEF285I   SYS1.DOUBLEP                                   KEPT
IEF285I   VOL SER NOS= ACS102.
IEF285I   SYS74040.T093735.RV000.ERTHACK3.R0001219       DELETED
IEF285I   VOL SER NOS= ACS002.
IEF285I   SYS74040.T093735.RV000.ERTHACK3.GOSET          PASSED
IEF285I   VOL SER NOS= ACS002.
IEF285I   ERT4610.P9990000.ERTLIB                        KEPT
IEF285I   VOL SER NOS= USER00.
IEF285I   LANTRAN                                        KEPT
IEF285I   VOL SER NOS= AIRMAP.
IEF373I STEP /LKED    / START 74040.1413
IEF374I STEP /LKED    / STOP  74040.1414 CPU   0MIN 20.69SEC MAIN  98K LCS   0K
XXGO   EXEC    PGM=*.LKED.SYSLMOD,COND=(5,LT,LKED)                       00000110
XXFT06F001 DD  SYSOUT=&PR,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1596)        00000120
IEF653I SUBSTITUTION JCL - SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1596)
//GO.FT07F001 DD DUMMY
//GO.FT09F001 DD DSN=C461002.ER701.LOGDATA,DISP=SHR,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AVC016)
//GO.FT11F001 DD UNIT=SYSDA,SPACE=(CYL,1),
// DCB=(RECFM=VBR,LRECL=448,BLKSIZE=4484)
//GO.FT12F001 DD UNIT=SYSDA,SPACE=(CYL,1),
// DCB=(RECFM=FB,LRECL=80,BLKSIZE=4800)
//GO.FT13F001 DD DSN=EMISS1,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO.FT14F001 DD DSN=EMISS2,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO.FT05F001 DD *
//
IEF236I ALLOC. FOR ERTHACK3 GO
IEF237I 253   ALLOCATED TO PGM=*.DD
IEF237I 080   ALLOCATED TO FT06F001
IEF237I 121   ALLOCATED TO FT09F001


IEF237I 253   ALLOCATED TO FT11F001
IEF237I 253   ALLOCATED TO FT12F001
IEF237I 101   ALLOCATED TO FT13F001
IEF237I 101   ALLOCATED TO FT14F001
IEF237I 062   ALLOCATED TO FT05F001
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS74040.T093735.RV000.ERTHACK3.GOSET          PASSED
IEF285I   VOL SER NOS= ACS002.
IEF285I   C461002.ER701.LOGDATA                          KEPT
IEF285I   VOL SER NOS= AVC016.
IEF285I   SYS74040.T093735.RV000.ERTHACK3.R0001222       DELETED
IEF285I   VOL SER NOS= ACS002.
IEF285I   SYS74040.T093735.RV000.ERTHACK3.R0001223       DELETED
IEF285I   VOL SER NOS= ACS002.
IEF285I   EMISS1                                         KEPT
IEF285I   VOL SER NOS= AIRMAP.
IEF285I   EMISS2                                         KEPT
IEF285I   VOL SER NOS= AIRMAP.
IEF373I STEP /GO      / START 74040.1414
IEF374I STEP /GO      / STOP  74040.1414 CPU   0MIN 10.14SEC MAIN 186K LCS   0K
IEF285I   SYS74040.T093735.RV000.ERTHACK3.GOSET          DELETED
IEF285I   VOL SER NOS= ACS002.
IEF375I  JOB /ERTHACK3/ START 74040.1413
IEF376I  JOB /ERTHACK3/ STOP  74040.1414 CPU   0MIN 30.83SEC
```

Figure 30 LANTRAN Test Case 1 Printed Output

```
BEGIN LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1 LEVEL 721220 RUN   1034
TABLE COUNT= 38
 19  1034     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)              9 FEB 1974          PAGE   1
*********************************************************************************************************************************

        PARAMETERS         LANTRAN MODE 1 EMISSIONS ALLOCATION TEST

                 SCALE UNIT= 1.000E 03 METERS

                 GRID ORIGIN:   578.000, 4520.000 UNITS

                 GRID DIMENSIONS:  5 CELLS(X) BY  3 CELLS(Y)

                 CELL DIMENSIONS(UNITS):      1.00(X) BY      1.00(Y)

                 OUTPUT TAPE=  7

                 MIN. RAD**2= 1.000E-04 UNITS**2
 19  1034     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)              9 FEB 1974          PAGE   2
*********************************************************************************************************************************

FIGURES             LANTRAN MODE 1 TEST CASE #1                                  (UNIT  5)

        FIGURE   4    TYPE: A    ID:      1A      CODE: R01       AREA 4-RESIDENT

                 VERTEX         X-COORD   Y-COORD
                    1           580.800  4521.199
                    2           580.800  4521.398
                    3           581.200  4521.598
                    4           580.900  4522.000
                    5           581.200  4522.098
                    6           581.300  4521.797
                    7           581.500  4521.797
                    8           581.700  4521.699
                    9           581.600  4521.098
                   10           581.200  4521.098
                   11           580.800  4521.199

                 CENTROID       581.271  4521.492 TOTAL AREA=      0.590

        FIGURE   8    TYPE: A    ID:      1A      CODE: R01       AREA 7-RESIDENT

                 VERTEX         X-COORD   Y-COORD
                    1           580.600  4520.699
                    2           581.100  4520.699
                    3           581.300  4520.598
                    4           581.500  4520.297
                    5           581.200  4520.000
                    6           581.300  4519.199
                    7           581.200  4519.098
                    8           580.600  4520.699

                 CENTROID       581.067  4520.137 TOTAL AREA=      0.630

**** END OF FILE, TAPE 11 ****

 19  1034     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)              9 FEB 1974          PAGE   3
*********************************************************************************************************************************

VALUES              LANTRAN MODE 1 TEST CASE #1                                  (UNIT  5)

        VALUES SPECIFIED FOR FIGURES--

        FIGURE      KFORM          KLINK          KRCODE         XFACTR         A3             X

           4        1.500E 01      0.0            0.0            0.0            0.0            0.0
           8        1.500E 01      0.0            0.0            0.0            0.0            0.0
 19  1034     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)              9 FEB 1974          PAGE   4
*********************************************************************************************************************************

ACTIVITIES          ACTIVITY CODES TO BE USED BY COMP1(#1)                       (UNIT  5)

KEY-ACTIVITY        ACTIVITY  ACTIVITY NAMES

                              ACTV           A1             A2             A4

  R01
                           18750.000       10.000          1.500          0.0
 19  1034     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)              9 FEB 1974          PAGE   5
*********************************************************************************************************************************

                    COMP1                                                        (UNIT  5)

                    COMPUTATIONS PERFORMED BY ROUTINE      1


  ****SUBROUTINE COMP



    IPVIN      IPVOUT     UNIT       JUNIT
      0          0          12          7
     DDW        DDA       DFPRNT     IFORM
  0.0        0.0        0.0            0
     NAM

    CONST
  0.0        0.0        0.0        0.0        0.0        0.0        0.0
        IPUNCH      PLAND            SEASON
          T           F              ANNUAL

  ****SUBROUTINE COMP1
 19  1034     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)              9 FEB 1974          PAGE   6
*********************************************************************************************************************************

  ****RECODE

    IREF  CODE         KFORM     KRCODE          AREA(KRCODE)            AREA(IREF)
```

Figure 30 Contd.

```
 19  1034     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)              9 FEB 1974           PAGE   7
*****************************************************************************************************************************

  ****NORM

     IREF  CODE           KFORM         A1          A2        AREA       ACTV                  X

        4  R01               15     10.00                   133.18  18750.00        2.49710E 07
        8  R01               15     10.00                   155.54  18750.00        2.91634E 07
 19  1034     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)              9 FEB 1974           PAGE   8
*****************************************************************************************************************************

  ****LINK

     IREF  CODE           KFORM     KLINK          A1          A2         A11         A22        AREA     AACTV          A4           X

 19  1034     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)              9 FEB 1974           PAGE   9
*****************************************************************************************************************************

  ****RECODE

     IREF  CODE           KFORM     KRCODE                X(KRCODE)                 X(IREF)

  ****SUBROUTINE COMP4

 19  1034     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)              9 FEB 1974           PAGE  10
*****************************************************************************************************************************

                IREF      KFORM     XFACTR          A3             X


                   4         15       0.0         0.0  2.49710E 07
                   8         15       0.0         0.0  2.91634E 07

 19  1034     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)              9 FEB 1974           PAGE  11
*****************************************************************************************************************************

ACTIVITIES          ACTIVITIES TO BE USED BY COMP2  (#2)                          (UNIT  5)

KEY-ACTIVITY        ACTIVITY  ACTIVITY NAMES

                                 SCHED          PROC            R-OIL            D-OIL            N-GAS           PROC1          PROC2

 R01                           10 D.U.
                                 8760.000       10.000            0.0              0.0            1.000             0.0            0.0


 19  1034     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)              9 FEB 1974           PAGE  12
*****************************************************************************************************************************

                    COMP2                                                         (UNIT  5)

                    COMPUTATIONS PERFORMED BY ROUTINE      2


  ****SUBROUTINE COMP



    IFVIN      IFVOUT     UNIT       JUNIT
        0          0         12          7
      DDW        DDA     DFPRHT      IFORM
    0.0        0.0        0.0            0
      NAM

    CONST
    0.0        0.0        0.0        0.0        0.0        0.0        0.0
         IPUNCH       PLAND                 SEASON
            T            F                  ANNUAL

  ****SUBROUTINE COMP2


          TSP        SOX        CO         HC         NOX
          TSP-W      SOX-W      CO-W       HC-W       NOX-W
          TSP-S      SOX-S      CO-S       HC-S       NOX-S

R01                     RES. FUEL BURNING
  *********  FUELNAME NOT FOUND IN AVNAM(LOCATIONS 3 TO 7).   FUEL IS R-COA
D-OIL         10.0000     6.5000     0.2000     3.0000     4.8000
N-GAS         19.0000     0.6000    20.0000     8.0000     5.0000
  PROCESS 1,2,3 ARRAY-- IPRC =      6     7     0  IXI -FLAG =     1

 19  1034     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)              9 FEB 1974           PAGE  13
*****************************************************************************************************************************

                IREF   CODE        FUEL        QFUEL POLLUTANT          EM-FAC       A-CONC     Z1         Z2
                   4   R01         N-GAS     2.20956E 02
                                   N-GAS     2.20956E 02   TSP          19.00 2.09908E 00
                                   N-GAS     2.20956E 02   SOX           0.60 6.62866E-02
                                   N-GAS     2.20956E 02   CO           20.00 2.20955E 00
                                   N-GAS     2.20956E 02   HC            8.00 8.83822E-01
                                   N-GAS     2.20956E 02   NOX           5.00 5.52389E-01
                   8   R01         N-GAS     2.58051E 02
                                   N-GAS     2.58051E 02   TSP          19.00 2.45149E 00
                                   N-GAS     2.58051E 02   SOX           0.60 7.74153E-02
                                   N-GAS     2.58051E 02   CO           20.00 2.58051E 00
                                   N-GAS     2.58051E 02   HC            8.00 1.03220E 00
                                   N-GAS     2.58051E 02   NOX           5.00 6.45128E-01

  ****SUBROUTINE COMP4
```

Figure 30 Contd.

```
19  1034    LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            9 FEB 1974          PAGE  14
************************************************************************************************************************

             EXTENT        AS          X             TSP          SOX          CO           HC           NOX
                                                     ANNUAL
                                                     WINTER
                                                     SUMMER


    4        0.5397        0.0     2.43051E 11   2.09908E 00  6.62866E-02  2.20955E 00  8.83822E-01  5.52389E-01
                                                 4.54521E 00  1.43533E-01  4.78444E 00  1.91377E 00  1.19611E 00
                                                 2.09907E-01  6.62866E-03  2.20955E-01  8.83822E-02  5.52389E-02

    8        0.6303        0.0     2.83857E 11   2.45149E 00  7.74153E-02  2.58051E 00  1.03220E 00  6.45128E-01
                                                 5.30830E 00  1.67630E-01  5.58768E 00  2.23507E 00  1.39692E 00
                                                 2.45148E-01  7.74153E-03  2.58051E-01  1.03220E-01  6.45128E-02
19  1034    LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            9 FEB 1974          PAGE  15
************************************************************************************************************************

ACTIVITIES       TEST FOR COMP3  (#3)                                   (UNIT  5)

KEY-ACTIVITY     ACTIVITY  ACTIVITY NAMES
                        TSP          SOX          CO           HC           NOX          DFMT         DFPL

 Z00
                       50.000       50.000       50.000       50.000       50.000      100.000       60.000
19  1034    LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            9 FEB 1974          PAGE  16
************************************************************************************************************************

                 COMP3                                                  (UNIT  5)

                 COMPUTATIONS PERFORMED BY ROUTINE     3


 ****SUBROUTINE COMP



   IFVIN    IFVOUT    UNIT     JUNIT
     0        0        12        7
    DDW      DDA     DFPRMT    IFORM
   0.0      0.0       0.0        0
    NAM

   CONST
   0.029     0.305    4.000     0.0       0.0       0.0       0.029
        IPUNCH      PLAND              SEASON
          T           F                ANNUAL

 ****SUBROUTINE COMP3


 ****SUBROUTINE COMP4
19  1034    LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            9 FEB 1974          PAGE  17
************************************************************************************************************************

             EXTENT        AS          X             TSP          SOX          CO           HC           NOX
                                                     ANNUAL
                                                     WINTER
                                                     SUMMER


    4        0.5397        0.0        0.0        1.11632E-01  3.52521E-03  1.17507E-01  4.70029E-02  2.93768E-02
                                                 2.41720E-01  7.63328E-03  2.54443E-01  1.01777E-01  6.36107E-02
                                                 1.11632E-02  3.52521E-04  1.17507E-02  4.70028E-03  2.93768E-03

    8        0.6303        0.0        0.0        1.11632E-01  3.52521E-03  1.17507E-01  4.70028E-02  2.93768E-02
                                                 2.41720E-01  7.63328E-03  2.54443E-01  1.01777E-01  6.36107E-02
                                                 1.11632E-02  3.52521E-04  1.17507E-02  4.70028E-03  2.93768E-03

19  1034    LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            9 FEB 1974          PAGE  18
************************************************************************************************************************

ALLOCATION       ANNUAL SOURCE CONCENTRATIONS                           (UNIT  5)


       FIGURES ALLOCATED TO GRID BY MODE  1

       VARIABLE NAME(S):  CO        NOX
       FIGURE    TYPE    IX - IY   EXTENT      CO          NOX

          4        A               5.397E-01  1.175E-01   2.938E-02

                          3    2   0.0617     7.246E-03   1.811E-03
                          4    2   0.4618     5.426E-02   1.357E-02
                          3    3   0.0016     1.916E-04   4.790E-05
                          4    3   0.0146     1.716E-03   4.290E-04
                         TOTALS    1.0000     6.341E-02   1.585E-02

          8        A               6.303E-01  1.175E-01   2.938E-02

                          3    1   0.1882     2.211E-02   5.529E-03
                          4    1   0.2445     2.873E-02   7.188E-03
                         TOTALS    0.6865     5.084E-02   1.271E-02
```

Figure 30 Contd.

```
 19  1034    LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            9 FEB 1974              PAGE  19
**************************************************************************************************************************

                    GRID LISTING FOR VARIABLE CO        :


                           1          2          3          4          5

                 3        0.0        0.0        0.00       0.00       0.0

                 2        0.0        0.0        0.01       0.05       0.0

                 1        0.0        0.0        0.02       0.03       0.0
 19  1034    LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            9 FEB 1974              PAGE  20
**************************************************************************************************************************

                    GRID LISTING FOR VARIABLE NOX       :


                           1          2          3          4          5

                 3        0.0        0.0        0.00       0.00       0.0

                 2        0.0        0.0        0.00       0.01       0.0

                 1        0.0        0.0        0.01       0.01       0.0
 19  1034    LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            9 FEB 1974              PAGE  21
**************************************************************************************************************************

                    GRID PLOT FOR VARIABLE CO        :


              1    2    3    4    5

                        .....-----
         3              .....-----            3
                        .....-----
                        .....-----
                        -----XXXXX
         2              -----XXXXX            2
                        -----XXXXX
                        -----XXXXX
                        ==========
         1              ==========            1
                        ==========
                        ==========

              1    2    3    4    5


         LEVEL DESIGNATIONS...

              1          2          3          4          5          6          7          8          9          10
                       .....      -----      =====      +++++      XXXXX      OOOOO      @@@@@      ■■■■■      ■■■■■
                       .....      -----      =====      +++++      XXXXX      OOOOO      @@@@@      ■■■■■      ■■■■■
                       .....      -----      =====      +++++      XXXXX      OOOOO      @@@@@      ■■■■■      ■■■■■
                       .....      -----      =====      +++++      XXXXX      OOOOO      @@@@@      ■■■■■      ■■■■■
CELL COUNT:   9          1          2          2          0          1          0          0          0          0
VALUE:       0.0        0.00       0.01       0.03       0.0        0.05       0.0        0.0        0.0        0.0

MAXIMUM:     0.00       0.00       0.01       0.03       0.05       0.10       0.15       0.25       0.50
MINIMUM:                0.00       0.00       0.01       0.03       0.05       0.10       0.15       0.25       0.50
 19  1034    LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            9 FEB 1974              PAGE  22
**************************************************************************************************************************

                    GRID PLOT FOR VARIABLE NOX       :


              1    2    3    4    5

                             .....
         3                   .....            3
                             .....
                             .....
                        -----=====
         2              -----=====            2
                        -----=====
                        -----=====
                        ----------
         1              ----------            1
                        ----------
                        ----------

              1    2    3    4    5


         LEVEL DESIGNATIONS...

              1          2          3          4          5          6          7          8          9          10
                       .....      -----      =====      +++++      XXXXX      OOOOO      @@@@@      ■■■■■      ■■■■■
                       .....      -----      =====      +++++      XXXXX      OOOOO      @@@@@      ■■■■■      ■■■■■
                       .....      -----      =====      +++++      XXXXX      OOOOO      @@@@@      ■■■■■      ■■■■■
                       .....      -----      =====      +++++      XXXXX      OOOOO      @@@@@      ■■■■■      ■■■■■
CELL COUNT:  10          1          3          1          0          0          0          0          0          0
VALUE:       0.00       0.00       0.01       0.01       0.0        0.0        0.0        0.0        0.0        0.0

MAXIMUM:     0.00       0.00       0.01       0.03       0.05       0.10       0.15       0.25       0.50
MINIMUM:                0.00       0.00       0.01       0.03       0.05       0.10       0.15       0.25       0.50
 19  1034    LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            9 FEB 1974              PAGE  23
**************************************************************************************************************************
OUTPUT              WRITES ANNUAL GRID PACKAGE                                      (UNIT  5)

                    GRID VALUES FOR CO       ,NOX      ,
                    OUTPUT TO TAPE  7 BEGINNING SEQUENCE NUMBER 10340030
```

Figure 30 contd.

```
19  1034      LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)              9 FEB 1974             PAGE  24
*****************************************************************************************************************************

              OUTPUT WINTER POINT SOURCES                                          (UNIT  5)

              COMPUTATIONS PERFORMED BY ROUTINE      4

 ****SUBROUTINE COMP



   IPVIN      IPVOUT     UNIT       JUNIT
     0          0          12          7
    DDW        DDA       DFPRHT     IFORM
   0,0        0,0        0,0           0
    NAM

   CONST
   0,0        0,0        0,0        0,0        0,0        0,0        0,0
        IPUNCH      PLAND             SEASON
          T           T               WINTER

 ****SUBROUTINE COMPA
19  1034      LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)              9 FEB 1974             PAGE  25
*****************************************************************************************************************************
ALLOCATION          WINTER SOURCE CONCENTRATIONS                                   (UNIT  5)


         FIGURES ALLOCATED TO GRID BY MODE  1

         VARIABLE NAME(S):    CO-W       NOX-W
         FIGURE     TYPE      IX - IY    EXTENT      CO-W        NOX-W

            4         A                  5,397E-01   2,544E-01   6,361E-02

                              3    2     0,0617      1,569E-02   3,922E-03
                              4    2     0,4618      1,175E-01   2,937E-02
                              3    3     0,0016      4,149E-04   1,037E-04
                              4    3     0,0146      3,716E-03   9,289E-04
                              TOTALS     1,0000      1,373E-01   3,433E-02

            8        .A                  6,303E-01   2,544E-01   6,361E-02

                              3    1     0,1882      4,788E-02   1,197E-02
                              4    1     0,2445      6,221E-02   1,555E-02
                              TOTALS     0,6865      1,101E-01   2,752E-02

19  1034      LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)              9 FEB 1974             PAGE  26
*****************************************************************************************************************************

              GRID LISTING FOR VARIABLE CO-W      1


                    1          2          3          4          5

           3       0,0        0,0        0,00       0,00       0,0

           2       0,0        0,0        0,02       0,12       0,0

           1       0,0        0,0        0,05       0,06       0,0
19  1034      LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)              9 FEB 1974             PAGE  27
*****************************************************************************************************************************

              GRID LISTING FOR VARIABLE NOX-W     1


                    1          2          3          4          5

           3       0,0        0,0        0,00       0,00       0,0

           2       0,0        0,0        0,00       0,03       0,0

           1       0,0        0,0        0,01       0,02       0,0
```

Figure 30 Contd.

```
 19  1034     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)              9 FEB 1974              PAGE  28
*****************************************************************************************************************************

                     GRID PLOT FOR VARIABLE CO-W     :

              1    2    3    4    5

                         .....-----
          3              .....-----              3
                         .....-----
                         .....-----
                         =====OOOOO
          2              =====OOOOO              2
                         =====OOOOO
                         =====OOOOO
                         +++++XXXXX
          1              +++++XXXXX              1
                         +++++XXXXX
                         +++++XXXXX

              1    2    3    4    5


             LEVEL DESIGNATIONS...

              1          2          3          4          5          6          7          8          9          10
                       .....      -----      =====      +++++      XXXXX      OOOOO      #####      #####      #####
                       .....      -----      =====      +++++      XXXXX      OOOOO      #####      #####      #####
                       .....      -----      =====      +++++      XXXXX      OOOOO      #####      #####      #####
                       .....      -----      =====      +++++      XXXXX      OOOOO      #####      #####      #####
     CELL COUNT:  9          1          1          1          1          1          1          0          0          0
     VALUE:      0.0       0.00       0.00       0.02       0.05       0.06       0.12       0.0        0.0        0.0

     MAXIMUM:    0.00      0.00       0.01       0.03       0.05       0.10       0.15       0.25       0.50
     MINIMUM:              0.00       0.00       0.01       0.03       0.05       0.10       0.15       0.25       0.50


 19  1034     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)              9 FEB 1974              PAGE  29
*****************************************************************************************************************************

                     GRID PLOT FOR VARIABLE NOX-W    :

              1    2    3    4    5

                         ..........
          3              ..........              3
                         ..........
                         ..........
                         -----=====
          2              -----=====              2
                         -----=====
                         -----=====
                         ==========
          1              ==========              1
                         ==========
                         ==========

              1    2    3    4    5


             LEVEL DESIGNATIONS...

              1          2          3          4          5          6          7          8          9          10
                       .....      -----      =====      +++++      XXXXX      OOOOO      #####      #####      #####
                       .....      -----      =====      +++++      XXXXX      OOOOO      #####      #####      #####
                       .....      -----      =====      +++++      XXXXX      OOOOO      #####      #####      #####
                       .....      -----      =====      +++++      XXXXX      OOOOO      #####      #####      #####
     CELL COUNT:  9          2          1          3          0          0          0          0          0          0
     VALUE:      0.0       0.00       0.00       0.06       0.0        0.0        0.0        0.0        0.0        0.0

     MAXIMUM:    0.00      0.00       0.01       0.03       0.05       0.10       0.15       0.25       0.50
     MINIMUM:              0.00       0.00       0.01       0.03       0.05       0.10       0.15       0.25       0.50


 19  1034     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)              9 FEB 1974              PAGE  30
*****************************************************************************************************************************

OUTPUT             WRITES WINTER GRID PACKAGE                                         (UNIT  5)


                   GRID VALUES FOR CO-W     ,NOX-W    ,
                   OUTPUT TO TAPE   7 BEGINNING SEQUENCE NUMBER 10340100


END OF PROGRAM.
```

Figure 30 Contd.

2.5.2 Test Case #2: Mode 1 Emissions Allocation

Job Control Language

As in the previous LANTRAN test case, the initial JCL invokes the Linkage Editor, and begins execution. This run uses the FORTRAN I/O units 9, 11, 12, 13, and 14.

FT09 is the program run log. The JCL for this unit must be included for every run of any program in the AQUIP system.

FT11 is a temporary dataset used to hold the figures descriptions. It must be provided for every run of LANTRAN.

FT12 is a temporary dataset used to hold Point source data. It should be included whenever point sources may be included. The unit number need not be 12. It can be changed by changing UNIT is the &COMPIN parameters.

FT13 and FT14 are datasets where card image output from LANTRAN will be stored. In this example the output will be the point sources and GRID source data from LANTRAN. This will later be used by MATRIK as part of a SRCE package.

Keyword Package Input

The card input for this LANTRAN run begins with a PARAMETERS package. The output unit for point sources and GRID data is set to 13, JC=13. The grid is defined as in the previous example, and the levels for printer plotting are set. The listing of the current status of program parameters is printed on page 1 of the output.

A FIGURES package follows to specify each of the figures used in this run. Section 2.2.2 describes the card format. This test case includes both areas "A" and points "p". The first four figures are areas, the next five are points, followed by more areas and points. FIGURES does not require any set order for inputting figures. Each figure is given a reference number, an activity code, figure type, and for printing purposes an ID, and a title.

The output on Pages 2 through 6 echoes the input data and also gives the centroid and area for area figures.

A VALUES package is then used to set the values for control variables associated with each figure. The VALUES package is described in Section 2.2.4

and the meaning of these variables is described in Section 2.3.1 and Section A.2 of Task 1 Appendix A. Briefly, KFORM specifies how each figure is to be treated, KLINK "links" schools and commercial areas to residential areas, KRCODE specifies connections of figures to central heating facilities, A3 specifies non-heating use for unheated figures such as parking areas, and X is left blank. X will be calculated by COMPUTE 1. Section 2.3.1 describes the method of calculation of heating demand, and describes the use of these variables in those calculations.

Page 7 of the output gives a tabulation of the values that have been associated with each figure.

After VALUES have been set, ACTIVITIES are associated with each activity code. In this run the activity variables ACTV, A1, A2, A4, and A5 were associated . Section 2.2.6 describes the card format, and Sections 2.3.1 and Appendix A.3 of the Task 1 Report describe the use and meaning of these variables. They are needed to calculate the BTU demand of each figure. A tabulation of the values that have been associated with activity codes is given on Pages 8 and 9.

With the VALUES set for each figure, and ACTIVITIES associated with each of the land use activity codes, COMPUTE 1 is initiated to calculate the BTU demand for each figure. Page 10 gives the present value for the COMPUTE parameters. Page 11 indicates the RECODE linking of similar land uses to central facilities. All RECODES are tallied. Page 12 gives the results from BTU calculations for non-LINKed figures. Page 13 gives the BTU demands for sources LINKed to other figures, finally, page 14 gives the RECODES for the LINKed figures which use a central heating facility. Page 15 gives the resulting values of each figure with a BTU demand in BTU/hr.

After all the BTU demands have been calculated, the resulting fuel usage must be calculated. An ACTIVITIES package is used to associate fuel use schedules, process usage, and fuel type breakdowns for each activity. Again Section 2.2.6 describes card formats, and Section A.3 of the Task 1 Report describes variable names. Section 2.3.1 describes the use made of these variables in the fuel use by activity. Page 17 gives the values associated with activities. Pages 16 and 17 give a tabulation of the input data. NOTE: for non-heating figures parameter A3 of the VALUES determines the activity level, so the SCHED is 1. and the PROC is 0.

With the fuel use determined COMPUTE 2 is used to take the BTU demand, the fuel use, and the fuel emissions factors to calculate the resulting emissions for each source. This is described in Section 2.3.1 and Section A.3 of the Task 1 Appendix.

Next the ACTIVITIES for ZOO are input. This code is a general code that permits the establishment of a level criteria that will apply to ALL point sources. The levels specified will select any point source that generates over 50 tons/year of any pollutant. The selected points will have a stack height of 100 ft and a plume rise of 60 ft^2/sec, set by DFHT and DFPL.

COMPUTE 3 is then initiated. The constants in CONST are reset from their default used in previous COMPUTEs, to the values for the units being given to COMPUTE 3. CONST(1) converts point source emissions from tons/year to gms/sec. CONST(2) converts distance from feet to meters. CONST(3) is a plume rise adjustment, and CONST(7) is the emissions conversion for non-point sources. CONST(5 and 6) are SCALE unit conversions, and ORIGIN resets. They are 0. indicating that there is no change.

COMPUTE 3 first scans the point sources for any source with an emission greater than the criteria in ZOO. The output on page 26 indicates that figure 30 is the only point exceeding the 50 ton/yr criteria. The POINT information listed on page 26 is also stored on UNIT 12. The POINT "card" for the current SEASON, ANNUAL, is also output to JUNIT, 13. This will eventually be read by MARTIK, so the output is in the proper form for MARTIK SRCE package.

The values that are output have been scaled to metric internal units by the array CONST. Pages 27 and 28 are a listing of the emissions data for all seasons after the conversion to internal units.

After the &COMPIN cards, the pollutant names for each season are set, followed by the corresponding emissions factors for each activity and fuel. When emissions factors remain the same between activity codes only one card is needed for the emissions, otherwise a card must be included for each fuel's emissions factor. Note that the same fuel may have different emissions factors when used in different activities. Processess such as parking lot automobile emissions are set relative to the process rate A3.

Pages 18 and 19 tabulate the emissions factors being used with each activity code. When an emissions factor has been provided for a fuel that is not associated with the activity the fuel is flagged. Although the SEASON is ANNUAL, COMPUTE 2 calculated the emissions for all three seasons.

The results of the calculations are on pages 20 through 24. The first three pages give the fuel usage for each figure and fuel, in fuel units per year. Then using CONST(1) to convert emissions factors from lbs/fuel unit to tons/fuel unit, the A CONC is calculated as tons/year. A concentration results for each pollutant. Z2 is the pollutants resulting from the non-heating sources of emissions such as the airport, Z1 is the amount of extra emissions due to separate processes such as associated with industry. These are input with PROP as the percentage of the fuel emissions that should be added to represent emisssions due to other processes. This is in addition to the percentage of fuel use due to process heating.

Pages 23 and 24 tally the extent, and BTU/yr for each figure. Then the emissions for each pollutant for each season, in tons/yr.

The next step is to allocate the emissions from the figures, to the grid that was defined in the PARAMETERS. The ALLOCATION is done with MODE 1 allocation, see Section 2.1.1.1 of the Task 5 Report. The output on pages the figures that have been allocated. The variables being allocated are the pollutants CO and NOX. For each figure the grid cell being filled is under the heading IX - IY, the extent in (scale units)^2, and the resulting level of weighted CO and NOX.

Next values for each cell are LISTed, for CO and NOX. These prints are on pages 31 and 32. Finally the values are PLOTed for CO and NOX. The symbols and levels were chosen in the PARAMETERS. Pages 33 and 34 have the resulting printer plots for the values.

The ALLOCATED output on the GRID is written out on unit JC, 13. The variables being written are specified on the second card, see Section 2.2.8 This results in a card image "GRID" format for the variable CO and NOX being output on Unit 13, immediately following the POINT cards output by COMPUTE 3. These are all annual values because the season was ANNUAL in COMPUTE 3, and the variable name was CO, NOX in both the ALLOCATION and OUTPUT. CO and NOX are the annual names.

The next steps are intended to obtain WINTER values. First a PARAMETERS package is read in to change JC to 14. This means that from here on all output will be on unit 14. Then a COMPUTE 4 is input, with the SEASON set to WINTER. This causes the POINT selected with WINTER values to be output to unit 14. PLAND defaults to .TRUE. in COMPUTE 4 so there is no tally of the POINT that was output.

An ALLOCATION of the WINTER sources is achieved by allocating CO-W and NOX-W. These are the names of the WINTER emissions rates associated with each figure. The MODE 1 allocation gives output on pages 38 and 39, in the same format as before. Then the GRID values are LISTed and PLOTed as in the annual case. This is on pages 40 through 43.

Finally the WINTER values are OUTPUT. This results in a GRID package for the winter emissions CO-W and NOX-W being output on unit 14 immediately following the POINT card image. This is verified on the page 44 listing indicating that CO-W and NOX-W were OUTPUT TO TAPE 14.

All of the desired computations, allocations, and dataset creations have been done so the job is terminated with and ENDJOB card.

```
//ERTMACKE JOB (58202440000,ERT--,101,---,MKEEFE,219---------,4610),KK,K
// MSGLEVEL=1
/*PARMS  COPIES=03
// EXEC FORTHLG,PARM.LKED='LET,MAP,LIST',REGION.GO=210K,TIME.GO=2
//LKED.SYSLIN DD *
 CHANGE INPUT(READER)
 INCLUDE ERT(INPUT,INE,HEADR,ERRX,SEQNO,TXLOC,GTABU,ICHAR,GPLOT)
 CHANGE INPUT(READER)
 INCLUDE LAN(MAIN,BLOCK,INPARM,INFIGS,INPTS,EVALS,FGRID,INGRDS)
 INCLUDE LAN(COMP,INAC,OUTS,PLANIM,PERIM,ALLOCF,ASEG)
/*
//LKED.ERT DD DSN=ERT4610,P9990000,ERTLIB,DISP=SHR
//LKED.LAN DD DSN=LANTRAN,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO.FT09F001 DD DSN=C461002,ER701,LOGDATA,DISP=SHR,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AVC016)
//GO.FT11F001 DD UNIT=SYSDA,SPACE=(CYL,1),
// DCB=(RECFM=VSB,LRECL=448,BLKSIZE=4484)
//GO.FT12F001 DD UNIT=SYSDA,SPACE=(CYL,1),
// DCB=(RECFM=FB,LRECL=80,BLKSIZE=4800)
//GO.FT13F001 DD DSN=EMISS1,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO.FT14F001 DD DSN=EMISS2,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO.FT05F001 DD *
PARAMETERS           LANTRAN MODE 1 EMISSIONS ALLOCATION
 &INPUT
 JC=13,
 NX=5,NY=3,ORIGIN=578.0,4520.0,
 LEV=.0001,0.1,1.0,5.0,10.,20.,50.,100.,500.,1000.,
 &END
FIGURES              LANTRAN MODE 1 TEST CASE #2
    1    1A  581.8    4522.0      1      R01       AREA 3=RESIDENT.
         2   582.5    4521.8
         3   582.5    4521.0
         4   581.5    4521.
         5   581.8    4522.0
    2    1A  581.0    4520.5      1      R01       AREA 85=RESIDENT
         2   582.0    4520.5
         3   581.6    4520.0
         4   581.0    4520.0
         5   581.0    4520.5
    3    1A  580.1    4521.5      1      R11       AREA 46=ISLAND RES
         2   580.9    4521.5
         3   580.9    4520.9
         4   580.1    4520.9
         5   580.1    4521.5
    4    1A  581.1    4522.3      1      R11       AREA 49=ISLAND RES
         2   581.8    4522.3
         3   581.4    4521.6
         4   581.1    4521.6
         5   581.1    4522.3
    5    1P  580.7    4521.1      1      I11       POINT 47=SCHOOL /
    6    1P  581.3    4521.7      1      I11       POINT 50=SCHOOL /
    7    1P  581.4    4521.1      1      I12       POINT 133=SCHOOL
    8    1P  581.4    4521.1      1      I12       POINT 149=SCHOOL /
    9    1P  580.1    4521.1      1      C11       POINT 48=BUSINESS
   10    1P  581.2    4522.2             C11       POINT 51=BUSINESS
   11    1P  581.0    4520.8             C11       POINT 143=TR=2 NEIGH
   12    1A  581.0    4521.0             C12       AREA 102=BUSINESS /

         2   581.5    4521.0
         3   581.5    4520.5
         4   581.0    4520.5
         5   581.0    4521.0
   13    1P  581.0    4520.8             C12       POINT 130=BUSINESS /
   14    1P  581.0    4520.8             R11       POINT 136=TR=2 /
   15    1P  581.6    4522.6             R11       //POINT// TR=2/
   16    1A  579.0    4521.3             C31       AREA 37=BUSINESS
         2   579.5    4521.1
         3   579.5    4520.5
         4   579.0    4520.5
         5   579.0    4521.3
   17    1A  580.0    4520.8             C31       AREA 38=BUSINESS
         2   580.5    4520.8
         3   580.5    4520.0
         4   580.0    4520.0
         5   580.0    4520.8
   18    1P  579.5    4521.0             C31       POINT 141=BERRYS
   19    1A  581.5    4523.0      1      C21       AREA 20=HOTEL HWY
         2   582.0    4523.0
         3   582.0    4522.5
         4   581.5    4522.5
         5   581.5    4523.0
   20    1A  580.5    4523.0             S42       AREA 4=DSTRBUTN
         2   581.5    4523.0
         3   581.5    4522.5
         4   580.5    4522.5
         5   580.5    4523.0
   21    1A  580.5    4520.8             S89       AREA 54=RESEARCH
         2   581.0    4520.8
         3   581.0    4520.0
         4   580.5    4520.0
         5   580.5    4520.8
   22    1A  579.5    4520.9             I71       AREA 42=CULTURE CTR
         2   580.0    4520.9
         3   580.0    4520.5
         4   579.5    4520.5
         5   579.5    4520.9
   23    1A  581.5    4521.0      1      I90       AREA 98=SPCIAL USE
         2   582.5    4521.0
         3   582.0    4520.5
         4   581.5    4520.5
         5   581.5    4521.0
   24    1A  579.0    4520.5             T10       AREA 2=TRANS CTR
         2   580.0    4520.5
         3   580.0    4520.0
         4   579.0    4520.0
         5   579.0    4520.5
   25    1A  579.6    4523.0             T20       AREA 1=AIRPORT
         2   580.5    4523.0
         3   580.5    4522.5
         4   579.0    4521.5
         5   578.5    4522.0
         6   579.6    4523.0
   26    1P  578.5    4520.5             T30       POINT 131=SPCIAL USE
   27    1P  582.5    4522.5             83585     POINT 201    INDUST
   28    1P  582.3    4522.7             82041     POINT 273    INDUST
   29    1P  582.5    4522.7             82041     POINT 274    INDUST
   30    1P  582.4    4522.7             82041     POINT 323    INDUST
   31    1P  582.1    4522.9             83585     POINT 278 /  INDUST
```

Figure 31   LANTRAN Test Case 2 Deck Setup

```
   32    1P  582.3    4522.9              83585     POINT 279 / INDUST
   33    1P  582.2    4522.9              83585     POINT 324 / INDUST
99999
VALUES               LANTRAN MODE 1 TEST CASE #2
             KFORM   KLINK     KRCODE    XFACTR
           1       15.
           2       15.
           3       19.                 14.
           4       19.                 14.
           5       60.       14.                 0.50
           6       60.       14.                 0.50
           7       60.       14.
           8       69.        1.        7.
           9       19.                 11.
          10       19.                 11.
          11       59.       14.       14.
          12       19.                 13.
          13       59.       14.       14.
          14       15.                           0.50
          15       80.       14.                 0.50
          16       19.                 18.
          17       19.                 18.
          18       10.
          19       10.
          20       10.
          21       10.
          22       10.
          23       10.
          24       10.
          25       20.                                     400000.
          26       20.                                       4500.
          27       30.
          28       39.                 30.
          29       39.                 30.
          30       30.
          31       39.                 33.
          32       39.                 33.
          33       30.
99999
ACTIVITIES           ACTIVITY CODES TO BE USED BY COMP1 & COMP5 (#1)
ACTV      A1         A2        A4        A5
R01                      LOW DENSITY RESIDENT
    18750.      10.        1.5                 3.5
R11                      ISLAND RESIDENT
     7500.      50.        0.5     1500.       2.5
I11                      PRIMARY SCHOOL
    15000.      25.        0.45
I12                      SECONDARY SCHOOL
    15000.      30.        0.20
C11                      NEIGHB.COMMERCIAL
     16.25      0.5        1.0
C12                      COMMUNITY COMMERC
     16.25      1.5        1.0
C21                      HOTEL HWY COMMERC
     16.25      35.        0.75
C21       C31            BERRYS CREEK COMMERC
S42                      DISTRIBUTION
      12.5      30.        1.0
S89                      RESEARCH
      20.0      25.        1.0
I71                      CULTURAL CTR
      12.5      40.        1.0
S42       I90            SPECIAL USES
T10                      TRANSP CTR
      12.5      40.        1.0
T20                      AIRPORT

T30                      PARKING LOT

S39                      INDUST
      27.5      40.        1.0
S39       83585          INDUST
S39       82041          INDUST
99999
COMPUTE              1  COMP1
 &COMPIN
 &END
ACTIVITIES           ACTIVITIES TO BE USED BY COMP2  (#2)
SCHED      PROC      R-OIL     D-OIL     N-GAS     PROC1     PROC2
R01                      LOW DENSITY RESIDENT
     8760.      10.                            1.0
R11                      ISLAND RESIDENT
     8760.      10.                  1.0
I11                      PRIMARY SCHOOL (ALL SCHOOLS)
     1600.       0.                  1.0
I11       I12            SECONDARY SCHOOL
C11                      NEIGHB.COMMERCIAL (ALL COMMERCIAL)
     3000.       0.                  1.0
C11       C12            COMMUNITY COMMERC
C11       C21            HOTEL HWY COMMERC
C11       C31            BERRYS CREEK COMMERC
S42                      DISTRIBUTION
     3600.       0.                  1.0
S89                      RESEARCH
     2000.       0.                  1.0
I71                      CULTURAL CTR
     1000.       0.                  1.0
I90                      SPECIAL USES
     3600.       0.                  1.0
T10                      TRANSP CTR
     8760.       0.                  1.0
T20                      AIRPORT-FLIGHTS/YR
      1.0                                                    1.0
T30                      PARKING LOT-VEHS/YR
      1.0                                          1.0
S39                      INDUST (LIGHT)
     3600.      75.        0.95      0.0       0.05
S20                      INDUST (HEAVY)
     8760.      90.        0.75      0.0       0.25
S20       82041          INDUST
S39       83585          INDUST
99999
COMPUTE              2  COMP2
 &COMPIN
 &END
          TSP       SOX       CO        HC        NOX
          TSP-W     SOX-W     CO-W      HC-W      NOX-W
          TSP-S     SOX-S     CO-S      HC-S      NOX-S
R11                      ISLAND RESIDENT (RES. FUEL BURNING)
B-COA          20.       7.6       90.       20.       3.0
```

Figure 31 Contd.

```
D=OIL               10.       6.5       0.2       3.        4.8
N=GAS               19.       0.6       20.       8.        5.0
88888
R11       R01                 LOW DENSITY RESIDENT
C11                           NEIGHB.COMMERC (COM.FUEL BURNING)
A=COA               10.       7.0       90.       2.5       3.
B=COA               18.       7.6       10.       3.0       6.
R=OIL               23.       40.0      0.2       3.0       24.
D=OIL               15.       11.0      0.2       3.0       24.
N=GAS               19.       0.6       20.       8.0       8.
88888
C11       I11                 PRIMARY SCHOOL
C11       I12                 SECONDARY SCHOOL
C11       C12                 COMMUNITY COMMERC
C11       C21                 HOTEL HWY COMMERC
C11       C31                 BERRYS CREEK COMMERC
C11       S42                 DISTRIBUTION
C11       S89                 RESEARCH
C11       I71                 CULTURAL CTR
C11       I90                 SPECIAL USES
C11       T10                 TRANSP CTR
T20                           AIRPORT  1=COMMERC 2=GEN.AVIATION
PROC1               8.0       2.        6.        4.0       3.5
PROC2               0.2       2.        6.        0.7       0.2
88888
T30                           PARKING LOT
PROC1               4.3       4.4       12.2      2.7       0.9
88888
S39                           INDUST (IND.FUEL BURNING)
A=COA               3.75      3.        5.        0.1       4.8
B=COA               3.        3.8       2.        1.        6.
R=OIL               23.       24.       0.2       3.        18.
D=OIL               15.       6.        0.2       3.        18.
N=GAS               18.       0.6       0.4       40.       140.
88888
S39       S3585               INDUST
S2041                         INDUST WITH PROCESS EMIS
R=OIL               23.       24.       0.2       3.        18.
D=OIL               15.       6.        0.2       3.        18.
N=GAS               18.       0.6       0.4       40.       140.
PROP                25.
88888
99999
ACTIVITIES               TEST FOR COMP3  (#3)
TSP       SOX       CO        HC        NOX       DFHT      DFPL
Z00
  50.       50.       50.       50.       50.       100.      60.
99999
COMPUTE                  3  COMP3
 &COMPIN
 CONST=0.0287,0.305,4.0,0.,0.,0.,0.0287,
 &END
ALLOCATION               ANNUAL SOURCE CONCENTRATIONS
MODE  1   CO             NOX
LIST      CO             NOX
PLOT      CO             NOX
99999
OUTPUT                   WRITES ANNUAL GRID PACKAGE TO UNIT 13
          CO             NOX
99999

PARAMETERS               NEW OUTPUT UNIT FOR WINTER POINT & GRID SOURCES
 &INPUT JC=14 &END
COMPUTE                4  OUTPUT WINTER POINT SOURCES
 &COMPIN SEASON='WINTER' &END
ALLOCATION               WINTER SOURCE CONCENTRATIONS
MODE  1   CO-W           NOX-W
LIST      CO-W           NOX-W
PLOT      CO-W           NOX-W
99999
OUTPUT                   WRITES WINTER GRID PACKAGE TO UNIT 14
          CO-W           NOX-W
99999
ENDJOB
/*EOF
**
```

Figure 31 Contd.

```
//ERTHACKE JOB (98202440000,ERT--,101,---,MKEEFE,219---------,4610),XX,X JOB 128
// MSGLEVEL=1
***PARMS COPIES=03                                                          ACCEPTED
// EXEC FORTHLG,PARM.LKED='LET,MAP,LIST',REGION.GO=210K,TIME.GO=2
XX         PROC PR=A                                                        00000010
XXLKED EXEC     PGM=IEWL,PARM='MAP,LET,LIST',                              X00000020
XX              REGION=100K                                                 00000030
XXSYSPRINT DD  SYSOUT=&PR,DCB=(LRECL=121,BLKSIZE=1573),                    X00000040
IEF653I SUBSTITUTION JCL - SYSOUT=A,DCB=(LRECL=121,BLKSIZE=1573),
XX              SPACE=(1573,(24,48))                                        00000050
XXSYSLIB   DD  DSNAME=SYS1,FORTLIB,DISP=SHR                                 00000060
XX         DD  DSNAME=SYS1,DOUBLEP,DISP=SHR                                 00000070
XXSYSUT1 DD UNIT=SYSDA,SPACE=(CYL,(2,1))                                    00000080
XXSYSLMOD  DD  DSN=&GOSET(FMXXMAIN),UNIT=SYSDA,DISP=(,PASS),                00000090
XX              SPACE=(CYL,(15,,1))                                         00000100
//LKED.SYSLIN DD *
//LKED.ERT DD DSN=ERT4610.P9990000.ERTLIB,DISP=SHR
//LKED.LAN DD DSN=LANTRAN,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
IEF236I ALLOC. FOR ERTHACKE LKED
IEF237I 08A    ALLOCATED TO SYSPRINT
IEF237I 256    ALLOCATED TO SYSLIB
IEF237I 257    ALLOCATED TO
IEF237I 253    ALLOCATED TO SYSUT1
IEF237I 253    ALLOCATED TO SYSLMOD
IEF237I 062    ALLOCATED TO SYSLIN
IEF237I 255    ALLOCATED TO ERT
IEF237I 101    ALLOCATED TO LAN
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS1.FORTLIB                                   KEPT
IEF285I   VOL SER NOS= ACS1 ,
IEF285I   SYS1.DOUBLEP                                   KEPT
IEF285I   VOL SER NOS= AC3122,
IEF285I   SYS74042.T081559.RV000.ERTHACKE.R0001521       DELETED
IEF285I   VOL SER NOS= AC3002,
IEF285I   SYS74042.T081559.RV000.ERTHACKE.GOSET          PASSED
IEF285I   VOL SER NOS= AC3002,
IEF285I   ERT4610.P9990000.ERTLIB                        KEPT
IEF285I   VOL SER NOS= ISFR00,
IEF285I   LANTRAN                                        KEPT
IEF285I   VOL SER NOS= AIRMAP,
IEF373I STEP /LKED     / START 74042.1054
IEF374I STEP /LKED     / STOP  74042.1056 CPU    0MIN 20.39SEC MAIN  98K LCS    0K
XXGO   EXEC     PGM=*.LKED.SYSLMOD,COND=(5,LT,LKED)                         00000110
XXFT06F001 DD  SYSOUT=&PR,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1596)            00000120
IEF653I SUBSTITUTION JCL - SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1596)
//GO.FT09F001 DD DSN=C461002.ER701.LOGDATA,DISP=SHR,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AVC016)
//GO.FT11F001 DD UNIT=SYSDA,SPACE=(CYL,1),
// DCB=(RECFM=VSB,LRECL=448,BLKSIZE=4484)
//GO.FT12F001 DD UNIT=SYSDA,SPACE=(CYL,1),
// DCB=(RECFM=FB,LRECL=80,BLKSIZE=4800)
//GO.FT13F001 DD DSN=EMISS1,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO.FT14F001 DD DSN=EMISS2,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO.FT05F001 DD *
//
IEF236I ALLOC. FOR ERTHACKE GO
IEF237I 253    ALLOCATED TO PGM=*.DD
IEF237I 083    ALLOCATED TO FT06F001
IEF237I 121    ALLOCATED TO FT09F001
IEF237I 253    ALLOCATED TO FT11F001
IEF237I 253    ALLOCATED TO FT12F001
IEF237I 101    ALLOCATED TO FT13F001
IEF237I 101    ALLOCATED TO FT14F001
IEF237I 067    ALLOCATED TO FT05F001
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS74042.T081559.RV000.ERTHACKE.GOSET          PASSED
IEF285I   VOL SER NOS= AC3002,
IEF285I   C461002.ER701.LOGDATA                          KEPT
IEF285I   VOL SER NOS= AVC016,
IEF285I   SYS74042.T081559.RV000.ERTHACKE.R0001524       DELETED
IEF285I   VOL SER NOS= AC3002,
IEF285I   SYS74042.T081559.RV000.ERTHACKE.R0001525       DELETED
IEF285I   VOL SER NOS= AC3002,
IEF285I   EMISS1                                         KEPT
IEF285I   VOL SER NOS= AIRMAP,
IEF285I   EMISS2                                         KEPT
IEF285I   VOL SER NOS= AIRMAP,
IEF373I STEP /GO       / START 74042.1056
IEF374I STEP /GO       / STOP  74042.1101 CPU    0MIN 18.68SEC MAIN 204K LCS    0K
IEF285I   SYS74042.T081559.RV000.ERTHACKE.GOSET          DELETED
IEF285I   VOL SER NOS= AC3002,
IEF375I  JOB /ERTHACKE/ START 74042.1054
IEF376I  JOB /ERTHACKE/ STOP  74042.1101 CPU    0MIN 39.07SEC

BEGIN LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1 LEVEL 721220 RUN   1040
TABLE COUNT= 38

 19  1040     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)          11 FEB 1974          PAGE   1
*********************************************************************************************************************************

       PARAMETERS          LANTRAN MODE 1 EMISSIONS ALLOCATION

                SCALE UNIT= 1.000E 03 METERS

                GRID ORIGIN:   578.000, 4520.000 UNITS

                GRID DIMENSIONS:  5 CELLS(X) BY  3 CELLS(Y)

                CELL DIMENSIONS(UNITS):     1.00(X) BY     1.00(Y)

                OUTPUT TAPE= 13

                MIN. RAD**2= 1.000E-04 UNITS**2
```

Figure 32   LANTRAN Test Case 2 Printed Output

```
FIGURES          LANTRAN MODE 1 TEST CASE #2                              (UNIT 5)

     FIGURE  1    TYPE: A   ID:    1      CODE: R01      AREA 3-RESIDENT.

          VERTEX        X-COORD    Y-COORD
             1          581.800   4522.000
             2          582.500   4521.797
             3          582.500   4521.000
             4          581.500   4521.000
             5          581.800   4522.000

          CENTROID      582.052   4521.426 TOTAL AREA=     0.779

     FIGURE  2    TYPE: A   ID:    1      CODE: R01      AREA 85-RESIDENT

          VERTEX        X-COORD    Y-COORD
             1          581.000   4520.500
             2          582.000   4520.500
             3          581.600   4520.000
             4          581.000   4520.000
             5          581.000   4520.500

          CENTROID      581.408   4520.270 TOTAL AREA=     0.400

     FIGURE  3    TYPE: A   ID:    1      CODE: R11      AREA 46-ISLAND RES

          VERTEX        X-COORD    Y-COORD
             1          580.100   4521.500
             2          580.900   4521.500
             3          580.900   4520.898
             4          580.100   4520.898
             5          580.100   4521.500

          CENTROID      580.500   4521.199 TOTAL AREA=     0.481

     FIGURE  4    TYPE: A   ID:    1      CODE: R11      AREA 49-ISLAND RES

          VERTEX        X-COORD    Y-COORD
             1          581.100   4522.297
             2          581.800   4522.297
             3          581.400   4521.598
             4          581.100   4521.598
             5          581.100   4522.297

          CENTROID      581.363   4521.992 TOTAL AREA=     0.350

     FIGURE  5    TYPE: P   ID:    1      CODE: I11      POINT 47-SCHOOL /

          VERTEX        X-COORD    Y-COORD
             1          580.700   4521.098
```



```
     FIGURE  6    TYPE: P   ID:    1      CODE: I11      POINT 50-SCHOOL /

          VERTEX        X-COORD    Y-COORD
             1          581.300   4521.699

     FIGURE  7    TYPE: P   ID:    1      CODE: I12      POINT 133-SCHOOL

          VERTEX        X-COORD    Y-COORD
             1          581.400   4521.098

     FIGURE  8    TYPE: P   ID:    1      CODE: I12      POINT 149-SCHOOL /

          VERTEX        X-COORD    Y-COORD
             1          581.400   4521.098

     FIGURE  9    TYPE: P   ID:    1      CODE: C11      POINT 48-BUSINESS

          VERTEX        X-COORD    Y-COORD
             1          580.100   4521.098

     FIGURE 10    TYPE: P   ID:           CODE: C11      POINT 51-BUSINESS

          VERTEX        X-COORD    Y-COORD
             1          581.200   4522.199

     FIGURE 11    TYPE: P   ID:           CODE: C11      POINT 143-IR-2 NEIGH

          VERTEX        X-COORD    Y-COORD
             1          581.000   4520.797

     FIGURE 12    TYPE: A   ID:           CODE: C12      AREA 102-BUSINESS /

          VERTEX        X-COORD    Y-COORD
             1          581.000   4521.000
             2          581.500   4521.000
             3          581.500   4520.500
             4          581.000   4520.500
             5          581.000   4521.000

          CENTROID      581.250   4520.750 TOTAL AREA=     0.250

     FIGURE 13    TYPE: P   ID:           CODE: C12      POINT 130-BUSINESS /

          VERTEX        X-COORD    Y-COORD
             1          581.000   4520.797

     FIGURE 14    TYPE: P   ID:           CODE: R11      POINT 136-IR-2 /

          VERTEX        X-COORD    Y-COORD
             1          581.000   4520.797

     FIGURE 15    TYPE: P   ID:           CODE: R11      //POINT// IR-2/

          VERTEX        X-COORD    Y-COORD
             1          581.600   4522.598
```

Figure 32 Contd.

```
19  1040     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION  1.1  (721220)          11 FEB 1974          PAGE  4
******************************************************************************************************************************

FIGURE  16     TYPE: A    ID:               CODE: C31       AREA 37-BUSINESS

          VERTEX         X-COORD    Y-COORD
             1           579,000   4521,297
             2           579,500   4521,098
             3           579,500   4520,500
             4           579,000   4520,500
             5           579,000   4521,297

          CENTROID       579,238   4520,848 TOTAL AREA=      0,349

FIGURE  17     TYPE: A    ID:               CODE: C31       AREA 38-BUSINESS

          VERTEX         X-COORD    Y-COORD
             1           580,000   4520,797
             2           580,500   4520,797
             3           580,500   4520,000
             4           580,000   4520,000
             5           580,000   4520,797

          CENTROID       580,250   4520,398 TOTAL AREA=      0,398

FIGURE  18     TYPE: P    ID:               CODE: C31       POINT 141-BERRYS

          VERTEX         X-COORD    Y-COORD
             1           579,500   4521,000

FIGURE  19     TYPE: A    ID:      1        CODE: C21       AREA 20-HOTEL HWY

          VERTEX         X-COORD    Y-COORD
             1           581,500   4523,000
             2           582,0 0   4523,000
             3           582,000   4522,500
             4           581,500   4522,500
             5           581,500   4523,000

          CENTROID       581,750   4522,750 TOTAL AREA=      0,250

FIGURE  20     TYPE: A    [illegible]       CODE: S42       AREA 4-DSTRBUTN

          VERTEX         [illegible] Y-COORD
             1           [illegible] 4523,000
             2           581,500   4523,000
             3           581,500   4522,500
             4           58[illegible] 4522,500
             5           58[illegible] 4523,000

          CENTROID       581,000   4522,750 TOTAL AREA=      0,500

FIGURE  21     TYPE: A    ID:               CODE: S89       AREA 54-RESEARCH

          VERTEX         X-COORD    Y-COORD
             1           580,500   4520,797
             2           581,000   4520,797
             3           581,000   4520,000
19  1040     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION  1.1  (721220)          11 FEB 1974          PAGE  5
******************************************************************************************************************************
             4           580,500   4520,000
             5           580,500   4520,797

          CENTROID       580,750   4520,398 TOTAL AREA=      0,398

FIGURE  22     TYPE: A    ID:               CODE: I71       AREA 42-CULTURE CTR

          VERTEX         X-COORD    Y-COORD
             1           579,[illegible] 4520,898
             2           [illegible] [illegible],898
             3           58[illegible] 4520,500
             4           579,500   4520,500
             5           579,500   4520,898

          CENTROID       579,750   4520,699 TOTAL AREA=      0,199

FIGURE  23     TYPE: A    ID:      1        CODE: I90       AREA 98-SPCIAL USE

          VERTEX         X-COORD    Y-COORD
             1           581,500   4521,000
             2           582,500   4521,000
             3           582,000   4520,500
             4           581,500   4520,500
             5           581,500   4521,000

          CENTROID       581,889   4520,777 TOTAL AREA=      0,375

FIGURE  24     TYPE: A    ID:               CODE: T10       AREA 2-TRANS CTR

          VERTEX         X-COORD    Y-COORD
             1           579,000   4520,500
             2           580,000   4520,500
             3           580,000   4520,000
             4           579,000   4520,000
             5           579,000   4520,500

          CENTROID       579,500   4520,250 TOTAL AREA=      0,500

FIGURE  25     TYPE: A    ID:               CODE: T20       AREA 1-AIRPORT

          VERTEX         X-COORD    Y-COORD
             1           579,600   4523,000
             2           580,500   4523,000
             3           580,500   4522,500
             4           579,000   4521,500
             5           578,500   4522,000
             6           579,600   4523,000

          CENTROID       579,549   4522,348 TOTAL AREA=      1,575

FIGURE  26     TYPE: P    ID:               CODE: T30       POINT 131-SPCIAL USE

          VERTEX         X-COORD    Y-COORD
             1           578,500   4520,500
```

Figure 32 Contd.

```
19  1040     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            11 FEB 1974            PAGE   6
**********************************************************************************************************************************

        FIGURE  27     TYPE: P    ID:               CODE: 83585     POINT 201    INDUST

                VERTEX          X-COORD   Y-COORD
                   1            582.500   4522.500

        FIGURE  28     TYPE: P    ID:               CODE: 82041     POINT 273    INDUST

                VERTEX          X-COORD   Y-COORD
                   1            582.300   4522.699

        FIGURE  29     TYPE: P    ID:               CODE: 82041     POINT 274    INDUST

                VERTEX          X-COORD   Y-COORD
                   1            582.500   4522.699

        FIGURE  30     TYPE: P    ID:               CODE: 82041     POINT 323    INDUST

                VERTEX          X-COORD   Y-COORD
                   1            582.400   4522.699

        FIGURE  31     TYPE: P    ID:               CODE: 83585     POINT 278 / INDUST

                VERTEX          X-COORD   Y-COORD
                   1            582.100   4522.898

        FIGURE  32'    TYPE: P    ID:               CODE: 83585     POINT 279 / INDUST

                VERTEX          X-COORD   Y-COORD
                   1            582.300   4522.898

        FIGURE  33     TYPE: P    ID:               CODE: 83585     POINT 324 / INDUST

                VERTEX          X-COORD   Y-COORD
                   1            582.200   4522.898

**** END OF FILE, TAPE 11 ****
```

```
19  1040     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            11 FEB 1974            PAGE   7
**********************************************************************************************************************************
VALUES            LANTRAN MODE 1 TEST CASE #2                                      (UNIT  5)

        VALUES SPECIFIED FOR FIGURES--
```

FIGURE	KFORM	KLINK	KRCODE	XFACTR	A3	X
1	1.500E 01	0.0	0.0	0.0	0.0	0.0
2	1.500E 01	0.0	0.0	0.0	0.0	0.0
3	1.900E 01	0.0	1.400E 01	0.0	0.0	0.0
4	1.900E 01	0.0	1.400E 01	0.0	0.0	0.0
5	6.000E 01	1.400E 01	0.0	5.000E-01	0.0	0.0
6	6.000E 01	1.400E 01	0.0	5.000E-01	0.0	0.0
7	6.000E 01	1.400E 01	0.0	0.0	0.0	0.0
8	6.900E 01	1.000E 00	7.000E 00	0.0	0.0	0.0
9	1.900E 01	0.0	1.100E 01	0.0	0.0	0.0
10	1.900E 01	0.0	1.100E 01	0.0	0.0	0.0
11	5.900E 01	1.400E 01	1.400E 01	0.0	0.0	0.0
12	1.900E 01	0.0	1.300E 01	0.0	0.0	0.0
13	5.900E 01	1.400E 01	1.400E 01	0.0	0.0	0.0
14	1.500E 01	0.0	0.0	5.000E-01	0.0	0.0
15	8.000E 01	1.400E 01	0.0	5.000E-01	0.0	0.0
16	1.900E 01	0.0	1.800E 01	0.0	0.0	0.0
17	1.900E 01	0.0	1.800E 01	0.0	0.0	0.0
18	1.000E 01	0.0	0.0	0.0	0.0	0.0
19	1.000E 01	0.0	0.0	0.0	0.0	0.0
20	1.000E 01	0.0	0.0	0.0	0.0	0.0
21	1.000E 01	0.0	0.0	0.0	0.0	0.0
22	1.000E 01	0.0	0.0	0.0	0.0	0.0
23	1.000E 01	0.0	0.0	0.0	0.0	0.0
24	1.000E 01	0.0	0.0	0.0	0.0	0.0
25	2.000E 01	0.0	0.0	0.0	4.000E 05	0.0
26	2.000E 01	0.0	0.0	0.0	4.500E 03	0.0
27	3.000E 01	0.0	0.0	0.0	0.0	0.0
28	3.900E 01	0.0	3.000E 01	0.0	0.0	0.0
29	3.900E 01	0.0	3.000E 01	0.0	0.0	0.0
30	3.000E 01	0.0	0.0	0.0	0.0	0.0
31	3.900E 01	0.0	3.300E 01	0.0	0.0	0.0
32	3.900E 01	0.0	3.300E 01	0.0	0.0	0.0
33	3.000E 01	0.0	0.0	0.0	0.0	0.0

Figure 32   Contd.

```
19  1040     LAND=USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)          11 FEB 1974          PAGE   8
**************************************************************************************************************************

ACTIVITIES        ACTIVITY CODES TO BE USED BY COMP1 & COMP5 (#1)            (UNIT  5)

KEY=ACTIVITY       ACTIVITY  ACTIVITY NAMES

                            ACTV            A1             A2             A4             A5

 R01                          LOW DENSITY RESIDENT
                            18750.000      10.000          1.500          0.0            3.500

 R11                          ISLAND RESIDENT
                             7500.000      50.000          0.500       1500.000          2.500

 I11                          PRIMARY SCHOOL
                            15000.000      25.000          0.450          0.0            0.0

 I12                          SECONDARY SCHOOL
                            15000.000      30.000          0.200          0.0            0.0

 C11                          NEIGHB.COMMERCIAL
                              16.250        0.500          1.000          0.0            0.0

 C12                          COMMUNITY COMMERC
                              16.250        1.500          1.000          0.0            0.0

 C21                          HOTEL HWY COMMERC
                              16.250       35.000          0.750          0.0            0.0

 C21               C31        BERRYS CREEK COMMERC
                              16.250       35.000          0.750          0.0            0.0

 S42                          DISTRIBUTION
                              12.500       30.000          1.000          0.0            0.0

 S89                          RESEARCH
                              20.000       25.000          1.000          0.0            0.0

 I71                          CULTURAL CTR
                              12.500       40.000          1.000          0.0            0.0

 S42               I90        SPECIAL USES
                              12.500       30.000          1.000          0.0            0.0

 T10                          TRANSP CTR
                              12.500       40.000          1.000          0.0            0.0

 T20                          AIRPORT
                               0.0          0.0            0.0            0.0            0.0

 T30                          PARKING LOT
                               0.0          0.0            0.0            0.0            0.0

 S39                          INDUST
                              27.500       40.000          1.000          0.0            0.0
19  1040     LAND=USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)          11 FEB 1974          PAGE   9
**************************************************************************************************************************

 S39               S3585      INDUST
                              27.500       40.000          1.000          0.0            0.0

 S39               S2041      INDUST
                              27.500       40.000          1.000          0.0            0.0
19  1040     LAND=USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)          11 FEB 1974          PAGE  10
**************************************************************************************************************************

                   COMP1                                                     (UNIT  5)

                   COMPUTATIONS PERFORMED BY ROUTINE      1


  ****SUBROUTINE COMP



   IFVIN      IFVOUT     UNIT       JUNIT
      0          0          12         13
    DOW        DOA      DFPRMT      IFORM
   0.0        0.0        0.0           0
    NAM

   CONST
   0.0        0.0        0.0        0.0        0.0        0.0        0.0
        IPUNCH      PLAND                SEASON
           T           F                 ANNUAL

  ****SUBROUTINE COMP1

19  1040     LAND=USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)          11 FEB 1974          PAGE  11
**************************************************************************************************************************

  ****RECODE

     IREF  CODE          KFORM     KRCODE          AREA(KRCODE)          AREA(IREF)

       3   R11             19        14            1.18771E 02           1.18771E 02
       4   R11             19        14            2.05048E 02           8.62772E 01
       9   C11             19        11            0.0                   0.0
      10   C11             19        11            0.0                   0.0
      12   C12             19        13            6.16954E 01           6.16954E 01
      16   C31             19        18            8.60362E 01           8.60362E 01
      17   C31             19        18            1.84363E 02           9.83270E 01
      28   S2041           39        30            2.00000E 01           1.00000E 01
      29   S2041           39        30            3.00000E 01           1.00000E 01
      31   S3585           39        33            2.00000E 01           1.00000E 01
      32   S3585           39        33            3.00000E 01           1.00000E 01
```

Figure 32 Contd.

19 1040 LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM VERSION 1,1 (721220) 11 FEB 1974 PAGE 12

****NORM

IREF	CODE	KFORM	A1	A2	AREA	ACTV	X
1	R01	15	10,00		192,24	18750,00	3,60448E 07
2	R01	15	10,00		98,70	18750,00	1,85069E 07
14	R11	15	50,00		205,05	7500,00	7,68930E 07
18	C31	10	35,00	0,75	184,36	16,25	3,42566E 07
19	C21	10	35,00	0,75	61,70	16,25	1,14637E 07
20	842	10	30,00	1,00	123,39	12,50	2,01559E 07
21	889	10	25,00	1,00	98,33	20,00	2,14156E 07
22	I71	10	40,00	1,00	49,16	12,50	1,07078E 07
23	I90	10	30,00	1,00	92,54	12,50	1,51169E 07
24	T10	10	40,00	1,00	123,39	12,50	2,68745F 07
25	T20	20					
26	T30	20					
27	83585	30	40,00	1,00	10,00	27,50	4,79160E 06
30	82041	30	40,00	1,00	30,00	27,50	1,43748F 07
33	83585	30	40,00	1,00	30,00	27,50	1,43748E 07

19 1040 LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM VERSION 1,1 (721220) 11 FEB 1974 PAGE 13

****LINK

IREF	CODE	KFORM	KLINK	A1	A2	A11	A22	AREA	AACTV	A4	X
5	I11	60	14	50,00	0,50	25,00	0,45	205,05	15000,00		1,38407E 06
6	I11	60	14	50,00	0,50	25,00	0,45	205,05	15000,00		1,38407E 06
7	I12	60	14	50,00	0,50	30,00	0,20	205,05	15000,00		5,12620E 05
8	I12	69	1	10,00	1,50	30,00	0,20	192,24	15000,00		2,88358E 05
11	C11	59	14	50,00		0,50		205,05	16,25	1500,00	1,24951E 06
13	C12	59	14	50,00		1,50		205,05	16,25	1500,00	3,74853E 06
15	R11	80	14								7,68930E 07

19 1040 LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM VERSION 1,1 (721220) 11 FEB 1974 PAGE 14

****RECODE

IREF	CODE	KFORM	KRCODE	X(KRCODE)	X(IREF)
8	I12	69	7	8,00978E 05	2,88358E 05
11	C11	59	14	7,81425E 07	1,24951E 06
13	C12	59	14	8,18910E 07	3,74853E 06

****SUBROUTINE COMP4

19 1040 LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM VERSION 1,1 (721220) 11 FEB 1974 PAGE 15

IREF	KFORM	XFACTR	A3	X
1	15	0,0	0,0	3,60448E 07
2	15	0,0	0,0	1,85069E 07
5	60	0,50	0,0	6,92037E 05
6	60	0,50	0,0	6,92037E 05
7	60	0,0	0,0	8,00978E 05
14	15	0,50	0,0	4,09455E 07
15	80	0,50	0,0	3,84465E 07
18	10	0,0	0,0	3,42566E 07
19	10	0,0	0,0	1,14637E 07
20	10	0,0	0,0	2,01559E 07
21	10	0,0	0,0	2,14156E 07
22	10	0,0	0,0	1,07078E 07
23	10	0,0	0,0	1,51169E 07
24	10	0,0	0,0	2,68745E 07
25	20	0,0	400000,00	0,0
26	20	0,0	4500,00	0,0
27	30	0,0	0,0	4,79160E 06
30	30	0,0	0,0	1,43748E 07
33	30	0,0	0,0	1,43748E 07

Figure 32 Contd.

```
 19  1040     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)           11 FEB 1974          PAGE  16
**********************************************************************************************************************

ACTIVITIES         ACTIVITIES TO BE USED BY COMP2  (#2)                          (UNIT  5)

KEY-ACTIVITY       ACTIVITY  ACTIVITY NAMES
                               SCHED          PROC          R-OIL          D-OIL          N-GAS          PROC1          PROC2

  R01                           LOW DENSITY RESIDENT
                               8760.000       10.000         0.0            0.0            1.000          0.0            0.0

  R11                           ISLAND RESIDENT
                               8760.000       10.000         0.0            1.000          0.0            0.0            0.0

  I11                           PRIMARY SCHOOL (ALL SCHOOLS)
                               1600.000        0.0           0.0            1.000          0.0            0.0            0.0

  I11            I12            SECONDARY SCHOOL
                               1600.000        0.0           0.0            1.000          0.0            0.0            0.0

  C11                           NEIGHB.COMMERCIAL (ALL COMMERCIAL)
                               3000.000        0.0           0.0            1.000          0.0            0.0            0.0

  C11            C12            COMMUNITY COMMERC
                               3000.000        0.0           0.0            1.000          0.0            0.0            0.0

  C11            C21            HOTEL HWY COMMERC
                               3000.000        0.0           0.0            1.000          0.0            0.0            0.0

  C11            C31            BERRYS CREEK COMMERC
                               3000.000        0.0           0.0            1.000          0.0            0.0            0.0

  S42                           DISTRIBUTION
                               3600.000        0.0           0.0            1.000          0.0            0.0            0.0

  S89                           RESEARCH
                               2000.000        0.0           0.0            1.000          0.0            0.0            0.0

  I71                           CULTURAL CTR
                               1000.000        0.0           0.0            1.000          0.0            0.0            0.0

  I90                           SPECIAL USES
                               3600.000        0.0           0.0            1.000          0.0            0.0            0.0

  T10                           TRANSP CTR
                               8760.000        0.0           0.0            1.000          0.0            0.0            0.0

  T20                           AIRPORT-FLIGHTS/YR
                                 1.000         0.0           0.0            0.0            0.0            0.0            1.000

  T30                           PARKING LOT-VEHS/YR
                                 1.000         0.0           0.0            0.0            0.0            1.000          0.0

  S39                           INDUST (LIGHT)
                               3600.000       75.000         0.950          0.0            0.050          0.0            0.0
 19  1040     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)           11 FEB 1974          PAGE  17
**********************************************************************************************************************

  S20                           INDUST (HEAVY)
                               8760.000       90.000         0.750          0.0            0.250          0.0            0.0

  S20            S2041          INDUST
                               8760.000       90.000         0.750          0.0            0.250          0.0            0.0

  S39            S3585          INDUST
                               3600.000       75.000         0.950          0.0            0.050          0.0            0.0
 19  1040     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)           11 FEB 1974          PAGE  18
**********************************************************************************************************************

                   COMP2                                                         (UNIT  5)

                   COMPUTATIONS PERFORMED BY ROUTINE      2


  ****SUBROUTINE COMP



    IFVIN      IFVOUT     UNIT       JUNIT
       0          0          12         13
     DOW         DOA      DFPRNT     IFORM
    0.0        0.0        0.0            0
     NAM

    CONST
    0.0        0.0        0.0        0.0        0.0        0.0        0.0
         IPUNCH      PLAND                  SEASON
           T           F                    ANNUAL

  ****SUBROUTINE COMP2


         TSP        SOX        CO         HC         NOX
         TSP-W      SOX-W      CO-W       HC-W       NOX-W
         TSP-S      SOX-S      CO-S       HC-S       NOX-S

R11                       ISLAND RESIDENT (RES. FUEL BURNING)
  *********  FUELNAME NOT FOUND IN AVNAM(LOCATIONS 3 TO 7),    FUEL IS B-COA
D-OIL        10.0000    6.5000    0.2000    3.0000    4.8000
N-GAS        19.0000    0.6000   20.0000    8.0000    5.0000

R11      R01              LOW DENSITY RESIDENT

C11                       NEIGHB.COMMERC (COM.FUEL BURNING)
  *********  FUELNAME NOT FOUND IN AVNAM(LOCATIONS 3 TO 7),    FUEL IS A-COA
  *********  FUELNAME NOT FOUND IN AVNAM(LOCATIONS 3 TO 7),    FUEL IS B-COA
R-OIL        23.0000   40.0000    0.2000    3.0000   24.0000
D-OIL        15.0000   11.0000    0.2000    3.0000   24.0000
N-GAS        19.0000    0.6000   20.0000    8.0000    8.0000
```

Figure 32 Contd.

```
C11       I11            PRIMARY SCHOOL

C11       I12            SECONDARY SCHOOL

C11       C12            COMMUNITY COMMERC

C11       C21            HOTEL HWY COMMERC

C11       C31            BERRYS CREEK COMMERC

C11       S42            DISTRIBUTION

C11       S89            RESEARCH

C11       I71            CULTURAL CTR

C11       I90            SPECIAL USES


C11       T10            TRANSP CTR

 19  1040     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            11 FEB 1974            PAGE  19
*******************************************************************************************************************************
          TSP        SOX         CO         HC         NOX

T20                          AIRPORT  1=COMMERC 2=GEN.AVIATION
PROC1        8.0000     2.0000     6.0000     4.0000     3.5000
PROC2        0.2000     2.0000     6.0000     0.7000     0.2000

T30                          PARKING LOT
PROC1        4.3000     4.4000    12.2000     2.7000     0.9000

S39                          INDUST (IND.FUEL BURNING)
  *********  FUELNAME NOT FOUND IN AVNAM(LOCATIONS 3 TO 7).   FUEL IS A-COA
  *********  FUELNAME NOT FOUND IN AVNAM(LOCATIONS 3 TO 7).   FUEL IS B-COA
R-OIL       23.0000    24.0000     0.2000     3.0000    18.0000
D-OIL       15.0000     6.0000     0.2000     3.0000    18.0000
N-GAS       18.0000     0.6000     0.4000    40.0000   140.0000

S39        S3585             INDUST

S2041                        INDUST WITH PROCESS EMIS
R-OIL       23.0000    24.0000     0.2000     3.0000    18.0000
D-OIL       15.0000     6.0000     0.2000     3.0000    18.0000
N-GAS       18.0000     0.6000     0.4000    40.0000   140.0000
PROP        25.0000     0.0        0.0        0.0        0.0
  PROCESS 1,2,3 ARRAY-- IPRC =      6     7     0  IXI -FLAG =     1


 19  1040     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            11 FEB 1974            PAGE  20
*******************************************************************************************************************************

                 IREF   CODE         FUEL        QFUEL POLLUTANT          EM-FAC       A-CONC      Z1          Z2
                    1   R01          N-GAS     3.18941E 02
                                     N-GAS     3.18941E 02   TSP           19.00 3.02994E 00
                                     N-GAS     3.18941E 02   SOX            0.60 9.56824E-02
                                     N-GAS     3.18941E 02   CO            20.00 3.18941E 00
                                     N-GAS     3.18941E 02   HC             8.00 1.27577E 00
                                     N-GAS     3.18941E 02   NOX            5.00 7.97354E-01
                    2   R01          N-GAS     1.63758E 02
                                     N-GAS     1.63758E 02   TSP           19.00 1.55570E 00
                                     N-GAS     1.63758E 02   SOX            0.60 4.91274E-02
                                     N-GAS     1.63758E 02   CO            20.00 1.63758E 00
                                     N-GAS     1.63758E 02   HC             8.00 6.55032E-01
                                     N-GAS     1.63758E 02   NOX            5.00 4.09395E-01
                    5   I11          D-OIL     7.79759E 00
                                     D-OIL     7.79759E 00   TSP           15.00 5.84819E-02
                                     D-OIL     7.79759E 00   SOX           11.00 4.28868E-02
                                     D-OIL     7.79759E 00   CO             0.20 7.79759E-04
                                     D-OIL     7.79759E 00   HC             3.00 1.16964E-02
                                     D-OIL     7.79759E 00   NOX           24.00 9.35711E-02
                    6   I11          D-OIL     7.79759E 00
                                     D-OIL     7.79759E 00   TSP           15.00 5.84819E-02
                                     D-OIL     7.79759E 00   SOX           11.00 4.28868E-02
                                     D-OIL     7.79759E 00   CO             0.20 7.79759E-04
                                     D-OIL     7.79759E 00   HC             3.00 1.16964E-02
                                     D-OIL     7.79759E 00   NOX           24.00 9.35711E-02
                    7   I12          D-OIL     9.02510E 00
                                     D-OIL     9.02510E 00   TSP           15.00 6.76882E-02
                                     D-OIL     9.02510E 00   SOX           11.00 4.96381E-02
                                     D-OIL     9.02510E 00   CO             0.20 9.02510E-04
                                     D-OIL     9.02510E 00   HC             3.00 1.35376E-02
                                     D-OIL     9.02510E 00   NOX           24.00 1.08301E-01
                   14   R11          D-OIL     2.80659E 03
                                     D-OIL     2.80659E 03   TSP           10.00 1.40330E 01
                                     D-OIL     2.80659E 03   SOX            6.50 9.12142E 00
                                     D-OIL     2.80659E 03   CO             0.20 2.80659E-01
                                     D-OIL     2.80659E 03   HC             3.00 4.20989E 00
                                     D-OIL     2.80659E 03   NOX            4.80 6.73582E 00
                   15   R11          D-OIL     2.63530E 03
                                     D-OIL     2.63530E 03   TSP           10.00 1.31765E 01
                                     D-OIL     2.63530E 03   SOX            6.50 8.56472E 00
                                     D-OIL     2.63530E 03   CO             0.20 2.63530E-01
                                     D-OIL     2.63530E 03   HC             3.00 3.95294E 00
                                     D-OIL     2.63530E 03   NOX            4.80 6.32471E 00
                   18   C31          D-OIL     7.23731E 02
                                     D-OIL     7.23731E 02   TSP           15.00 5.42798E 00
                                     D-OIL     7.23731E 02   SOX           11.00 3.98052E 00
                                     D-OIL     7.23731E 02   CO             0.20 7.23730E-02
                                     D-OIL     7.23731E 02   HC             3.00 1.08560E 00
                                     D-OIL     7.23731E 02   NOX           24.00 8.68477E 00
                   19   C21          D-OIL     2.42190E 02
                                     D-OIL     2.42190E 02   TSP           15.00 1.81642E 00
                                     D-OIL     2.42190E 02   SOX           11.00 1.33204E 00
                                     D-OIL     2.42190E 02   CO             0.20 2.42190E-02
```

Figure 32 Contd.

IREF	CODE	FUEL	QFUEL	POLLUTANT	EM-FAC	A-CONC	Z1	Z2
		D-OIL	2.42190E 02	HC	3.00	3.63285E-01		
		D-OIL	2.42190E 02	NOX	24.00	2.90628E 00		
20	S42	D-OIL	5.10994E 02					
		D-OIL	5.10994E 02	TSP	15.00	3.83245E 00		
		D-OIL	5.10994E 02	SOX	11.00	2.81046E 00		
		D-OIL	5.10994E 02	CO	0.20	5.10994E-02		
		D-OIL	5.10994E 02	HC	3.00	7.66490E-01		
		D-OIL	5.10994E 02	NOX	24.00	6.13192E 00		
21	S89	D-OIL	3.01628E 02					
		D-OIL	3.01628E 02	TSP	15.00	2.26221E 00		
		D-OIL	3.01628E 02	SOX	11.00	1.65895E 00		
		D-OIL	3.01628E 02	CO	0.20	3.01628E-02		
		D-OIL	3.01628E 02	HC	3.00	4.52442E-01		
		D-OIL	3.01628E 02	NOX	24.00	3.61954E 00		
22	I71	D-OIL	7.54071E 01					
		D-OIL	7.54071E 01	TSP	15.00	5.65553E-01		
		D-OIL	7.54071E 01	SOX	11.00	4.14739E-01		
		D-OIL	7.54071E 01	CO	0.20	7.54071E-03		
		D-OIL	7.54071E 01	HC	3.00	1.13111E-01		
		D-OIL	7.54071E 01	NOX	24.00	9.04885E-01		
23	I90	D-OIL	3.83245E 02					
		D-OIL	3.83245E 02	TSP	15.00	2.87434E 00		
		D-OIL	3.83245E 02	SOX	11.00	2.10785E 00		
		D-OIL	3.83245E 02	CO	0.20	3.83245E-02		
		D-OIL	3.83245E 02	HC	3.00	5.74868E-01		
		D-OIL	3.83245E 02	NOX	24.00	4.59894E 00		
24	T10	D-OIL	1.65789E 03					
		D-OIL	1.65789E 03	TSP	15.00	1.24342E 01		
		D-OIL	1.65789E 03	SOX	11.00	9.11840E 00		
		D-OIL	1.65789E 03	CO	0.20	1.65789E-01		
		D-OIL	1.65789E 03	HC	3.00	2.48684E 00		
		D-OIL	1.65789E 03	NOX	24.00	1.98947E 01		
25	T20			TSP			0.0	4.000E 01
25	T20			SOX			0.0	4.000E 02
25	T20			CO			0.0	1.200E 03
25	T20			HC			0.0	1.400E 02
25	T20			NOX			0.0	4.000E 01
26	T30			TSP			0.0	9.675E 00
26	T30			SOX			0.0	9.900E 00
26	T30			CO			0.0	2.745E 01
26	T30			HC			0.0	6.075E 00
26	T30			NOX			0.0	2.025E 00
27	S3585	R-OIL	4.31243E 02					
27	S3585	N-GAS	3.13631E 00					
		R-OIL	4.31243E 02	TSP	23.00	4.95929E 00		
		N-GAS	3.13631E 00	TSP	18.00	4.98752E 00		
		R-OIL	4.31243E 02	SOX	24.00	5.17492E 00		
		N-GAS	3.13631E 00	SOX	0.60	5.17586E 00		
		R-OIL	4.31243E 02	CO	0.20	4.31243E-02		
		N-GAS	3.13631E 00	CO	0.40	4.37516E-02		
		R-OIL	4.31243E 02	HC	3.00	6.46865E-01		
		N-GAS	3.13631E 00	HC	40.00	7.09591E-01		
		R-OIL	4.31243E 02	NOX	18.00	3.88119E 00		

IREF	CODE	FUEL	QFUEL	POLLUTANT	EM-FAC	A-CONC	Z1	Z2
		N-GAS	3.13631E 00	NOX	140.00	4.10073E 00		
30	S2041	R-OIL	6.21331E 03					
30	S2041	N-GAS	2.86189E 02					
		R-OIL	6.21331E 03	TSP	23.00	7.14531E 01		
		N-GAS	2.86189E 02	TSP	18.00	7.40288E 01		
		R-OIL	6.21331E 03	SOX	24.00	7.45597E 01		
		N-GAS	2.86189E 02	SOX	0.60	7.46456E 01		
		R-OIL	6.21331E 03	CO	0.20	6.21331E-01		
		N-GAS	2.86189E 02	CO	0.40	6.78569E-01		
		R-OIL	6.21331E 03	HC	3.00	9.31997E 00		
		N-GAS	2.86189E 02	HC	40.00	1.90437E 01		
		R-OIL	6.21331E 03	NOX	18.00	5.59198E 01		
		N-GAS	2.86189E 02	NOX	140.00	7.59530E 01		
30	S2041			TSP			1.851E 01	0.0
33	S3585	R-OIL	1.29373E 03					
33	S3585	N-GAS	9.40895E 00					
		R-OIL	1.29373E 03	TSP	23.00	1.48779E 01		
		N-GAS	9.40895E 00	TSP	18.00	1.49626E 01		
		R-OIL	1.29373E 03	SOX	24.00	1.55248E 01		
		N-GAS	9.40895E 00	SOX	0.60	1.55276E 01		
		R-OIL	1.29373E 03	CO	0.20	1.29373E-01		
		N-GAS	9.40895E 00	CO	0.40	1.31255E-01		
		R-OIL	1.29373E 03	HC	3.00	1.94060E 00		
		N-GAS	9.40895E 00	HC	40.00	2.12878E 00		
		R-OIL	1.29373E 03	NOX	18.00	1.16436E 01		
		N-GAS	9.40895E 00	NOX	140.00	1.23022E 01		

****SUBROUTINE COMP4

Figure 32 Contd.

	EXTENT	AS	X	TSP ANNUAL WINTER SUMMER	SOX	CO	HC	NOX
1	0.7790	0.0	3.50836E 11	3.02994E 00 6.56085E 00 3.02994E-01	9.56824E-02 2.07185E-01 9.56823E-03	3.18941E 00 6.90616E 00 3.18941E-01	1.27577E 00 2.76246E 00 1.27576E-01	7.97354E-01 1.72654E 00 7.97353E-02
2	0.4000	0.0	1.80134E 11	1.55570E 00 3.36862E 00 1.55570E-01	4.91274E-02 1.06377E-01 4.91273E-03	1.63758E 00 3.54592E 00 1.63758E-01	6.55032E-01 1.41837E 00 6.55031E-02	4.09395E-01 8.86479E-01 4.09395E-02
5	1.0000	0.0	1.10726E 09	5.84819E-02 1.34206E-01 0.0	4.28868E-02 9.84175E-02 0.0	7.79759E-04 1.78941E-03 0.0	1.16964E-02 2.68411E-02 0.0	9.35711E-02 2.14729E-01 0.0
6	1.0000	0.0	1.10726E 09	5.84819E-02 1.34206E-01 0.0	4.28868E-02 9.84175E-02 0.0	7.79759E-04 1.78941E-03 0.0	1.16964E-02 2.68411E-02 0.0	9.35711E-02 2.14729E-01 0.0
7	1.0000	0.0	1.28156E 09	6.76882E-02 1.55332E-01 0.0	4.96381E-02 1.13910E-01 0.0	9.02510E-04 2.07110E-03 0.0	1.35376E-02 3.10665E-02 0.0	1.08301E-01 2.48532E-01 0.0
14	1.0000	0.0	3.98536E 11	1.40330E 01 3.03861E 01 1.40330E 00	9.12142E 00 1.97510E 01 9.12142E-01	2.80659E-01 6.07722E-01 2.80659E-02	4.20989E 00 9.11584E 00 4.20989E-01	6.73582E 00 1.45853E 01 6.73582E-01
15	1.0000	0.0	3.74212E 11	1.31765E 01 2.85316E 01 1.31765E 00	8.56472E 00 1.85455E 01 8.56471E-01	2.63530E-01 5.70631E-01 2.63530E-02	3.95294E 00 8.55947E 00 3.95294E-01	6.32471E 00 1.36951E 01 6.32471E-01
18	1.0000	0.0	1.02770E 11	5.42798E 00 1.24563E 01 0.0	3.98052E 00 9.13459E 00 0.0	7.23730E-02 1.66083E-01 0.0	1.08560E 00 2.49125E 00 0.0	8.68477E 00 1.99300E 01 0.0
19	0.2500	0.0	3.43910E 10	1.81642E 00 4.16837E 00 0.0	1.33204E 00 3.05680E 00 0.0	2.42190E-02 5.55783E-02 0.0	3.63285E-01 8.33674E-01 0.0	2.90628E 00 6.66939E 00 0.0
20	0.5000	0.0	7.25611E 10	3.83245E 00 8.79480E 00 0.0	2.81046E 00 6.44952E 00 0.0	5.10994E-02 1.17264E-01 0.0	7.66490E-01 1.75896E 00 0.0	6.13192E 00 1.40717E 01 0.0
21	0.3984	0.0	4.28312E 10	2.26221E 00 5.19137E 00 0.0	1.65895E 00 3.80701E 00 0.0	3.01628E-02 6.92183E-02 0.0	4.52442E-01 1.03827E 00 0.0	3.61954E 00 8.30619E 00 0.0
22	0.1992	0.0	1.07078E 10	5.65553E-01 1.29784E 00 0.0	4.14739E-01 9.51752E-01 0.0	7.54071E-03 1.73046E-02 0.0	1.13111E-01 2.59569E-01 0.0	9.04885E-01 2.07655E [illegible] 0.0

	EXTENT	AS	X	TSP ANNUAL WINTER SUMMER	SOX	CO	HC	NOX
23	0.3750	0.0	5.44209E 10	2.87434E 00 6.59610E 00 0.0	2.10785E 00 4.83714E 00 0.0	3.83245E-02 8.79480E-02 0.0	5.74868E-01 1.31922E 00 0.0	4.59894E 00 1.05538E 01 0.0
24	0.5000	0.0	2.35421E 11	1.24342E 01 2.85342E 01 0.0	9.11840E 00 2.09251E 01 0.0	1.65789E-01 3.80456E-01 0.0	2.48684E 00 5.70685E 00 0.0	1.98947E 01 4.56548E 01 0.0
25	1.5751	400000.0000	0.0	4.00000E 01 4.00000E 01 4.00000E 01	4.00000E 02 4.00000E 02 4.00000E 02	1.20000E 03 1.20000E 03 1.20000E 03	1.40000E 02 1.40000E 02 1.40000E 02	4.00000E 01 4.00000E 01 4.00000E 01
26	1.0000	4500.0000	0.0	9.67500E 00 9.67500E 00 9.67500E 00	9.90000E 00 9.90000E 00 9.90000E 00	2.74500E 01 2.74500E 01 2.74500E 01	6.07500E 00 6.07500E 00 6.07500E 00	2.02500E 00 2.02500E 00 2.02500E 00
27	1.0000	0.0	6.89989E 10	4.98752E 00 6.60201E 00 3.74064E 00	5.17586E 00 6.85131E 00 3.88189E 00	4.37516E-02 5.79142E-02 3.28137E-02	7.09591E-01 9.39290E-01 5.32193E-01	4.10073E 00 5.42816E 00 3.07555E 00
30	1.0000	0.0	1.25923E 12	9.25360E 01 1.02121E 02 8.51331E 01	7.46456E 01 8.43108E 01 6.71810E 01	6.78569E-01 7.66431E-01 6.10712E-01	1.50437E 01 1.69916E 01 1.35394E 01	7.59530E 01 8.57875E 01 6.83577E 01
33	1.0000	0.0	2.06997E 11	1.49626E 01 1.98061E 01 1.12219E 01	1.55276E 01 2.05540E 01 1.16457E 01	1.31255E-01 1.73743E-01 9.84411E-02	2.12878E 00 2.81787E 00 1.59658E 00	1.23022E 01 1.62845E 01 9.22666E 00

Figure 32 Contd.

```
 19  1040     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1,1  (721220)            11 FEB 1974            PAGE  25
***********************************************************************************************************************************

ACTIVITIES        TEST FOR COMP3  (#3)                                        (UNIT  5)

KEY-ACTIVITY      ACTIVITY  ACTIVITY NAMES
                            TSP            SOX            CO             HC             NOX            DFHT           DFPL
  Z00
                            50,000         50,000         50,000         50,000         50,000         100,000        60,000

 19  1040     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1,1  (721220)            11 FEB 1974            PAGE  26
***********************************************************************************************************************************

                  COMP3                                                       (UNIT  5)

                  COMPUTATIONS PERFORMED BY ROUTINE      3

  ****SUBROUTINE COMP


   IFVIN      IFVOUT    UNIT       JUNIT
      0          0         12         13
    DDW        DDA     DFPRHT      IFORM
   0,0        0,0       0,0            0
    NAM

   CONST
   0,029      0,305     4,000      0,0        0,0        0,0        0,029
        IPUNCH      PLAND                 SEASON
          T           F                   ANNUAL

  ****SUBROUTINE COMP3


  ****SUBROUTINE LARGE

   FIGURE     30  EXCEEDS SIZE CRITERIA FOR POLLUTANT  TSP
POINT                FIGURE NUMBER      30 CODE    52041      SEAS       1
        0,5824E 034,5227E 03                          3,0500E 017,3200E 01
        2,6558E 002,1423E 001,9475E-024,3176E-012,1799E 00
POINT                FIGURE NUMBER      30 CODE    52041      SEAS       2
        0,5824E 034,5227E 03                          3,0500E 017,3200E 01
        2,9309E 002,4197E 002,1997E-024,8766E-012,4621E 00
POINT                FIGURE NUMBER      30 CODE    52041      SEAS       3
        0,5824E 034,5227E 03                          3,0500E 017,3200E 01
        2,4433E 001,9281E 001,7527E-023,8858E-011,9619E 00

  ****SUBROUTINE COMP4

 19  1040     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1,1  (721220)            11 FEB 1974            PAGE  27
***********************************************************************************************************************************
```

	EXTENT	A3	X	TSP ANNUAL WINTER SUMMER	SOX	CO	HC	NOX
1	0,7790	0,0	0,0	1,11632E-01 2,41720E-01 1,11632E-02	3,52521E-03 7,63327E-03 3,52521E-04	1,17507E-01 2,54443E-01 1,17507E-02	4,70028E-02 1,01777E-01 4,70028E-03	2,93768E-02 6,36107E-02 2,93768E-03
2	0,4000	0,0	0,0	1,11632E-01 2,41720E-01 1,11632E-02	3,52521E-03 7,63328E-03 3,52521E-04	1,17507E-01 2,54443E-01 1,17507E-02	4,70028E-02 1,01777E-01 4,70028E-03	2,93768E-02 6,36107E-02 2,93768E-03
5	1,0000	0,0	0,0	1,67843E-03 3,85170E-03 0,0	1,23085E-03 2,82458E-03 0,0	2,23791E-05 5,13560E-05 0,0	3,35686E-04 7,70340E-04 0,0	2,68549E-03 6,16273E-03 0,0
6	1,0000	0,0	0,0	1,67843E-03 3,85170E-03 0,0	1,23085E-03 2,82458E-03 0,0	2,23791E-05 5,13560E-05 0,0	3,35686E-04 7,70340E-04 0,0	2,68549E-03 6,16273E-03 0,0
7	1,0000	0,0	0,0	1,94265E-03 4,45804E-03 0,0	1,42461E-03 3,26923E-03 0,0	2,59020E-05 5,94406E-05 0,0	3,88530E-04 8,91608E-04 0,0	3,10824E-03 7,13287E-03 0,0
14	1,0000	0,0	0,0	4,02746E-01 8,72082E-01 4,02746E-02	2,61785E-01 5,66853E-01 2,61785E-02	8,05492E-03 1,74416E-02 8,05491E-04	1,20824E-01 2,61624E-01 1,20824E-02	1,93318E-01 4,18599E-01 1,93318E-02
15	1,0000	0,0	0,0	3,78165E-01 8,18856E-01 3,78165E-02	2,45807E-01 5,32256E-01 2,45807E-02	7,56330E-03 1,63771E-02 7,56330E-04	1,13449E-01 2,45657E-01 1,13449E-02	1,81519E-01 3,93051E-01 1,81519E-02
18	1,0000	0,0	0,0	1,55793E-01 3,57494E-01 0,0	1,14241E-01 2,62163E-01 0,0	2,07711E-03 4,76659E-03 0,0	3,11566E-02 7,14988E-02 0,0	2,49253E-01 5,71991E-01 0,0
19	0,2500	0,0	0,0	2,08525E-01 4,78529E-01 0,0	1,52919E-01 3,50921E-01 0,0	2,78034E-03 6,38038E-03 0,0	4,17051E-02 9,57057E-02 0,0	3,33640E-01 7,65646E-01 0,0
20	0,5000	0,0	0,0	2,19983E-01 5,04821E-01 0,0	1,61321E-01 3,70202E-01 0,0	2,93310E-03 6,73095E-03 0,0	4,39965E-02 1,00964E-01 0,0	3,51972E-01 8,07714E-01 0,0
21	0,3984	0,0	0,0	1,62950E-01 3,73942E-01 0,0	1,19497E-01 2,74224E-01 0,0	2,17267E-03 4,98588E-03 0,0	3,25900E-02 7,47883E-02 0,0	2,60720E-01 5,98306E-01 0,0
22	0,1992	0,0	0,0	8,14751E-02 1,86971E-01 0,0	5,97484E-02 1,37112E-01 0,0	1,08633E-03 2,49295E-03 0,0	1,62950E-02 3,73942E-02 0,0	1,30360E-01 2,99150E-01 0,0

Figure 32   Contd.

23	0,3750	0,0	0,0	2,19983E-01	1,61321E-01	2,93310E-03	4,39966E-02	3,51972E-01
				5,04821E-01	3,70202E-01	6,73095E-03	1,00964E-01	8,07714E-01
				0,0	0,0	0,0	0,0	0,0
24	0,5000	0,0	0,0	7,13722E-01	5,23396E-01	9,51628E-03	1,42744E-01	1,14195E 00
				1,63787E 00	1,20110E 00	2,18382E-02	3,27573E-01	2,62058E 00
				0,0	0,0	0,0	0,0	0,0
25	1,5751	0,0	0,0	7,28854E-01	7,28855E 00	2,18656E 01	2,55099E 00	7,28854E-01
				7,28854E-01	7,28855E 00	2,18656E 01	2,55099E 00	7,28854E-01
				7,28854E-01	7,28855E 00	2,18656E 01	2,55099E 00	7,28854E-01
26	1,0000	0,0	0,0	2,77672E-01	2,84130E-01	7,87815E-01	1,74352E-01	5,81175E-02
				2,77672E-01	2,84130E-01	7,87815E-01	1,74352E-01	5,81175E-02
				2,77672E-01	2,84130E-01	7,87815E-01	1,74352E-01	5,81175E-02
27	1,0000	0,0	0,0	1,43142E-01	1,48547E-01	1,25567E-03	2,03653E-02	1,17691E-01
				1,89478E-01	1,96633E-01	1,66214E-03	2,69576E-02	1,55788E-01
				1,07356E-01	1,11410E-01	9,41752E-04	1,52739E-02	8,82682E-02
33	1,0000	0,0	0,0	4,29426E-01	4,45642E-01	3,76701E-03	6,10959E-02	3,53073E-01
				5,68434E-01	5,89898E-01	4,98641E-03	8,08729E-02	4,67365E-01
				3,22070E-01	3,34231E-01	2,82526E-03	4,58219E-02	2,64805E-01

ALLOCATION ANNUAL SOURCE CONCENTRATIONS (UNIT 5)

FIGURES ALLOCATED TO GRID BY MODE 1

VARIABLE NAME(S): FIGURE	TYPE	CO IX - IY	NOX EXTENT	CO	NOX
1	A		7,790E-01	1,175E-01	2,938E-02
		4 2	0,3443	4,046E-02	1,011E-02
		5 2	0,4347	5,108E-02	1,277E-02
		TOTALS	1,0000	9,154E-02	2,288E-02
2	A		4,000E-01	1,175E-01	2,938E-02
		4 1	0,4000	4,700E-02	1,175E-02
		TOTALS	1,0000	4,700E-02	1,175E-02
5	P		1,000E 00	2,238E-05	2,685E-03
		3 2	1,000E 00	2,238E-05	2,685E-03
		TOTALS	1,0000	2,238E-05	2,685E-03
6	P		1,000E 00	2,238E-05	2,685E-03
		4 2	1,000E 00	2,238E-05	2,685E-03
		TOTALS	1,0000	2,238E-05	2,685E-03
7	P		1,000E 00	2,590E-05	3,108E-03
		4 2	1,000E 00	2,590E-05	3,108E-03
		TOTALS	1,0000	2,590E-05	3,108E-03
14	P		1,000E 00	8,055E-03	1,933E-01
		3 1	5,000E-01	4,027E-03	9,666E-02
		4 1	5,000E-01	4,027E-03	9,666E-02
		TOTALS	1,0000	8,055E-03	1,933E-01
15	P		1,000E 00	7,563E-03	1,815E-01
		4 3	1,000E 00	7,563E-03	1,815E-01
		TOTALS	1,0000	7,563E-03	1,815E-01
18	P		1,000E 00	2,077E-03	2,493E-01
		2 1	5,000E-01	1,039E-03	1,246E-01
		2 2	5,000E-01	1,039E-03	1,246E-01
		TOTALS	1,0000	2,077E-03	2,493E-01
19	A		2,500E-01	2,780E-03	3,336E-01
		4 3	0,2500	6,951E-04	8,341E-02

Figure 32 Contd.

```
19  1040     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            11 FEB 1974            PAGE  30
*************************************************************************************************************************************
                               TOTALS     1,0000      6,951E-04    8,341E-02

         20         A                     5,000E-01   2,933E-03    3,520E-01

                               3     3    0,2500      7,333E-04    8,799E-02
                               4     3    0,2500      7,333E-04    8,799E-02
                               TOTALS     1,0000      1,467E-03    1,760E-01

         21         A                     3,984F-01   2,173E-03    2,607E-01

                               3     1    0,3984      8,657E-04    1,039E-01
                               TOTALS     1,0000      8,657E-04    1,039E-01

         22         A                     1,992E-01   1,086F-03    1,304E-01

                               2     1    0,1992      2,164E-04    2,597E-02
                               TOTALS     1,0000      2,164E-04    2,597E-02

         23         A                     3,750E-01   2,933E-03    3,520E-01

                               4     1    0,2500      7,333E-04    8,799E-02
                               5     1    0,1250      3,666E-04    4,400E-02
                               TOTALS     1,0000      1,100E-03    1,320E-01

         24         A                     5,000F-01   9,516E-03    1,142E 00

                               2     1    0,5000      4,758E-03    5,710E-01
                               TOTALS     1,0000      4,758E-03    5,710E-01

         25         A                     1,575E 00   2,187E 01    7,289E-01

                               1     2    0,1250      2,733E 00    9,111F-02
                               2     2    0,1875      4,100E 00    1,367F-01
                               1     3    0,1137      2,485E 00    8,284E-02
                               2     3    0,8156      1,783E 01    5,944E-01
                               3     3    0,3333      7,289E 00    2,430E-01
                               TOTALS     1,0000      3,444E 01    1,148E 00

         26         P                     1,000F 00   7,878E-01    5,812E-02

                               1     1    1,000E 00   7,878E-01    5,812E-02
                               TOTALS     1,0000      7,878E-01    5,812F-02

         27         P                     1,000E 00   1,256E-03    1,177E-01

                               5     3    1,000E 00   1,256E-03    1,177E-01
                               TOTALS     1,0000      1,256E-03    1,177E-01

         33         P                     1,000F 00   3,767E-03    3,531F-01

                               5     3    1,000E 00   3,767E-03    3,531E-01
                               TOTALS     1,0000      3,767E-03    3,531E-01
19  1040     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            11 FEB 1974            PAGE  31
*************************************************************************************************************************************

                GRID LISTING FOR VARIABLE CO        I


                       1          2          3          4          5

           3         2,49      17,83       7,29       0,01       0,01

           2         2,73       4,10       0,00       0,04       0,05

           1         0,79       0,01       0,00       0,09       0,00
19  1040     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            11 FEB 1974            PAGE  32
*************************************************************************************************************************************

                GRID LISTING FOR VARIABLE NOX       I


                       1          2          3          4          5

           3         0,08       0,59       0,33       0,35       0,47

           2         0,09       0,26       0,00       0,02       0,01

           1         0,06       0,72       0,20       0,20       0,04
```

Figure 32 Contd.

```
 19  1040     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            11 FEB 1974          PAGE  33
*************************************************************************************************************************

                   GRID PLOT FOR VARIABLE CO        ,

          1    2    3    4    5

         =====XXXXX+++++..........
       3 =====XXXXX+++++..........    3
         =====XXXXX+++++..........
         =====XXXXX+++++..........
         ==========     ..........
       2 ==========     ..........    2
         ==========     ..........
         ==========     ..........
         -----....................
       1 -----....................    1
         -----....................
         -----....................

          1    2    3    4    5


         LEVEL DESIGNATIONS...

          1         2         3         4         5         6         7         8         9         10
                  .....     -----     =====     +++++     XXXXX     00000     #####     #####     #####
                  .....     -----     =====     +++++     XXXXX     00000     #####     #####     #####
                  .....     -----     =====     +++++     XXXXX     00000     #####     #####     #####
                  .....     -----     =====     +++++     XXXXX     00000     #####     #####     #####
CELL COUNT:  1         8         1         3         1         1         0         0         0         0
VALUE:     0.00      0.17      0.79      9.32      7.29     17.83      0.0       0.0       0.0       0.0

MAXIMUM:   0.00      0.10      1.00      5.00     10.00     20.00     50.00    100.00    500.00
MINIMUM:             0.00      0.10      1.00      5.00     10.00     20.00     50.00    100.00    500.00
 19  1040     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            11 FEB 1974          PAGE  34
*************************************************************************************************************************

                   GRID PLOT FOR VARIABLE NOX       ,

          1    2    3    4    5

         .....--------------------
       3 .....--------------------    3
         .....--------------------
         .....--------------------
         .....-----...............
       2 .....-----...............    2
         .....-----...............
         .....-----...............
         .....---------------.....
       1 .....---------------.....    1
         .....---------------.....
         .....---------------.....

          1    2    3    4    5


         LEVEL DESIGNATIONS...

          1         2         3         4         5         6         7         8         9         10
                  .....     -----     =====     +++++     XXXXX     00000     #####     #####     #####
                  .....     -----     =====     +++++     XXXXX     00000     #####     #####     #####
                  .....     -----     =====     +++++     XXXXX     00000     #####     #####     #####
                  .....     -----     =====     +++++     XXXXX     00000     #####     #####     #####
CELL COUNT:  0         7         8         0         0         0         0         0         0         0
VALUE:     0.0       0.31      3.13      0.0       0.0       0.0       0.0       0.0       0.0       0.0

MAXIMUM:   0.00      0.10      1.00      5.00     10.00     20.00     50.00    100.00    500.00
MINIMUM:             0.00      0.10      1.00      5.00     10.00     20.00     50.00    100.00    500.00
 19  1040     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            11 FEB 1974          PAGE  35
*************************************************************************************************************************
OUTPUT            WRITES ANNUAL GRID PACKAGE TO UNIT 13                     (UNIT  5)

                  GRID VALUES FOR CO       ,NOX      ,
                  OUTPUT TO TAPE 13 BEGINNING SEQUENCE NUMBER 10400060
 19  1040     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            11 FEB 1974          PAGE  36
*************************************************************************************************************************
       PARAMETERS          NEW OUTPUT UNIT FOR WINTER POINT & GRID SOURCES

                  SCALE UNIT= 1.000E 03 METERS

                  GRID ORIGIN:   578.000, 4520.000 UNITS

                  GRID DIMENSIONS:  5 CELLS(X) BY  3 CELLS(Y)

                  CELL DIMENSIONS(UNITS):      1.00(X) BY      1.00(Y)

                  OUTPUT TAPE= 14

                  MIN. RAD**2= 1.000E-04 UNITS**2
```

Figure 32   Contd.

```
                 OUTPUT WINTER POINT SOURCES                              (UNIT  5)

                 COMPUTATIONS PERFORMED BY ROUTINE     4

 ****SUBROUTINE COMP


   IPVIN     IPVOUT    UNIT      JUNIT
     0          0        12        14
    DDW        DDA     DFPRMT    IFORM
   0.0        0.0       0.0         0
    NAM

   CONST
   0.0        0.0       0.0       0.0       0.0       0.0       0.0
        IPUNCH     PLAND               SEASON
          T          T                 WINTER

 ****SUBROUTINE COMP4
```


ALLOCATION   WINTER SOURCE CONCENTRATIONS   (UNIT 5)

FIGURES ALLOCATED TO GRID BY MODE 1

VARIABLE NAME(S):		CO-W	NOX-W		
FIGURE	TYPE	IX - IY	EXTENT	CO-W	NOX-W
1	A		7.790E-01	2.544E-01	6.361E-02
		4 2	0.3443	8.760E-02	2.190E-02
		5 2	0.4347	1.106E-01	2.765E-02
		TOTALS	1.0000	1.982E-01	4.955E-02
2	A		4.000E-01	2.544E-01	6.361E-02
		4 1	0.4000	1.018E-01	2.544E-02
		TOTALS	1.0000	1.018E-01	2.544E-02
5	P		1.000E 00	5.136E-05	6.163E-03
		3 2	1.000E 00	5.136E-05	6.163E-03
		TOTALS	1.0000	5.136E-05	6.163E-03
6	P		1.000E 00	5.136E-05	6.163E-03
		4 2	1.000E 00	5.136E-05	6.163E-03
		TOTALS	1.0000	5.136E-05	6.163E-03
7	P		1.000E 00	5.944E-05	7.133E-03
		4 2	1.000E 00	5.944E-05	7.133E-03
		TOTALS	1.0000	5.944E-05	7.133E-03
14	P		1.000E 00	1.744E-02	4.186E-01
		3 1	5.000E-01	8.721E-03	2.093E-01
		4 1	5.000E-01	8.721E-03	2.093E-01
		TOTALS	1.0000	1.744E-02	4.186E-01
15	P		1.000E 00	1.638E-02	3.931E-01
		4 3	1.000E 00	1.638E-02	3.931E-01
		TOTALS	1.0000	1.638E-02	3.931E-01
18	P		1.000E 00	4.767E-03	5.720E-01
		2 1	5.000E-01	2.383E-03	2.860E-01
		2 2	5.000E-01	2.383E-03	2.860E-01
		TOTALS	1.0000	4.767E-03	5.720E-01
19	A		2.500E-01	6.380E-03	7.656E-01
		4 3	0.2500	1.595E-03	1.914E-01

Figure 32 Contd.

```
*********************************************************************************************************************
                       TOTALS    1.0000     1.595E-03   1.914E-01

      20        A                5.000E-01  6.731E-03   8.077E-01

                       3    3    0.2500     1.683E-03   2.019E-01
                       4    3    0.2500     1.683E-03   2.019E-01
                       TOTALS    1.0000     3.365E-03   4.039E-01

      21        A                3.984E-01  4.986E-03   5.983E-01

                       3    1    0.3984     1.987E-03   2.384E-01
                       TOTALS    1.0000     1.987E-03   2.384E-01

      22        A                1.992E-01  2.493E-03   2.992E-01

                       2    1    0.1992     4.966E-04   5.960E-02
                       TOTALS    1.0000     4.966E-04   5.960E-02

      23        A                3.750E-01  6.731E-03   8.077E-01

                       4    1    0.2500     1.683E-03   2.019E-01
                       5    1    0.1250     8.414E-04   1.010E-01
                       TOTALS    1.0000     2.524E-03   3.029E-01

      24        A                5.000E-01  2.184E-02   2.621E 00

                       2    1    0.5000     1.092E-02   1.310E 00
                       TOTALS    1.0000     1.092E-02   1.310E 00

      25        A                1.575E 00  2.187E 01   7.289E-01

                       1    2    0.1250     2.733E 00   9.111E-02
                       2    2    0.1875     4.100E 00   1.367E-01
                       1    3    0.1137     2.485E 00   8.284E-02
                       2    3    0.8154     1.783E 01   5.944E-01
                       3    3    0.3333     7.289E 00   2.430E-01
                       TOTALS    1.0000     3.444E 01   1.148E 00

      26        P                1.000E 00  7.878E-01   5.812E-02

                       1    1    1.000E 00  7.878E-01   5.812E-02
                       TOTALS    1.0000     7.878E-01   5.812E-02

      27        P                1.000E 00  1.662E-03   1.558E-01

                       5    3    1.000E 00  1.662E-03   1.558E-01
                       TOTALS    1.0000     1.662E-03   1.558E-01

      33        P                1.000E 00  4.986E-03   4.674E-01

                       5    3    1.000E 00  4.986E-03   4.674E-01
                       TOTALS    1.0000     4.986E-03   4.674E-01
```


GRID LISTING FOR VARIABLE CO-W   1

	1	2	3	4	5
3	2.49	17.83	7.29	0.02	0.01
2	2.73	4.10	0.00	0.09	0.11
1	0.79	0.01	0.01	0.11	0.00

GRID LISTING FOR VARIABLE NOX-W   1

	1	2	3	4	5
3	0.08	0.59	0.44	0.79	0.62
2	0.09	0.42	0.01	0.04	0.03
1	0.06	1.66	0.45	0.44	0.10

Figure 32 Contd.

```
 19  1040      LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            11 FEB 1974           PAGE  42
********************************************************************************************************************************

                    GRID PLOT FOR VARIABLE CO-W     :

              1    2    3    4    5

              =====XXXXX+++++..........
            3 =====XXXXX+++++..........       3
              =====XXXXX+++++..........
              =====XXXXX+++++..........
              ==========          .....-----
            2 ==========          .....-----  2
              ==========          .....-----
              ==========          .....-----
              -----..........-----.....
            1 -----..........-----.....       1
              -----..........-----.....
              -----..........-----.....

              1    2    3    4    5


              LEVEL DESIGNATIONS...

              1         2         3         4         5         6         7         8         9        10
                      .....     -----     =====     +++++     XXXXX     OOOOO     #####     #####     #####
                      .....     -----     =====     +++++     XXXXX     OOOOO     #####     #####     #####
                      .....     -----     =====     +++++     XXXXX     OOOOO     #####     #####     #####
                      .....     -----     =====     +++++     XXXXX     OOOOO     #####     #####     #####
CELL COUNT:   1         6         3         3         1         1         0         0         0         0
VALUE:      0.00      0.14      1.01      9.32      7.29     17.83      0.0       0.0       0.0       0.0

MAXIMUM:    0.00      0.10      1.00      5.00     10.00     20.00     50.00    100.00    500.00
MINIMUM:              0.00      0.10      1.00      5.00     10.00     20.00     50.00    100.00    500.00
```

```
 19  1040      LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            11 FEB 1974           PAGE  43
********************************************************************************************************************************

                    GRID PLOT FOR VARIABLE NOX-W    :

              1    2    3    4    5

              .....--------------------
            3 .....--------------------       3
              .....--------------------
              .....--------------------
              .....-----...............
            2 .....-----...............       2
              .....-----...............
              .....-----...............
              .....=====---------------
            1 .....=====---------------       1
              .....=====---------------
              .....=====---------------

              1    2    3    4    5


              LEVEL DESIGNATIONS...

              1         2         3         4         5         6         7         8         9        10
                      .....     -----     =====     +++++     XXXXX     OOOOO     #####     #####     #####
                      .....     -----     =====     +++++     XXXXX     OOOOO     #####     #####     #####
                      .....     -----     =====     +++++     XXXXX     OOOOO     #####     #####     #####
                      .....     -----     =====     +++++     XXXXX     OOOOO     #####     #####     #####
CELL COUNT:   0         6         8         1         0         0         0         0         0         0
VALUE:      0.0       0.30      3.86      1.66      0.0       0.0       0.0       0.0       0.0       0.0

MAXIMUM:    0.00      0.10      1.00      5.00     10.00     20.00     50.00    100.00    500.00
MINIMUM:              0.00      0.10      1.00      5.00     10.00     20.00     50.00    100.00    500.00
```

```
 19  1040      LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            11 FEB 1974           PAGE  44
********************************************************************************************************************************
OUTPUT              WRITES WINTER GRID PACKAGE TO UNIT 14                        (UNIT  5)

                    GRID VALUES FOR CO-W    ,NOX-W    ,
                    OUTPUT TO TAPE 14 BEGINNING SEQUENCE NUMBER 10400300

END OF PROGRAM.
```

Figure 32 Contd.

2.5.3 Test Case 3: Mode 1, Population Allocation

Job Control Language

After initiating LANTRAN from the linkage editor, the CCL initiates execution. The datasets used by this run are on Units 9, 11, 12, and 13.

FT09 is the program run log.

FT11 is a temporary dataset used to hold figure descriptions.

FT12 is a temporary dataset. It is not used in this run but as description has been provided.

FT13 is the dataset that will hold the GRID package which will be created in this run for use in IMPACT.

Keyword Package Input

The initial parameters specify the same grid system as has been used in the other runs. The levels in LEV have been reset to levels chosen to represent the variables to be calculated. HEADR = .FALSE. so now OUTPUT will create a GRID package instead of a SRCE package.

The FIGURES are identical to the figures in the previous test case; the land use being studied is the same.

The VALUES package creates the links and recodes between schools, commercial areas, and residential areas. The variables A3 and X are needed only for heat calculations, so they are not included in the VALUES package. Otherwise, this VALUES package is the same as in the emissions creation test case.

The ACTIVITIES package is identical to that in the other test case with the addition of the variable A5. This is the number of people per dwelling unit.

A VALUES package creates the variables R01 and R11. These are variables that will be assigned to grid cells and although they have the same spelling as the activity codes R01 and R11, they will be used differently.

The COMPUTE 5 is run with CONST(1) = 1. This would normally result in calculation of the values for POP and SCHOOLS but these variable names have not yet been specified. When COMPUTE 5 discovers that the variable names have not been specified it bypasses the calculations and behaves as though CONST(1) has been multiplied by 10. In this case the "conglomerations" have taken the extent of each figure with an activity code of R01 and R11, and placed this in the variable R01 for each figure. Page 11 indicates the figures which have been used in creating these values.

A COMPUTE 6 follows to delete the last active variable name, R11. This is done to provide the space that will be needed in the next part of the run. The activity code R11 will remain active; only the variable R11 has been deleted.

The next two VALUES packages define as variable names for "gridded" variables:

POP, SCHOOLS, S, S89, S42, C21, C31, T10, I71, I90, and T20.

This completely fills the 18 available slots for names of variables. Without the use of COMPUTE 6 the last name, T20, could not have fit.

A COMPUTE 5 follows. CONST(1) = 1. again, but not the variables POP and SCHOOLS exist. As described in Section 2.3.1 the COMPUTE 5 uses the information given in A1, dwelling units per acre, A5, population per dwelling unit, and A2, given in the ACTIVITIES package and in A1, A2, A5 and the links and recodes to determine the population present in each grid cell and the school population present in each grid cell. The output on Page 16 indicates the figures and linkages that were used in the calculations.

At the end of the COMPUTE 5 calculations the SCHOOLS and POP have been calculated. The same compute has also "conglomerated" the extents of the land use variables specified into the variable S.

Another COMPUTE 5 immediately follows to complete the "conglomeration." This COMPUTE specifies that CONST(1) = 10. The value 10. indicates that the SCHOOLS and POP calculations have been completed. This COMPUTE 5 will take the variables I90 and T20, add them to S and save the result in S. Now S contains the extent of all the commercial figures.

With all of the variables specified, an ALLOCATION is performed to allocate the variables from the figures on to the grid. A mode 1 allocation is performed on the variables POP, SCHOOLS, R01, and S. Now each grid cell contains the values for each of the variables that have been allocated. The variables are LISTed and PLOTed. Pages 22 through 29 show the values that have resulted.

The final stage is to OUTPUT the variables POP, SCHOOLS, R01, and S. HEADR = .FALSE. so the OUTPUT will create a GRID package on unit JC. JC was specified 13 in the initial PARAMETERS; the GRID package is output to FT13. This package conforms completely to the specifications for a GRID package, and the GRID card title identifies the run which created it.

With the variables that IMPACT will need created in "gridded" format the test case is ended with an ENDJOB.

```
// MSGLEVEL=1
/*PARMS  COPIES=03
// EXEC FORTHLG,PARM.LKED='LET,MAP,LIST',REGION.GO=198K,TIME.GO=2
//LKED.SYSLIN DD *
 CHANGE INPUT(READER)
 INCLUDE ERT(INPUT,INE,HEADR,ERRX,SEQNO,TXLOC,GTASU,ICHAR,GPLOT)
 CHANGE INPUT(READER)
 INCLUDE LAN(MAIN,BLOCK,INPARM,INFIGS,INPTS,FVALS,FGRID,INGRDS)
 INCLUDE LAN(COMP,INAC,OUTS,PLANIM,PERIM,ALLOCF,ASFG)
/*
//LKED.ERT DD DSN=ERT4610.P9990000.ERTLIB,DISP=SHR
//LKED.LAN DD DSN=LANTRAN,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO.FT09F001 DD DSN=C461002.ER701.LOGDATA,DISP=SHR,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AVCO16)
//GO.FT11F001 DD UNIT=SYSDA,SPACE=(CYL,1),
// DCB=(RECFM=VBS,LRECL=446,BLKSIZE=4484)
//GO.FT12F001 DD UNIT=SYSDA,SPACE=(CYL,1),
// DCB=(RECFM=FB,LRECL=80,BLKSIZE=4800)
//GO.FT13F001 DD DSN=LANUSE,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO.FT05F001 DD *
PARAMETERS           LANTRAN MODE 1 LAND USE ALLOCATION
 &INPUT
 JC=13,
 NX=5,NY=3,ORIGIN=578.0,4520.0,
 LFV=0.0001,0.15,1.0,10.0,50.0,300.0,1000.0,3000.0,5000.0,10000.0,
 HEADP=.FALSE.,
 &END
FIGURES              LANTRAN MODE 1 TEST CASE #3
    1   1A  581.8   4522.0      1     R01      AREA 3=RESIDENT.
        2   582.5   4521.8
        3   582.5   4521.0
        4   581.5   4521.
        5   581.8   4522.0
    2   1A  581.0   4520.5      1     R01      AREA 85=RESIDENT
        2   582.0   4520.5
        3   581.6   4520.0
        4   581.0   4520.0
        5   581.0   4520.5
    3   1A  580.1   4521.5      1     R11      AREA 46=ISLAND RES
        2   580.9   4521.5
        3   580.9   4520.9
        4   580.1   4520.9
        5   580.1   4521.5
    4   1A  581.1   4522.3      1     R11      AREA 49=ISLAND RES
        2   581.8   4522.3
        3   581.4   4521.6
        4   581.1   4521.6
        5   581.1   4522.3
    5   1P  580.7   4521.1      1     I11      POINT 47=SCHOOL /
    6   1P  581.3   4521.7      1     I11      POINT 50=SCHOOL /
    7   1P  581.4   4521.1      1     I12      POINT 133=SCHOOL
    8   1P  581.4   4521.1      1     I12      POINT 149=SCHOOL /
    9   1P  580.1   4521.1      1     C11      POINT 48=BUSINESS
   10   1P  581.2   4522.2            C11      POINT 51=BUSINESS
   11   1P  581.0   4520.8            C11      POINT 143=IR=2 NEIGH
   12   1A  581.0   4521.0            C12      AREA 102=BUSINESS /
        2   581.5   4521.0
        3   581.5   4520.5
        4   581.0   4520.5
        5   581.0   4521.0
   13   1P  581.0   4520.8            C12      POINT 130=BUSINESS /
   14   1P  581.0   4520.8            R11      POINT 136=IR=2 /
   15   1P  581.6   4522.6            R11      //POINT// IR=2/
   16   1A  579.0   4521.3            C31      AREA 37=BUSINESS
        2   579.5   4521.1
        3   579.5   4520.5
        4   579.0   4520.5
        5   579.0   4521.3
   17   1A  580.0   4520.8            C31      AREA 38=BUSINESS
        2   580.5   4520.8
        3   580.5   4520.0
        4   580.0   4520.0
        5   580.0   4520.8
   18   1P  579.5   4521.0            C31      POINT 141=BERRYS
   19   1A  581.9   4523.0      1     C21      AREA 20=HOTEL HWY
        2   582.5   4523.0
        3   582.0   4522.5
        4   581.5   4522.5
        5   581.5   4523.0
   20   1A  580.5   4523.0            S42      AREA 4=DSTRBUTN
        2   581.5   4523.0
        3   581.9   4522.5
        4   580.5   4522.5
        5   580.5   4523.0
   21   1A  580.5   4520.8            S89      AREA 54=RESEARCH
        2   581.0   4520.8
        3   581.0   4520.0
        4   580.5   4520.0
        5   580.5   4520.8
   22   1A  579.5   4520.9            I71      AREA 42=CULTURE CTR
        2   580.0   4520.9
        3   580.0   4520.5
        4   579.5   4520.5
        5   579.5   4520.9
   23   1A  581.5   4521.0      1     T90      AREA 98=SPCIAL USE
        2   582.5   4521.0
        3   582.0   4520.5
        4   581.5   4520.5
        5   581.5   4521.0
   24   1A  579.0   4520.5            T10      AREA 2=TRANS CTR
        2   580.0   4520.5
        3   580.0   4520.0
        4   579.0   4520.0
        5   579.0   4520.5
   25   1A  579.6   4523.0            T20      AREA 1=AIRPORT
        2   580.5   4523.0
        3   580.5   4522.5
        4   579.0   4521.5
        5   578.5   4522.0
        6   579.6   4523.0
   26   1P  578.5   4520.5            T30      POINT 131=SPCIAL USE
   27   1P  582.5   4522.5            S3585    POINT 201   INDUST
   28   1P  582.3   4522.7            S2041    POINT 273   INDUST
   29   1P  582.5   4522.7            S2041    POINT 274   INDUST
   30   1P  582.4   4522.7            S2041    POINT 323   INDUST
   31   1P  582.1   4522.9            S3585    POINT 278 / INDUST
   32   1P  582.3   4522.9            S3585    POINT 279 / INDUST
```

Figure 33 LANTRAN Test Case 3, Deck Setup

```
   33   .1P  582.2    4522.9              S3585     POINT 324 / INDUST
99999
VALUES                LANTRAN MODE 1 TEST CASE #3
         KFORM        KLINK     KRCODE    XFACTR
          1        15.
          2        15.
          3        19.                 14.
          4        19.                 14.
          5        60.       14.                 0.80
          6        60.       14.                 0.50
          7        60.       14.
          8        69.        1.        7.
          9        19.                 11.
         10        19.                 11.
         11        59.       14.       14.
         12        19.                 13.
         13        59.       14.       14.
         14        15.                           0.50
         15        80.       14.                 0.50
         16        19.                 18.
         17        19.                 18.
         18        10.
         19        10.
         20        10.
         21        10.
         22        10.
         23        10.
         24        10.
         25        20.                                  400000.
         26        20.                                    4500.
         27        30.
         28        39.                 30.
         29        39.                 30.
         30        30.
         31        39.                 33.
         32        39.                 33.
         33        30.
99999
ACTIVITIES            ACTIVITY CODES TO BE USED BY COMP1 & COMP5 (#1)
ACTV       A1         A2        A4       A5
R01                       LOW DENSITY RESIDENT
    18750.       10.       1.5                     3.5
R11                       ISLAND RESIDENT
     7500.       50.       0.5    1500.            2.5
I11                       PRIMARY SCHOOL
    15000.       25.       0.45
I12                       SECONDARY SCHOOL
    15000.       30.       0.20
C11                       NEIGHB.COMMERCIAL
     16.25       0.5       1.0
C12                       COMMUNITY COMMERC
     16.25       1.5       1.0
C21                       HOTEL HWY COMMERC
     16.25       35.       0.75
C21        C31            BERRYS CREEK COMMERC
S42                       DISTRIBUTION
      12.5       30.       1.0
S89                       RESEARCH
      20.0       25.       1.0
I71                       CULTURAL CTR

      12.5       40.       1.0
S42        I90            SPECIAL USES
T10                       TRANSP CTR
      12.5       40.       1.0
T20                       AIRPORT

T30                       PARKING LOT

S39                       INDUST
      27.5       40.       1.0
S39        S3585          INDUST
S39        S2041          INDUST
99999
VALUES                LAND USES--RESIDENTIAL
           R01        R11
99999
COMPUTE            5  LAND USE OPERATIONS
 &COMPIN
 CONST=1.,2.,
 NAM='R01','R11',
 &END
COMPUTE            6  DELETE LAST RESIDENTIAL VARIABLE
 &COMPIN
 CONST=7.,
 &END
VALUES                LAND USE VARIABLES
           POP        SCHOOLS   S         S89        S42        C21
99999
VALUES                LAND USE VARIABLES (CONT.)
           C31        T10       I71       I90        T20
99999
COMPUTE            5  NON-RESIDENTIAL LAND USES
 &COMPIN
 CONST=1.,7.,
 NAM='S','S89','S42','C21','C31','T10','I71',
 &END
COMPUTE            5  NON-RESIDENTIAL LAND USES (CONT.)
 &COMPIN
 CONST=10.,3.,
 NAM='S','I90','T20',
 &END
ALLOCATION            MODE 1 LAND USE ALLOCATION
MODE  1    POP        SCHOOLS   R01       S
LIST       POP        SCHOOLS   R01       S
PLOT       POP        SCHOOLS   R01       S
99999
OUTPUT                WRITE LAND USES TO UNIT 13
           POP        SCHOOLS   R01       S
99999
ENDJOB
/*EOF
**
```

Figure 33 Contd.

```
//ERTHACKL JOB (38202440000,ERT--,101,---,MKEEFE,219---------,4610),XX,X JOB 576
// MSGLEVEL=1
***PARMS COPIES=03                                                          ACCEPTED
//INPARM EXEC FORTHC,PARM.FORT='LOAD,OPT=2'
XX         PROC PR=A,PU=B                                                   00000010
XXFORT EXEC     PGM=IEKAA00,PARM='NOLOAD',                                 X00000020
XX              REGION=230K                                                 00000030
XXSYSPRINT DD   SYSOUT=&PR,DCB=(RECFM=VBA,LRECL=137,BLKSIZE=1648)          00000040
IEF653I SUBSTITUTION JCL - SYSOUT=A,DCB=(RECFM=VBA,LRECL=137,BLKSIZE=1648)
XXSYSPUNCH DD   SYSOUT=&PU,DCB=(RECFM=FB,LRECL=80,BLKSIZE=1680),           X00000050
IEF653I SUBSTITUTION JCL - SYSOUT=B,DCB=(RECFM=FB,LRECL=80,BLKSIZE=1680),
XX              SPACE=(1680,(48,120))                                       00000060
//FORT.SYSLIN DD DSN=LANTRAN(INPARM),DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP),SPACE=
X/SYSLIN   DD   UNIT=SYSDA,DISP=(,PASS),SPACE=(3200,(100,50)),             X00000070
XX              DCB=(,RECFM=FB,LRECL=80,BLKSIZE=3200)                       00000080
//FORT.SYSIN DD *
IEF236I ALLOC. FOR ERTHACKL FORT      INPARM
IEF237I 081    ALLOCATED TO SYSPRINT
IEF237I 091    ALLOCATED TO SYSPUNCH
IEF237I 101    ALLOCATED TO SYSLIN
IEF237I 064    ALLOCATED TO SYSIN
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   LANTRAN                                          KEPT
IEF285I   VOL SER NOS= AIRMAP.
IEF373I STEP /FORT     / START 74046.0047
IEF374I STEP /FORT     / STOP  74046.0047 CPU   0MIN 09.08SEC MAIN 228K LCS   0K
// EXEC FORTHLG,PARM.LKED='LET,MAP,LIST',REGION.GO=198K,TIME.GO=2
XX         PROC PR=A                                                        00000010
XXLKED EXEC     PGM=IEWL,PARM='MAP,LET,LIST',                              X00000020
XX              REGION=100K                                                 00000030
XXSYSPRINT DD   SYSOUT=&PR,DCB=(LRECL=121,BLKSIZE=1573),                   X00000040
IEF653I SUBSTITUTION JCL - SYSOUT=A,DCB=(LRECL=121,BLKSIZE=1573),
XX              SPACE=(1573,(29,48))                                        00000050
XXSYSLIB   DD   DSNAME=SYS1.FORTLIB,DISP=SHR                                00000060
XX         DD   DSNAME=SYS1.DOUBLEP,DISP=SHR                                00000070
XXSYSUT1 DD UNIT=SYSDA,SPACE=(CYL,(2,1))                                    00000080
XXSYSLMOD  DD   DSN=&GOSET(FHXXMAIN),UNIT=SYSDA,DISP=(,PASS),               00000090
XX              SPACE=(CYL,(15,,1))                                         00000100
//LKED.SYSLIN DD *
//LKED.ERT DD DSN=ERT4610.P9990000.ERTLIB,DISP=SHR
//LKED.LAN DD DSN=LANTRAN,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
IEF236I ALLOC. FOR ERTHACKL LKED
IEF237I 081    ALLOCATED TO SYSPRINT
IEF237I 256    ALLOCATED TO SYSLIB
IEF237I 257    ALLOCATED TO
IEF237I 250    ALLOCATED TO SYSUT1
IEF237I 251    ALLOCATED TO SYSLMOD
IEF237I 065    ALLOCATED TO SYSLIN
IEF237I 255    ALLOCATED TO ERT
IEF237I 101    ALLOCATED TO LAN
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS1.FORTLIB                                     KEPT
IEF285I   VOL SER NOS= ACS101.
IEF285I   SYS1.DOUBLEP                                     KEPT
IEF285I   VOL SER NOS= ACS102.
IEF285I   SYS74046.T002138.RV000.ERTHACKL.R0000057         DELETED
IEF285I   VOL SER NOS= ACS000.
IEF285I   SYS74046.T002138.RV000.ERTHACKL.GOSET            PASSED
IEF285I   VOL SER NOS= ACS001.
IEF285I   ERT4610.P9990000.ERTLIB                          KEPT
IEF285I   VOL SER NOS= USER00.


IEF285I   LANTRAN                                          KEPT
IEF285I   VOL SER NOS= AIRMAP.
IEF373I STEP /LKED     / START 74046.0047
IEF374I STEP /LKED     / STOP  74046.0048 CPU   0MIN 20.36SEC MAIN  98K LCS   0K
XXGO   EXEC     PGM=*.LKED.SYSLMOD,COND=(5,LT,LKED)                         00000110
XXFT06F001 DD   SYSOUT=&PR,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1596)           00000120
IEF653I SUBSTITUTION JCL - SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1596)
//GO.FT09F001 DD DSN=C461002.ER701.LOGDATA,DISP=SHR,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AVC016)
//GO.FT11F001 DD UNIT=SYSDA,SPACE=(CYL,1),
// DCB=(RECFM=VSB,LRECL=448,BLKSIZE=4484)
//GO.FT12F001 DD UNIT=SYSDA,SPACE=(CYL,1),
// DCB=(RECFM=FB,LRECL=80,BLKSIZE=4800)
//GO.FT13F001 DD DSN=LANUSE,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO.FT05F001 DD *
//
IEF236I ALLOC. FOR ERTHACKL GO
IEF237I 251    ALLOCATED TO PGM=*.DD
IEF237I 081    ALLOCATED TO FT06F001
IEF237I 121    ALLOCATED TO FT09F001
IEF237I 250    ALLOCATED TO FT11F001
IEF237I 251    ALLOCATED TO FT12F001
IEF237I 101    ALLOCATED TO FT13F001
IEF237I 066    ALLOCATED TO FT05F001
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS74046.T002138.RV000.ERTHACKL.GOSET            PASSED
IEF285I   VOL SER NOS= ACS001.
IEF285I   C461002.ER701.LOGDATA                            KEPT
IEF285I   VOL SER NOS= AVC016.
IEF285I   SYS74046.T002138.RV000.ERTHACKL.R0000060         DELETED
IEF285I   VOL SER NOS= ACS000.
IEF285I   SYS74046.T002138.RV000.ERTHACKL.R0000061         DELETED
IEF285I   VOL SER NOS= ACS001.
IEF285I   LANUSE                                           KEPT
IEF285I   VOL SER NOS= AIRMAP.
IEF373I STEP /GO       / START 74046.0048
IEF374I STEP /GO       / STOP  74046.0048 CPU   0MIN 10.48SEC MAIN 180K LCS   0K
IEF285I   SYS74046.T002138.RV000.ERTHACKL.GOSET            DELETED
IEF285I   VOL SER NOS= ACS001.
IEF375I  JOB /ERTHACKL/ START 74046.0047
IEF376I  JOB /ERTHACKL/ STOP  74046.0048 CPU   0MIN 39.92SEC
```

Figure 34 LANTRAN Test Case 3 Printed Output

```
BEGIN LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1 LEVEL 721220 RUN   1056
TABLE COUNT= 38
 19  1056     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)          15 FEB 1974          PAGE   1
*****************************************************************************************************************************

        PARAMETERS           LANTRAN MODE 1 LAND USE ALLOCATION

                  SCALE UNIT= 1.000E 03 METERS

                  GRID ORIGIN:   578.000, 4520.000 UNITS

                  GRID DIMENSIONS:  5 CELLS(X) BY  3 CELLS(Y)

                  CELL DIMENSIONS(UNITS):      1.00(X) BY      1.00(Y)

                  OUTPUT TAPE= 13

                  MIN. RAD**2= 1.000E-04 UNITS**2

 19  1056     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)          15 FEB 1974          PAGE   2
*****************************************************************************************************************************

FIGURES             LANTRAN MODE 1 TEST CASE #3                                 (UNIT  5)

        FIGURE   1    TYPE: A    ID:     1       CODE: R01       AREA 3-RESIDENT.

                  VERTEX        X-COORD   Y-COORD
                     1          581.800  4522.000
                     2          582.500  4521.797
                     3          582.500  4521.000
                     4          581.500  4521.000
                     5          581.800  4522.000

                  CENTROID      582.052  4521.426 TOTAL AREA=      0.779

        FIGURE   2    TYPE: A    ID:     1       CODE: R01       AREA 85-RESIDENT

                  VERTEX        X-COORD   Y-COORD
                     1          581.000  4520.500
                     2          582.000  4520.500
                     3          581.600  4520.000
                     4          581.000  4520.000
                     5          581.000  4520.500

                  CENTROID      581.408  4520.270 TOTAL AREA=      0.400

        FIGURE   3    TYPE: A    ID:     1       CODE: R11       AREA 46-ISLAND RES

                  VERTEX        X-COORD   Y-COORD
                     1          580.100  4521.500
                     2          580.900  4521.500
                     3          580.900  4520.898
                     4          580.100  4520.898
                     5          580.100  4521.500

                  CENTROID      580.500  4521.199 TOTAL AREA=      0.481

        FIGURE   4    TYPE: A    ID:     1       CODE: R11       AREA 49-ISLAND RES

                  VERTEX        X-COORD   Y-COORD
                     1          581.100  4522.297
                     2          581.800  4522.297
                     3          581.400  4521.598
                     4          581.100  4521.598
                     5          581.100  4522.297

                  CENTROID      581.363  4521.992 TOTAL AREA=      0.350

        FIGURE   5    TYPE: P    ID:     1       CODE: I11       POINT 47-SCHOOL /

                  VERTEX        X-COORD   Y-COORD
                     1          580.700  4521.098
```

Figure 34 Contd.

```
19 1056    LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION  1.1  (721220)          15 FEB 1974          PAGE  3
***************************************************************************************************************************

      FIGURE   6    TYPE: P   ID:     1       CODE: I11      POINT 90-SCHOOL /

             VERTEX       X-COORD   Y-COORD
                1         581,300  4521,699

      FIGURE   7    TYPE: P   ID:     1       CODE: I12      POINT 133-SCHOOL

             VERTEX       X-COORD   Y-COORD
                1         581,400  4521,098

      FIGURE   8    TYPE: P   ID:     1       CODE: I12      POINT 149-SCHOOL /

             VERTEX       X-COORD   Y-COORD
                1         581,400  4521,098

      FIGURE   9    TYPE: P   ID:     1       CODE: C11      POINT 48-BUSINESS

             VERTEX       X-COORD   Y-COORD
                1         580,100  4521,098

      FIGURE  10    TYPE: P   ID:             CODE: C11      POINT 51-BUSINESS

             VERTEX       X-COORD   Y-COORD
                1         581,200  4522,199

      FIGURE  11    TYPE: P   ID:             CODE: C11      POINT 103-IR-2 NEIGH

             VERTEX       X-COORD   Y-COORD
                1         581,000  4520,797

      FIGURE  12    TYPE: A   ID:             CODE: C12      AREA 102-BUSINESS /

             VERTEX       X-COORD   Y-COORD
                1         581,000  4521,000
                2         581,500  4521,000
                3         581,500  4520,500
                4         581,000  4520,500
                5         581,000  4521,000

             CENTROID     581,250  4520,750 TOTAL AREA=     0,250

      FIGURE  13    TYPE: P   ID:             CODE: C12      POINT 130-BUSINESS /

             VERTEX       X-COORD   Y-COORD
                1         581,000  4520,797

      FIGURE  14    TYPE: P   ID:             CODE: R11      POINT 136-IR-2 /

             VERTEX       X-COORD   Y-COORD
                1         581,000  4520,797

      FIGURE  15    TYPE: P   ID:             CODE: R11      //POINT// IR-2/

             VERTEX       X-COORD   Y-COORD
                1         581,600  4522,598

19 1056    LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION  1.1  (721220)          15 FEB 1974          PAGE  4
***************************************************************************************************************************

      FIGURE  16    TYPE: A   ID:             CODE: C31      AREA 37-BUSINESS

             VERTEX       X-COORD   Y-COORD
                1         579,000  4521,297
                2         579,500  4521,098
                3         579,500  4520,500
                4         579,000  4520,500
                5         579,000  4521,297

             CENTROID     579,238  4520,848 TOTAL AREA=     0,349

      FIGURE  17    TYPE: A   ID:             CODE: C31      AREA 38-BUSINESS

             VERTEX       X-COORD   Y-COORD
                1         580,000  4520,797
                2         580,500  4520,797
                3         580,500  4520,000
                4         580,000  4520,000
                5         580,000  4520,797

             CENTROID     580,250  4520,398 TOTAL AREA=     0,398

      FIGURE  18    TYPE: P   ID:             CODE: C31      POINT 141-AERRYS

             VERTEX       X-COORD   Y-COORD
                1         579,500  4521,000

      FIGURE  19    TYPE: A   ID:     1       CODE: C21      AREA 20-HOTEL HWY

             VERTEX       X-COORD   Y-COORD
                1         581,500  4523,000
                2         582,000  4523,000
                3         582,000  4522,500
                4         581,500  4522,500
                5         581,500  4523,000

             CENTROID     581,750  4522,750 TOTAL AREA=     0,250

      FIGURE  20    TYPE: A   ID:             CODE: 942      AREA 4-DSTRBUTN

             VERTEX       X-COORD   Y-COORD
                1         580,500  4523,000
                2         581,500  4523,000
                3         581,500  4522,500
                4         580,500  4522,500
                5         580,500  4523,000

             CENTROID     581,000  4522,750 TOTAL AREA=     0,500

      FIGURE  21    TYPE: A   ID:             CODE: 809      AREA 30-RESEARCH

             VERTEX       X-COORD   Y-COORD
                1         580,500  4520,797
                2         581,000  4520,797
                3         581,000  4520,000
```

Figure 34 Contd.

```
          4         580,500  4520,000
          5         580,500  4520,797

     CENTROID       580,750  4520,398 TOTAL AREA=     0,398

FIGURE  22    TYPE: A    ID:           CODE: I71      AREA 42-CULTURE CTR

     VERTEX         X-COORD   Y-COORD
          1         579,500  4520,898
          2         580,000  4520,898
          3         580,000  4520,500
          4         579,500  4520,500
          5         579,500  4520,898

     CENTROID       579,750  4520,699 TOTAL AREA=     0,199

FIGURE  23    TYPE: A    ID:    1      CODE: I90      AREA 98-SPCIAL USE

     VERTEX         X-COORD   Y-COORD
          1         581,500  4521,000
          2         582,500  4521,000
          3         582,000  4520,500
          4         581,500  4520,500
          5         581,500  4521,000

     CENTROID       581,889  4520,777 TOTAL AREA=     0,375

FIGURE  24    TYPE: A    ID:           CODE: T10      AREA 2-TRANS CTR

     VERTEX         X-COORD   Y-COORD
          1         579,000  4520,500
          2         580,000  4520,500
          3         580,000  4520,000
          4         579,000  4520,000
          5         579,000  4520,500

     CENTROID       579,500  4520,250 TOTAL AREA=     0,500

FIGURE  25    TYPE: A    ID:           CODE: T20      AREA 1-AIRPORT

     VERTEX         X-COORD   Y-COORD
          1         579,600  4523,000
          2         580,500  4523,000
          3         580,500  4522,500
          4         579,000  4521,500
          5         578,500  4522,000
          6         579,600  4523,000

     CENTROID       579,549  4522,348 TOTAL AREA=     1,575

FIGURE  26    TYPE: P    ID:           CODE: T30      POINT 131-SPCIAL USE

     VERTEX         X-COORD   Y-COORD
          1         578,500  4520,500
```



```
FIGURE  27    TYPE: P    ID:           CODE: S3585    POINT 201  INDUST

     VERTEX         X-COORD   Y-COORD
          1         582,500  4522,500

FIGURE  28    TYPE: P    ID:           CODE: S2041    POINT 273  INDUST

     VERTEX         X-COORD   Y-COORD
          1         582,300  4522,699

FIGURE  29    TYPE: P    ID:           CODE: S2041    POINT 274  INDUST

     VERTEX         X-COORD   Y-COORD
          1         582,500  4522,699

FIGURE  30    TYPE: P    ID:           CODE: S2041    POINT 323  INDUST

     VERTEX         X-COORD   Y-COORD
          1         582,400  4522,699

FIGURE  31    TYPE: P    ID:           CODE: S3585    POINT 278 / INDUST

     VERTEX         X-COORD   Y-COORD
          1         582,100  4522,898

FIGURE  32    TYPE: P    ID:           CODE: S3585    POINT 279 / INDUST

     VERTEX         X-COORD   Y-COORD
          1         582,300  4522,898

FIGURE  33    TYPE: P    ID:           CODE: S3585    POINT 324 / INDUST

     VERTEX         X-COORD   Y-COORD
          1         582,200  4522,898

**** END OF FILE, TAPE 11 ****
```

Figure 34 Contd.

VALUES LANTRAN MODE 1 TEST CASE #3 (UNIT 5)

VALUES SPECIFIED FOR FIGURES--

FIGURE	KFORM	KLINK	KRCODE	XFACTR
1	1.500E 01	0.0	0.0	0.0
2	1.500E 01	0.0	0.0	0.0
3	1.900E 01	0.0	1.400E 01	0.0
4	1.900E 01	0.0	1.400E 01	0.0
5	6.000E 01	1.400E 01	0.0	5.000E-01
6	6.000E 01	1.400E 01	0.0	5.000E-01
7	6.000E 01	1.400E 01	0.0	0.0
8	6.900E 01	1.000E 00	7.000E 00	0.0
9	1.900E 01	0.0	1.100E 01	0.0
10	1.900E 01	0.0	1.100E 01	0.0
11	5.900E 01	1.400E 01	1.400E 01	0.0
12	1.900E 01	0.0	1.300E 01	0.0
13	5.900E 01	1.400E 01	1.400E 01	0.0
14	1.500E 01	0.0	0.0	5.000E-01
15	8.000E 01	1.400E 01	0.0	5.000E-01
16	1.900E 01	0.0	1.800E 01	0.0
17	1.900E 01	0.0	1.800E 01	0.0
18	1.000E 01	0.0	0.0	0.0
19	1.000E 01	0.0	0.0	0.0
20	1.000E 01	0.0	0.0	0.0
21	1.000E 01	0.0	0.0	0.0
22	1.000E 01	0.0	0.0	0.0
23	1.000E 01	0.0	0.0	0.0
24	1.000E 01	0.0	0.0	0.0
25	2.000E 01	0.0	0.0	0.0
26	2.000E 01	0.0	0.0	0.0
27	3.000E 01	0.0	0.0	0.0
28	3.900E 01	0.0	3.000E 01	0.0
29	3.900E 01	0.0	3.000E 01	0.0
30	3.000E 01	0.0	0.0	0.0
31	3.900E 01	0.0	3.300E 01	0.0
32	3.900E 01	0.0	3.300E 01	0.0
33	3.000E 01	0.0	0.0	0.0

ACTIVITIES ACTIVITY CODES TO BE USED BY COMP1 & COMP5 (#1) (UNIT 5)

KEY-ACTIVITY	ACTIVITY	ACTIVITY NAMES	ACTV	A1	A2	A4	A5
R01		LOW DENSITY RESIDENT	18750.000	10.000	1.500	0.0	3.500
R11		ISLAND RESIDENT	7500.000	50.000	0.500	1500.000	2.500
I11		PRIMARY SCHOOL	15000.000	25.000	0.450	0.0	0.0
I12		SECONDARY SCHOOL	15000.000	30.000	0.200	0.0	0.0
C11		NEIGHB.COMMERCIAL	16.250	0.500	1.000	0.0	0.0
C12		COMMUNITY COMMERC	16.250	1.500	1.000	0.0	0.0
C21		HOTEL HWY COMMERC	16.250	35.000	0.750	0.0	0.0
C21	C31	BERRYS CREEK COMMERC	16.250	35.000	0.750	0.0	0.0
S42		DISTRIBUTION	12.500	30.000	1.000	0.0	0.0
S69		RESEARCH	20.000	25.000	1.000	0.0	0.0
I71		CULTURAL CTR	12.500	40.000	1.000	0.0	0.0
S42	I90	SPECIAL USES	12.500	30.000	1.000	0.0	0.0
T10		TRANSP CTR	12.500	40.000	1.000	0.0	0.0
T20		AIRPORT	0.0	0.0	0.0	0.0	0.0
T30		PARKING LOT	0.0	0.0	0.0	0.0	0.0
S39		INDUST	27.500	40.000	1.000	0.0	0.0

Figure 34 Contd.

```
 19  1056      LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            15 FEB 1974           PAGE   9
*******************************************************************************************************************************

 539              33585          INDUST
                                 27.500         40.000          1.000          0.0           0.0

 539              32041          INDUST
                                 27.500         40.000          1.000          0.0           0.0
 19  1056      LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            15 FEB 1974           PAGE  10
*******************************************************************************************************************************

VALUES            LAND USES--RESIDENTIAL                                       (UNIT  5)

       VALUES SPECIFIED FOR FIGURES--

       FIGURE     R01          R11
 19  1056      LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            15 FEB 1974           PAGE  11
*******************************************************************************************************************************

                  LAND USE OPERATIONS                                          (UNIT  5)

                  COMPUTATIONS PERFORMED BY ROUTINE     5

 ****SUBROUTINE COMP


   IFVIN      IFVOUT     UNIT       JUNIT
     0          0          12         13
    DDW        DDA       DFPRHT     IFORM
  0.0        0.0        0.0           0
    NAM
R01       R11
  CONST
  1.000      2.000      0.0         0.0        0.0        0.0        0.0
       IPUNCH       PLAND                SEASON
         T            F                  ANNUAL

 ****SUBROUTINE COMPS


      ACTIVITY  AREA       VALUE      FIGURE
      R01        7.790E-01 1.000E 00      1
      R01        4.000E-01 1.000E 00      2
      R11        4.813E-01 1.000E 00      3
      R11        3.496E-01 1.000E 00      4
 19  1056      LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            15 FEB 1974           PAGE  12
*******************************************************************************************************************************

                  DELETE LAST RESIDENTIAL VARIABLE                             (UNIT  5)

                  COMPUTATIONS PERFORMED BY ROUTINE     6

 ****SUBROUTINE COMP


   IFVIN      IFVOUT     UNIT       JUNIT
     0          0          12         13
    DDW        DDA       DFPRHT     IFORM
  0.0        0.0        0.0           0
    NAM

  CONST
  7.000      0.0        0.0         0.0        0.0        0.0        0.0
       IPUNCH       PLAND                SEASON
         T            F                  ANNUAL
 19  1056      LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            15 FEB 1974           PAGE  13
*******************************************************************************************************************************

VALUES            LAND USE VARIABLES                                           (UNIT  5)

       VALUES SPECIFIED FOR FIGURES--

       FIGURE     POP          SCHOOLS       S            SR9          842          C21
 19  1056      LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            15 FEB 1974           PAGE  14
*******************************************************************************************************************************

VALUES            LAND USE VARIABLES (CONT.)                                   (UNIT  5)

       VALUES SPECIFIED FOR FIGURES--

       FIGURE     C31          T10           I71          I90          T20
```

Figure 34 Contd.

NON-RESIDENTIAL LAND USES (UNIT 5)

COMPUTATIONS PERFORMED BY ROUTINE 5

****SUBROUTINE COMP

```
  IFVIN     IFVOUT    UNIT      JUNIT
    0          0        12        13
   DDW        DDA     DFPRMT    IFORM
  0.0       0.0       0.0         0
   NAM
S        S69       S42        C21        C31        T10        I71
  CONST
  1.000      7.000      0.0        0.0        0.0        0.0        0.0
         IPUNCH      PLAND              SEASON
            T          F                ANNUAL
```

****SUBROUTINE COMPS

****RECODE

IREF	CODE	KFORM	KRCODE	AREA(KRCODE)	AREA(IREF)
3	R11	19	14	4.81279E-01	4.81279F-01
4	R11	19	14	8.30889E-01	3.49609E-01
9	C11	19	11	0.0	0.0
10	C11	19	11	0.0	0.0
12	C12	19	13	2.50000E-01	2.50000E-01
16	C31	19	18	3.48633E-01	3.48633E-01
17	C31	19	18	7.47070E-01	3.98438E-01

ACTIVITY	AREA	VALUE	FIGURE
R01	7.790E-01	1.000F 00	1
R01	4.000E-01	1.000E 00	2
C31	3.486F-01	1.000F 00	16
C31	3.984E-01	1.000E 00	17
C21	2.500E-01	1.000E 00	19
S42	5.000E-01	1.000E 00	20
S69	3.984E-01	1.000E 00	21
I71	1.992F-01	1.000E 00	22
I90	3.750E-01	1.000E 00	23
T10	5.000E-01	1.000E 00	24
T20	1.575F 00	1.000E 00	25
S3585	4.052E-02	4.052E-02	27
S2041	4.052E-02	4.052E-02	28
S2041	4.052E-02	4.052E-02	29
S3585	4.052E-02	4.052E-02	31
S3585	4.052E-02	4.052F-02	32

FIGURE	AREA	A1	A5	POPULATION	DENSITY
1	7.790E-01	10.00	3.50	6.728E 03	8.637E 03
2	4.000E-01	10.00	3.50	3.455E 03	8.637E 03
3	4.813E-01	50.00	2.50	1.485E 04	3.085E 04
4	3.496E-01	50.00	2.50	1.079E 04	3.085E 04

AREA	A2	A1	A22	XFACTR	SCHOOL CHILDREN	DENSITY	AREA(IREF)	FIGURE
8.309E-01	0.50	50.000	0.4500	0.5000	1.154E 03	1.153E 03	1.000E 00	5
8.309E-01	0.50	50.000	0.4500	0.5000	1.154E 03	1.153E 03	1.000F 00	6
8.309F-01	0.50	50.000	0.2000	0.0	1.025E 03	1.025F 03	1.000F 00	7
7.790E-01	1.50	10.000	0.2000	0.0	5.770E 02	5.767F 02	1.000F 00	8

NON-RESIDENTIAL LAND USES (CONT.) (UNIT 5)

COMPUTATIONS PERFORMED BY ROUTINE 5

****SUBROUTINE COMP

```
  IFVIN     IFVOUT    UNIT      JUNIT
    0          0        12        13
   DDW        DDA     DFPRMT    IFORM
  0.0       0.0       0.0         0
   NAM
S        I90       T20
  CONST
 10.000      3.000      0.0        0.0        0.0        0.0        0.0
         IPUNCH      PLAND              SEASON
            T          F                ANNUAL
```

****SUBROUTINE COMPS

Figure 34 Contd.

ALLOCATION MODE 1 LAND USE ALLOCATION (UNIT 5)

FIGURES ALLOCATED TO GRID BY MODE 1

VARIABLE NAME(S):		POP	SCHOOLS	R01	S		
FIGURE	TYPE	IX - IY	EXTENT	POP	SCHOOLS	R01	S
1	A		7.790E-01	8.637E 03	0.0	1.000E 00	0.0
		4 2	0.3443	2.974E 03	0.0	3.443E-01	0.0
		5 2	0.4347	3.755E 03	0.0	4.347E-01	0.0
		TOTALS	1.0000	6.728E 03	0.0	7.790E-01	0.0
2	A		4.000E-01	8.637E 03	0.0	1.000E 00	0.0
		4 1	0.4000	3.455E 03	0.0	4.000E-01	0.0
		TOTALS	1.0000	3.455E 03	0.0	4.000E-01	0.0
3	A		4.813E-01	3.085E 04	0.0	1.000E 00	0.0
		3 1	0.0813	2.507E 03	0.0	8.125E-02	0.0
		3 2	0.4000	1.234E 04	0.0	4.000E-01	0.0
		TOTALS	1.0000	1.485E 04	0.0	4.813E-01	0.0
4	A		3.496E-01	3.085E 04	0.0	1.000E 00	0.0
		4 2	0.1670	5.152E 03	0.0	1.670E-01	0.0
		4 3	0.1826	5.633E 03	0.0	1.826E-01	0.0
		TOTALS	1.0000	1.078E 04	0.0	3.496E-01	0.0
5	P		1.000E 00	0.0	1.153E 03	0.0	0.0
		3 2	1.000E 00	0.0	1.153E 03	0.0	0.0
		TOTALS	1.0000	0.0	1.153E 03	0.0	0.0
6	P		[illegible]	0.0	1.153E 03	0.0	0.0
		4 2	1.000E 00	0.0	1.153E 03	0.0	0.0
		TOTALS	1.0000	0.0	1.153E 03	0.0	0.0
7	P		1.000E 00	0.0	1.025E 03	0.0	0.0
		4 2	1.000E 00	0.0	1.025E 03	0.0	0.0
		TOTALS	1.0000	0.0	1.025E 03	0.0	0.0
8	P		1.000E 00	0.0	5.767E 02	0.0	0.0
		4 2	1.000E 00	0.0	5.767E 02	0.0	0.0
		TOTALS	1.0000	0.0	5.767E 02	0.0	0.0
9	P		1.000E 00	0.0	0.0	0.0	0.0
		3 2	1.000E 00	0.0	0.0	0.0	0.0

		TOTALS	1.0000	0.0	0.0	0.0	0.0
10	P		1.000E 00	0.0	0.0	0.0	0.0
		4 3	1.000E 00	0.0	0.0	0.0	0.0
		TOTALS	1.0000	0.0	0.0	0.0	0.0
11	P		1.000E 00	0.0	0.0	0.0	0.0
		3 1	5.000E-01	0.0	0.0	0.0	0.0
		4 1	5.000E-01	0.0	0.0	0.0	0.0
		TOTALS	1.0000	0.0	0.0	0.0	0.0
12	A		2.500E-01	0.0	0.0	0.0	0.0
		4 1	0.2500	0.0	0.0	0.0	0.0
		TOTALS	1.0000	0.0	0.0	0.0	0.0
13	P		1.000E 00	0.0	0.0	0.0	0.0
		3 1	5.000E-01	0.0	0.0	0.0	0.0
		4 1	5.000E-01	0.0	0.0	0.0	0.0
		TOTALS	1.0000	0.0	0.0	0.0	0.0
14	P		1.000E 00	0.0	0.0	0.0	0.0
		3 1	5.000E-01	0.0	0.0	0.0	0.0
		4 1	5.000E-01	0.0	0.0	0.0	0.0
		TOTALS	1.0000	0.0	0.0	0.0	0.0
15	P		1.000E 00	0.0	0.0	0.0	0.0
		4 3	1.000E 00	0.0	0.0	0.0	0.0
		TOTALS	1.0000	0.0	0.0	0.0	0.0
16	A		3.486E-01	0.0	0.0	0.0	1.000E 00
		2 1	0.2500	0.0	0.0	0.0	2.500E-01
		2 2	0.0986	0.0	0.0	0.0	9.863E-02
		TOTALS	1.0000	0.0	0.0	0.0	3.486E-01
17	A		3.984E-01	0.0	0.0	0.0	1.000E 00
		3 1	0.3984	0.0	0.0	0.0	3.984E-01
		TOTALS	1.0000	0.0	0.0	0.0	3.984E-01
18	P		1.000E 00	0.0	0.0	0.0	0.0
		2 1	5.000E-01	0.0	0.0	0.0	0.0
		2 2	5.000E-01	0.0	0.0	0.0	0.0
		TOTALS	1.0000	0.0	0.0	0.0	0.0
19	A		2.500E-01	0.0	0.0	0.0	1.000E 00
		4 3	0.2500	0.0	0.0	0.0	2.500E-01
		TOTALS	1.0000	0.0	0.0	0.0	2.500E-01

Figure 34 Contd.

19 1056 LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM VERSION 1.1 (721220) 15 FEB 1974 PAGE 20

20	A		5.000E-01	0.0	0.0	0.0	1.000E 00
		3 3	0.2500	0.0	0.0	0.0	2.500E-01
		4 3	0.2500	0.0	0.0	0.0	2.500E-01
		TOTALS	1.0000	0.0	0.0	0.0	5.000E-01
21	A		3.984E-01	0.0	0.0	0.0	1.000E 00
		3 1	0.3984	0.0	0.0	0.0	3.984E-01
		TOTALS	1.0000	0.0	0.0	0.0	3.984E-01
22	A		1.992E-01	0.0	0.0	0.0	1.000E 00
		2 1	0.1992	0.0	0.0	0.0	1.992E-01
		TOTALS	1.0000	0.0	0.0	0.0	1.992E-01
23	A		3.750E-01	0.0	0.0	0.0	1.000E 00
		4 1	0.2500	0.0	0.0	0.0	2.500E-01
		5 1	0.1250	0.0	0.0	0.0	1.250E-01
		TOTALS	1.0000	0.0	0.0	0.0	3.750E-01
24	A		5.000E-01	0.0	0.0	0.0	1.000E 00
		2 1	0.5000	0.0	0.0	0.0	5.000E-01
		TOTALS	1.0000	0.0	0.0	0.0	5.000E-01
25	A		1.575E 00	0.0	0.0	0.0	1.000E 00
		1 2	0.1250	0.0	0.0	0.0	1.250E-01
		2 2	0.1875	0.0	0.0	0.0	1.875E-01
		1 3	0.1137	0.0	0.0	0.0	1.137E-01
		2 3	0.8156	0.0	0.0	0.0	8.156E-01
		3 3	0.3333	0.0	0.0	0.0	3.333E-01
		TOTALS	1.0000	0.0	0.0	0.0	1.575E 00
26	P		1.000E 00	0.0	0.0	0.0	0.0
		1 1	1.000E 00	0.0	0.0	0.0	0.0
		TOTALS	1.0000	0.0	0.0	0.0	0.0
27	P		1.000E 00	0.0	0.0	0.0	4.052E-02
		5 3	1.000E 00	0.0	0.0	0.0	4.052E-02
		TOTALS	1.0000	0.0	0.0	0.0	4.052E-02
28	P		1.000E 00	0.0	0.0	0.0	4.052E-02
		5 3	1.000E 00	0.0	0.0	0.0	4.052E-02
		TOTALS	1.0000	0.0	0.0	0.0	4.052E-02
29	P		1.000E 00	0.0	0.0	0.0	4.052E-02
		5 3	1.000E 00	0.0	0.0	0.0	4.052E-02
		TOTALS	1.0000	0.0	0.0	0.0	4.052E-02

19 1056 LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM VERSION 1.1 (721220) 15 FEB 1974 PAGE 21

31	P		1.000E 00	0.0	0.0	0.0	4.052E-02
		5 3	1.000E 00	0.0	0.0	0.0	4.052E-02
		TOTALS	1.0000	0.0	0.0	0.0	4.052E-02
32	P		1.000E 00	0.0	0.0	0.0	4.052E-02
		5 3	1.000E 00	0.0	0.0	0.0	4.052E-02
		TOTALS	1.0000	0.0	0.0	0.0	4.052E-02

19 1056 LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM VERSION 1.1 (721220) 15 FEB 1974 PAGE 22

GRID LISTING FOR VARIABLE POP :

	1	2	3	4	5
3	0.0	0.0	0.0	5632.62	0.0
2	0.0	0.0	12339.83	8125.72	3754.65
1	0.0	0.0	2506.53	3454.63	0.0

19 1056 LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM VERSION 1.1 (721220) 15 FEB 1974 PAGE 23

GRID LISTING FOR VARIABLE SCHOOLS :

	1	2	3	4	5
3	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	1153.39	2755.35	0.0
1	0.0	0.0	0.0	0.0	0.0

19 1056 LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM VERSION 1.1 (721220) 15 FEB 1974 PAGE 24

GRID LISTING FOR VARIABLE R01 :

	1	2	3	4	5
3	0.0	0.0	0.0	0.18	0.0
2	0.0	0.0	0.40	0.51	0.43
1	0.0	0.0	0.08	0.40	0.0

Figure 34 Contd.

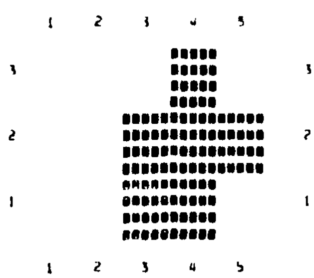
19 1056 LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM VERSION 1.1 (721220) 15 FEB 1974 PAGE 25

GRID LISTING FOR VARIABLE S :

	1	2	3	4	5
3	0.11	0.82	0.58	0.50	0.20
2	0.13	0.29	0.0	0.0	0.0
1	0.0	0.95	0.80	0.25	0.13

19 1056 LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM VERSION 1.1 (721220) 15 FEB 1974 PAGE 26

GRID PLOT FOR VARIABLE POP :

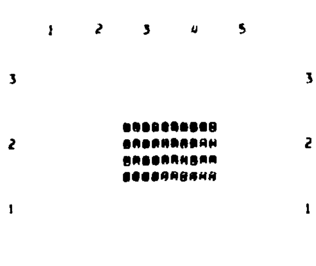


LEVEL DESIGNATIONS...

	1	2	3	4	5	6	7	8	9	10
		.....	-----	=====	+++++	XXXXX	OOOOO			
CELL COUNT:	9	0	0	0	0	0	0	1	2	3
VALUE:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2506.53	7209.28	26098.17
MAXIMUM:	0.00	0.15	1.00	10.00	50.00	300.00	1000.00	3000.00	5000.00	
MINIMUM:		0.00	0.15	1.00	10.00	50.00	300.00	1000.00	3000.00	5000.00

19 1056 LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM VERSION 1.1 (721220) 15 FEB 1974 PAGE 27

GRID PLOT FOR VARIABLE SCHOOLS :



LEVEL DESIGNATIONS...

	1	2	3	4	5	6	7	8	9	10
		.....	-----	=====	+++++	XXXXX	OOOOO			
CELL COUNT:	13	0	0	0	0	0	0	2	0	0
VALUE:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3908.75	0.0	0.0
MAXIMUM:	0.00	0.15	1.00	10.00	50.00	300.00	1000.00	3000.00	5000.00	
MINIMUM:		0.00	0.15	1.00	10.00	50.00	300.00	1000.00	3000.00	5000.00

Figure 34 Contd.

```
 19  1056     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)           15 FEB 1974          PAGE  28
*****************************************************************************************************************************

                    GRID PLOT FOR VARIABLE R01      ,

          1    2    3    4    5

                         -----
      3                  -----              3
                         -----
                         -----
                    ---------------
      2             ---------------         2
                    ---------------
                    ---------------
                    .....-----
      1             .....-----              1
                    .....-----
                    .....-----

          1    2    3    4    5


        LEVEL DESIGNATIONS...

          1         2         3         4         5         6         7         8         9        10
                  .....     -----     =====     +++++     XXXXX     00000     #####     #####     #####
                  .....     -----     =====     +++++     XXXXX     00000     #####     #####     #####
                  .....     -----     =====     +++++     XXXXX     00000     #####     #####     #####
                  .....     -----     =====     +++++     XXXXX     00000     #####     #####     #####
CELL COUNT:   9             1         5         0         0         0         0         0         0         0
VALUE:      0.0           0.08      1.93       0.0       0.0       0.0       0.0       0.0       0.0       0.0

MAXIMUM:    0.00          0.15      1.00     10.00     50.00    300.00   1000.00   3000.00   5000.00
MINIMUM:                  0.00      0.15      1.00     10.00     50.00    300.00   1000.00   3000.00   5000.00
 19  1056     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)           15 FEB 1974          PAGE  29
*****************************************************************************************************************************

                    GRID PLOT FOR VARIABLE S        ,

          1    2    3    4    5

         .....--------------------
      3  .....--------------------           3
         .....--------------------
         .....--------------------
         .....-----
      2  .....-----                         2
         .....-----
         .....-----
              ---------------.....
      1       ---------------.....          1
              ---------------.....
              ---------------.....

          1    2    3    4    5


        LEVEL DESIGNATIONS...

          1         2         3         4         5         6         7         8         9        10
                  .....     -----     =====     +++++     XXXXX     00000     #####     #####     #####
                  .....     -----     =====     +++++     XXXXX     00000     #####     #####     #####
                  .....     -----     =====     +++++     XXXXX     00000     #####     #####     #####
                  .....     -----     =====     +++++     XXXXX     00000     #####     #####     #####
CELL COUNT:   4             3         8         0         0         0         0         0         0         0
VALUE:      0.0           0.36      4.38       0.0       0.0       0.0       0.0       0.0       0.0       0.0

MAXIMUM:    0.00          0.15      1.00     10.00     50.00    300.00   1000.00   3000.00   5000.00
MINIMUM:                  0.00      0.15      1.00     10.00     50.00    300.00   1000.00   3000.00   5000.00

 19  1056     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)           15 FEB 1974          PAGE  30
*****************************************************************************************************************************
OUTPUT              WRITE LAND USES TO UNIT 13                               (UNIT  5)

                    GRID VALUES FOR POP     ,SCHOOLS ,R01     ,S        ,
                    OUTPUT TO TAPE 13 BEGINNING SEQUENCE NUMBER 10560010

END OF PROGRAM.
```

Figure 34 Contd.

2.5.4 Test Case 4: Mode 2, Allocating

This test case is provided to supply a demonstration of how the Mode 2 allocation could have been used. The test case is not part of the system runs to evaluate the Hackensack Meadowlands air quality.

Job Control Language

The datasets used are:

FT09, the run log accounting file.

FT11 is a temporary dataset used to hold the figures.

FT12 is a dataset which was provided for temporary storage.

Keyword Package Imput

The PARAMETERS package defines the grid to be identical with the grid definition used throughout the test cases. The number of levels is set to 6, and the levels are respecified.

The FIGURES is the figures for the test case land use.

The VALUES are the values used in the Model 1 emissions calculations.

A VALUES is provided to establish the variable WATER. This will be used for an associated value for Mode 2 allocation. Values are provided for figures 1, 3, 12, and 20.

The ALLOCATION specifies Mode 2 allocation, see Section 2.1.1 and Section 2.2.7. N2 is specified equal to 1; only the selected figures will be allocated. The next card is used to specify the associated variable WATER. Finally, the list of figures to be allocated is given. Figures 3, 12, and 20 are to be allocated. No other figure will be considered in this allocation.

The output on Page 9 indicates that the figures 3, 12, and 20 have been allocated and gives the values for the three variables being allocated, KLINK, KFORM, and KRCODE.

The resulting grid values are LISTed and PLOTted for the three variables. This output is on Pages 10 through 15. The run has demonstrated how associated allocation can be done and is terminated with and ENDJOB.

```
//ERTMACKX JOB (88202440000,ERT==,101,===,MKEEFE,219=========,4610),XX,X
// MSGLEVEL=1
/*PARMS  COPIES=03
// EXEC FORTHLG,PARM.LKED='LET,MAP,LIST',REGION.GO=198K,TI[illegible].G[illegible]
//LKED.SYSLIN DD *
 CHANGE INPUT(READER)
 INCLUDE ERT(INPUT,INE,HEADR,FRRX,SEGND,TXLOC,STABU,ICHAR,SPL[illegible]
 CHANGE INPUT(READER)
 INCLUDE LAN(MAIN,BLOCK,INPARM,INFIGS,INPTS,FVALS,PGRID,INGRDS)
 INCLUDE LAN(COMP,INAC,OUTS,PLANIM,PERIM,ALLOCF,ASEG)
/*
//LKED.ERT DD DSN=ERT4610.P9990000.ERTLIB,DISP=SHR
//LKED.LAN DD DSN=LANTRAN,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO.FT09F001 DD DSN=C461002.ER701.LOGDATA,DISP=SHR,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AVCO16)
//GO.FT11F001 DD UNIT=SYSDA,SPACE=(CYL,1),
// DCB=(RECFM=VSB,LRECL=448,BLKSIZE=4484)
//GO.FT12F001 DD UNIT=SYSDA,SPACE=(CYL,1),
// DCB=(RECFM=FB,LRECL=80,BLKSIZE=4800)
//GO.FT05F001 DD *
PARAMETERS            LANTRAN MODE 2 ALLOCATION BY ASSOCIATION
 &INPUT
 NX=5,NY=3,ORIGIN=578.0,4520.0,
 NLEV=6, LEV=.0001,10.,25.,40.,55.,70.,
 &END
FIGURES               LANTRAN MODE 2 TEST CASE
    1   1A  581.8   4522.0      1     R01       AREA 3=RESIDENT.
        2   582.5   4521.8
        3   582.5   4521.0
        4   581.5   4521.
        5   581.8   4522.0
    2   1A  581.0   4520.5      1     R01       AREA 85=RESIDENT
        2   582.0   4520.5
        3   581.6   4520.0
        4   581.0   4520.0
        5   581.0   4520.5
    3   1A  580.1   4521.5      1     R11       AREA 46=ISLAND RES
        2   580.9   4521.5
        3   580.9   4520.9
        4   580.1   4520.9
        5   580.1   4521.5
    4   1A  581.1   4522.3      1     R11       AREA 49=ISLAND RES
        2   581.8   4522.3
        3   581.4   4521.6
        4   581.1   4521.6
        5   581.1   4522.3
    5   1P  580.7   4521.1      1     I11       POINT 47=SCHOOL /
    6   1P  581.3   4521.7      1     I11       POINT 50=SCHOOL /
    7   1P  581.4   4521.1      1     I12       POINT 133=SCHOOL
    8   1P  581.4   4521.1      1     I12       POINT 149=SCHOOL /
    9   1P  580.1   4521.1      1     C11       POINT 48=BUSINESS
   10   1P  581.2   4522.2            C11       POINT 51=BUSINESS
   11   1P  581.0   4520.8            C11       POINT 143=IR=2 NEIGH
   12   1A  581.0   4521.0            C12       AREA 102=BUSINESS /
        2   581.5   4521.0
        3   581.5   4520.5
        4   581.0   4520.5
        5   581.0   4521.0
   13   1P  581.0   4520.8            C12       POINT 130=BUSINESS /

   14   1P  581.0   4520.8            R11       POINT 136=IR=2 /
   15   1P  581.6   4522.6            R11       //POINT// IR=2/
   16   1A  579.0   4521.3            C31       AREA 37=BUSINESS
        2   579.5   4521.1
        3   579.5   4520.5
        4   579.0   4520.5
        5   579.0   4521.3
   17   1A  580.0   4520.8            C31       AREA 38=BUSINESS
        2   580.5   4520.8
        3   580.5   4520.0
        4   580.0   4520.0
        5   580.0   4520.8
   18   1P  579.5   4521.0            C31       POINT 141=BERRYS
   19   1A  581.5   4523.0      1     C21       AREA 20=HOTEL HWY
        2   582.0   4523.0
        3   582.0   4522.5
        4   581.5   4522.5
        5   581.5   4523.0
   20   1A  580.5   4523.0            S42       AREA 4=DSTRBUTN
        2   581.5   4523.0
        3   581.5   4522.5
        4   580.5   4522.5
        5   580.5   4523.0
   21   1A  580.5   4520.8            S89       AREA 54=RESEARCH
        2   581.0   4520.8
        3   581.0   4520.0
        4   580.5   4520.0
        5   580.5   4520.8
   22   1A  579.5   4520.9            I71       AREA 42=CULTURE CTR
        2   580.0   4520.9
        3   580.0   4520.5
        4   579.5   4520.5
        5   579.5   4520.9
   23   1A  581.5   4521.0      1     I90       AREA 98=SPCIAL USE
        2   582.5   4521.0
        3   582.0   4520.5
        4   581.5   4520.5
        5   581.5   4521.0
   24   1A  579.0   4520.5            T10       AREA 2=TRANS CTR
        2   580.0   4520.5
        3   580.0   4520.0
        4   579.0   4520.0
        5   579.0   4520.5
   25   1A  579.6   4523.0            T20       AREA 1=AIRPORT
        2   580.5   4523.0
        3   580.5   4522.5
        4   579.0   4521.5
        5   578.5   4522.0
        6   579.6   4523.0
   26   1P  578.5   4520.5            T30       POINT 131=SPCIAL USE
   27   1P  582.5   4522.5            83585     POINT 201    INDUST
   28   1P  582.3   4522.7            82041     POINT 273    INDUST
   29   1P  582.5   4522.7            82041     POINT 274    INDUST
   30   1P  582.4   4522.7            82041     POINT 323    INDUST
   31   1P  582.1   4522.9            83585     POINT 278 /  INDUST
   32   1P  582.3   4522.9            83585     POINT 279 /  INDUST
   33   1P  582.2   4522.9            83585     POINT 324 /  INDUST
99999
VALUES                LANTRAN MODE 2 TEST CASE
          KFORM       KLINK     KRCODE     XFACTR
```

Figure 35   LANTRAN Test Case 4, Deck Setup

```
         1       15.
         2       15.
         3       19.                 14.
         4       19.                 14.
         5       60.       14.                 0,50
         6       60.       14.                 0,50
         7       60.       14.
         8       69.        1.        7.
         9       19.                 11.
        10       19.                 11.
        11       59.       14.       14.
        12       19.                 13.
        13       59.       14.       14.
        14       15.                           0,50
        15       80.       14.                 0,50
        16       19.                 18.
        17       19.                 18.
        18       10.
        19       10.
        20       10.
        21       10.
        22       10.
        23       10.
        24       10.
        25       20.                                    400000.
        26       20.                                      4500.
        27       30.
        28       39.                 30.
        29       39.                 30.
        30       30.
        31       39.                 33.
        32       39.                 33.
        33       30.
99999
VALUES                ASSOCIATED VARIABLE DEFINED
          WATER
         1        .5
         3        1.
        12        .8
        20       .65
99999
ALLOCATION            MODE 2 ALLOCATION (ASSOCIATED VAR, 'WATER')
MODE  2  1KFORM       KLINK      KRCODE
          WATER
    3   12   20
LIST       KFORM      KLINK      KRCODE
PLOT       KFORM      KLINK      KRCODE
99999
ENDJOB
/*EOF
**
```

Figure 35 Contd.

```
//ERTHACKX JOB (5A2024400C0,ERT--,101,---,MKEEFE,219---------,4610),XX,X JOB 181
// MSGLEVEL=1
***PARMS COPIES=03                                                          ACCEPTED
// EXEC FORTHLG,PARM.LKED='LET,MAP,LIST',REGION.GO=198K,TIME.GO=2
XX         PROC [illegible]                                                 00000010
XXLKED EXEC     PGM=IEWL,PARM='MAP,LET,LIST',                              X00000020
XX              REGION=100K                                                 00000030
XXSYSPRINT DD  SYSOUT=LPR,DCB=(LRECL=121,BLKSIZE=1573),                   X00000040
IEF653I SUBSTITUTION JCL - SYSOUT=A,DCB=(LRECL=121,BLKSIZE=1573),
XX              SPACE=(1573,(24,48))                                        00000050
XXSYSLIB   DD  DSNAME=SYS1.FORTLIB,DISP=SHR                                 00000060
XX         DD  DSNAME=SYS1.DOUBLEP,DISP=SHR                                 00000070
XXSYSUT1 DD  [illegible],SPACE=(CYL,(2,1))                                  00000080
XXSYSLMOD  DD  DSNAME=&GOSET(EMXXMAIN),UNIT=SYSDA,DISP=(,PASS),             00000090
XX              SPACE=(CYL,(15,,1))                                         00000100
//LKED.SYSLIN DD *
//LKED.ERT DD DSN=ERT4610.P9990000.ERTLIB,DISP=SHR
//LKED.LAN DD DSN=LANTRAN,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
IEF236I ALLOC. FOR ERTHACKX LKED
IEF237I 084   ALLOCATED TO SYSPRINT
IEF237I 256   ALLOCATED TO SYSLIB
IEF237I 257   ALLOCATED TO
IEF237I 253   ALLOCATED TO SYSUT1
IEF237I 251   ALLOCATED TO SYSLMOD
IEF237I 061   ALLOCATED TO SYSLIN
IEF237I 255   ALLOCATED TO ERT
IEF237I 101   ALLOCATED TO LAN
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS1.FORTLIB                                        KEPT
IEF285I   VOL SER NOS= ACS101.
IEF285I   SYS1.DOUBLEP                                        KEPT
IEF285I   VOL SER NOS= ACS102.
IEF285I   SYS74043.T073257.RV000.ERTHACKX.R0002803           DELETED
IEF285I   VOL SER NOS= ACS002.
IEF285I   SYS74043.T073257.RV000.ERTHACKX.GOSET              PASSED
IEF285I   VOL SER NOS= ACS001.
IEF285I   ERT4610.P9990000.ERTLIB                             KEPT
IEF285I   VOL SER NOS= USER00.
IEF285I   LANTRAN                                             KEPT
IEF285I   VOL SER NOS= AIRMAP.
IEF373I STEP /LKED    / START 74043.1237
IEF374I STEP /LKED    / STOP  74043.1239 CPU    0MIN 20.66SEC MAIN  98K LCS    0K
XXGO    EXEC    PGM=*.LKED.SYSLMOD,COND=(5,LT,LKED)                         00000110
XXFT06F001 DD  SYSOUT=LPR,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1596)            00000120
IEF653I SUBSTITUTION JCL - SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1596)
//GO.FT09F001 DD DSN=[illegible]002.ER701.LOGDATA,DISP=SHR,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AVC016)
//GO.FT11F001 DD UNIT=SYSDA,SPACE=(CYL,1),
// DCB=(RECFM=VS,LRECL=448,BLKSIZE=4484)
//GO.FT12F001 DD UNIT=SYSDA,SPACE=(CYL,1),
// DCB=(RECFM=FB,LRECL=80,BLKSIZE=4800)
//GO.FT05F001 DD *
//
IEF236I ALLOC. FOR ERTHACKX GO
IEF237I 251   ALLOCATED TO PGM=*.DD
IEF237I 080   ALLOCATED TO FT06F001
IEF237I 121   ALLOCATED TO FT09F001
IEF237I 251   ALLOCATED TO FT11F001
IEF237I 253   ALLOCATED TO FT12F001
IEF237I 068   ALLOCATED TO FT05F001
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS74043.T073257.RV000.ERTHACKX.GOSET              PASSED


IEF285I   VOL SER NOS= ACS001.
IEF285I   C4610002.ER701.LOGDATA                              KEPT
IEF285I   VOL SER NOS= AVC016.
IEF285I   SYS74043.T073257.RV000.ERTHACKX.R0002806           DELETED
IEF285I   VOL SER NOS= ACS001.
IEF285I   SYS74043.T073257.RV000.ERTHACKX.R0002807           DELETED
IEF285I   VOL SER NOS= ACS002.
IEF373I STEP /GO      / START 74043.1239
IEF374I STEP /GO      / STOP  74043.1240 CPU    0MIN 07.42SEC MAIN 172K LCS    0K
IEF285I   SYS74043.T073257.RV000.ERTHACKX.GOSET              DELETED
IEF285I   VOL SER NOS= ACS001.
IEF375I  JOB /ERTHACKX/ START 74043.1237
IEF376I  JOB /ERTHACKX/ STOP  74043.1240 CPU    0MIN 28.08SEC
```

Figure 36   LANTRAN Test Case 4 Printed Output

```
BEGIN LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1 LEVEL 721220 RUN   1044
TABLE COUNT= 38

 19  1044     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)           12 FEB 1974           PAGE   1
*************************************************************************************************************************

        PARAMETERS          LANTRAN MODE 2 ALLOCATION BY ASSOCIATION

                 SCALE UNIT= 1.000E 03 METERS

                 GRID ORIGIN:   578.000, 4520.000 UNITS

                 GRID DIMENSIONS:  5 CELLS(X) BY  3 CELLS(Y)

                 CELL DIMENSIONS(UNITS):     1.00(X) BY     1.00(Y)

                 OUTPUT TAPE=  0

                 MIN. RAD**2= 1.000E-04 UNITS**2

 19  1044     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)           12 FEB 1974           PAGE   2
*************************************************************************************************************************

FIGURES             LANTRAN MODE 2 TEST CASE                                          (UNIT  5)

        FIGURE   1    TYPE: A   ID:      1       CODE: R01       AREA 3-RESIDENT.

                 VERTEX        X-COORD   Y-COORD
                    1          581.800  4522.000
                    2          582.500  4521.797
                    3          582.500  4521.000
                    4          581.500  4521.000
                    5          581.800  4522.000

                 CENTROID      582.052  4521.426 TOTAL AREA=     0.779

        FIGURE   2    TYPE: A   ID:      1       CODE: R01       AREA 85-RESIDENT

                 VERTEX        X-COORD   Y-COORD
                    1          581.000  4520.500
                    2          582.000  4520.500
                    3          581.600  4520.000
                    4          581.000  4520.000
                    5          581.000  4520.500

                 CENTROID      581.408  4520.270 TOTAL AREA=     0.400

        FIGURE   3    TYPE: A   ID:      1       CODE: R11       AREA 46-ISLAND RES

                 VERTEX        X-COORD   Y-COORD
                    1          580.100  4521.500
                    2          580.900  4521.500
                    3          580.900  4520.898
                    4          580.100  4520.898
                    5          580.100  4521.500

                 CENTROID      580.500  4521.199 TOTAL AREA=     0.481

        FIGURE   4    TYPE: A   ID:      1       CODE: R11       AREA 49-ISLAND RES

                 VERTEX        X-COORD   Y-COORD
                    1          581.100  4522.297
                    2          581.800  4522.297
                    3          581.400  4521.598
                    4          581.100  4521.598
                    5          581.100  4522.297

                 CENTROID      581.363  4521.992 TOTAL AREA=     0.350

        FIGURE   5    TYPE: P   ID:      1       CODE: I11       POINT 47-SCHOOL /

                 VERTEX        X-COORD   Y-COORD
                    1          580.700  4521.098
```

Figure 36   Contd.

```
19  1044      LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            12 FEB 1974            PAGE   3
*****************************************************************************************************************************

        FIGURE   6    TYPE: P   ID:     1       CODE: I11      POINT 50-SCHOOL /

                 VERTEX        X-COORD   Y-COORD
                    1          581,300   4521,699

        FIGURE   7    TYPE: P   ID:     1       CODE: I12      POINT 133-SCHOOL

                 VERTEX        X-COORD   Y-COORD
                    1          581,400   4521,098

        FIGURE   8    TYPE: P   ID:     1       CODE: I12      POINT 109-SCHOOL /

                 VERTEX        X-COORD   Y-COORD
                    1          581,400   4521,098

        FIGURE   9    TYPE: P   ID:     1       CODE: C11      POINT 48-BUSINESS

                 VERTEX        X-COORD   Y-COORD
                    1          580,100   4521,098

        FIGURE  10    TYPE: P   ID:             CODE: C11      POINT 51-BUSINESS

                 VERTEX        X-COORD   Y-COORD
                    1          581,200   4522,199

        FIGURE  11    TYPE: P   ID:             CODE: C11      POINT 143-IR-2 NEIGH

                 VERTEX        X-COORD   Y-COORD
                    1          581,000   4520,797

        FIGURE  12    TYPE: A   ID:             CODE: C12      AREA 102-BUSINESS /

                 VERTEX        X-COORD   Y-COORD
                    1          581,000   4521,000
                    2          581,500   4521,000
                    3          581,500   4520,500
                    4          581,000   4520,500
                    5          581,000   4521,000

                 CENTROID      581,250   4520,750 TOTAL AREA=     0,250

        FIGURE  13    TYPE: P   ID:             CODE: C12      POINT 130-BUSINESS /

                 VERTEX        X-COORD   Y-COORD
                    1          581,000   4520,797

        FIGURE  14    TYPE: P   ID:             CODE: R11      POINT 136-IR-2 /

                 VERTEX        X-COORD   Y-COORD
                    1          581,000   4520,797

        FIGURE  15    TYPE: P   ID:             CODE: R11      //POINT// IR-2/

                 VERTEX        X-COORD   Y-COORD
                    1          581,600   4522,598
19  1044      LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            12 FEB 1974            PAGE   4
*****************************************************************************************************************************

        FIGURE  16    TYPE: A   ID:             CODE: C31      AREA 37-BUSINESS

                 VERTEX        X-COORD   Y-COORD
                    1          579,000   4521,297
                    2          579,500   4521,098
                    3          579,500   4520,500
                    4          579,000   4520,500
                    5          579,000   4521,297

                 CENTROID      579,238   4520,848 TOTAL AREA=     0,349

        FIGURE  17    TYPE: A   ID:             CODE: C31      AREA 38-BUSINESS

                 VERTEX        X-COORD   Y-COORD
                    1          580,000   4520,797
                    2          580,500   4520,797
                    3          580,500   4520,000
                    4          580,000   4520,000
                    5          580,000   4520,797

                 CENTROID      580,250   4520,398 TOTAL AREA=     0,398

        FIGURE  18    TYPE: P   ID:             CODE: C31      POINT 141-BERRYS

                 VERTEX        X-COORD   Y-COORD
                    1          579,500   4521,000

        FIGURE  19    TYPE: A   ID:     1       CODE: C21      AREA 20-HOTEL HWY

                 VERTEX        X-COORD   Y-COORD
                    1          581,500   4523,000
                    2          582,000   4523,000
                    3          582,000   4522,500
                    4          581,500   4522,500
                    5          581,500   4523,000

                 CENTROID      581,750   4522,750 TOTAL AREA=     0,250

        FIGURE  20    TYPE: A   ID:             CODE: 842      AREA 4-DSTRBUTN

                 VERTEX        X-COORD   Y-COORD
                    1          580,500   4523,000
                    2          581,500   4523,000
                    3          581,500   4522,500
                    4          580,500   4522,500
                    5          580,500   4523,000

                 CENTROID      581,000   4522,750 TOTAL AREA=     0,500

        FIGURE  21    TYPE: A   ID:             CODE: 889      AREA 54-RESEARCH

                 VERTEX        X-COORD   Y-COORD
                    1          580,500   4520,797
                    2          581,000   4520,797
                    3          581,000   4520,000
```

Figure 36 Contd.

```
19  1044    LAND=USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)          12 FEB 1974          PAGE   5
*****************************************************************************************************************************
                4          580,500  4520,000
                5          580,500  4520,797

             CENTROID      580,750  4520,398 TOTAL AREA=     0,398

       FIGURE  22    TYPE: A   ID:            CODE: I71      AREA 48=CULTURE CTR

             VERTEX        X=COORD   Y=COORD
                1          579,500  4520,898
                2          580,000  4520,898
                3          580,000  4520,500
                4          579,500  4520,500
                5          579,500  4520,898

             CENTROID      579,750  4520,699 TOTAL AREA=     0,199

       FIGURE  23    TYPE: A   ID:      1     CODE: I90      AREA 98=SPCIAL USE

             VERTEX        X=COORD   Y=COORD
                1          581,500  4521,000
                2          582,500  4521,000
                3          582,000  4520,500
                4          581,500  4520,500
                5          581,500  4521,000

             CENTROID      581,889  4520,777 TOTAL AREA=     0,375

       FIGURE  24    TYPE: A   ID:            CODE: T10      AREA 2=TRANS CTR

             VERTEX        X=COORD   Y=COORD
                1          579,000  4520,500
                2          580,000  4520,500
                3          580,000  4520,000
                4          579,000  4520,000
                5          579,000  4520,500

             CENTROID      579,500  4520,250 TOTAL AREA=     0,500

       FIGURE  25    TYPE: A   ID:            CODE: T20      AREA 1=AIRPORT

             VERTEX        X=COORD   Y=COORD
                1          579,600  4523,000
                2          580,500  4523,000
                3          580,500  4522,500
                4          579,000  4521,500
                5          578,500  4522,000
                6          579,600  4523,000

             CENTROID      579,549  4522,348 TOTAL AREA=     1,575

       FIGURE  26    TYPE: P   ID:            CODE: T30      POINT 131=SPCIAL USE

             VERTEX        X=COORD   Y=COORD
                1          578,500  4520,500


19  1044    LAND=USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)          12 FEB 1974          PAGE   6
*****************************************************************************************************************************

       FIGURE  27    TYPE: P   ID:            CODE: 83585    POINT 201   INDUST

             VERTEX        X=COORD   Y=COORD
                1          582,500  4522,500

       FIGURE  28    TYPE: P   ID:            CODE: 82041    POINT 273   INDUST

             VERTEX        X=COORD   Y=COORD
                1          582,300  4522,699

       FIGURE  29    TYPE: P   ID:            CODE: 32041    POINT 274   INDUST

             VERTEX        X=COORD   Y=COORD
                1          582,500  4522,699

       FIGURE  30    TYPE: P   ID:            CODE: 32041    POINT 323   INDUST

             VERTEX        X=COORD   Y=COORD
                1          582,400  4522,699

       FIGURE  31    TYPE: P   ID:            CODE: 83585    POINT 278 / INDUST

             VERTEX        X=COORD   Y=COORD
                1          582,100  4522,898

       FIGURE  32    TYPE: P   ID:            CODE: 83585    POINT 279 / INDUST

             VERTEX        X=COORD   Y=COORD
                1          582,300  4522,898

       FIGURE  33    TYPE: P   ID:            CODE: 83585    POINT 324 / INDUST

             VERTEX        X=COORD   Y=COORD
                1          582,200  4522,898

**** END OF FILE, TAPE 11 ****
```

Figure 36   Contd.

VALUES LANTRAN MODE & TEST CASE

VALUES SPECIFIED FOR FIGURES--

FIGURE	KFORM	KLINK	KRCODE	XFACTR	A3	X
1	1.500E 01	0.0	0.0	0.0	0.0	0.0
2	1.500E 01	0.0	0.0	0.0	0.0	0.0
3	1.900E 01	0.0	1.400E 01	0.0	0.0	0.0
4	1.900E 01	0.0	1.400E 01	0.0	0.0	0.0
5	6.000E 01	1.400E 01	0.0	5.000E-01	0.0	0.0
6	6.000E 01	1.400E 01	0.0	5.000E-01	0.0	0.0
7	6.000E 01	1.400E 01	0.0	0.0	0.0	0.0
8	6.900E 01	1.000E 00	7.000E 00	0.0	0.0	0.0
9	1.900E 01	0.0	1.100E 01	0.0	0.0	0.0
10	1.900E 01	0.0	1.100E 01	0.0	0.0	0.0
11	5.900E 01	1.400E 01	1.400E 01	0.0	0.0	0.0
12	1.900E 01	0.0	1.300E 01	0.0	0.0	0.0
13	5.900E 01	1.400E 01	1.400E 01	0.0	0.0	0.0
14	1.500E 01	0.0	0.0	5.000E-01	0.0	0.0
15	8.000E 01	1.400E 01	0.0	5.000E-01	0.0	0.0
16	1.900E 01	0.0	1.800E 01	0.0	0.0	0.0
17	1.900E 01	0.0	1.800E 01	0.0	0.0	0.0
18	1.000E 01	0.0	0.0	0.0	0.0	0.0
19	1.000E 01	0.0	0.0	0.0	0.0	0.0
20	1.000E 01	0.0	0.0	0.0	0.0	0.0
21	1.000E 01	0.0	0.0	0.0	0.0	0.0
22	1.000E 01	0.0	0.0	0.0	0.0	0.0
23	1.000E 01	0.0	0.0	0.0	0.0	0.0
24	1.000E 01	0.0	0.0	0.0	0.0	0.0
25	2.000E 01	0.0	0.0	0.0	4.000E 05	0.0
26	2.000E 01	0.0	0.0	0.0	4.500E 03	0.0
27	3.000E 01	0.0	0.0	0.0	0.0	0.0
28	3.900E 01	0.0	3.000E 01	0.0	0.0	0.0
29	3.900E 01	0.0	3.000E 01	0.0	0.0	0.0
30	3.000E 01	0.0	0.0	0.0	0.0	0.0
31	3.900E 01	0.0	3.300E 01	0.0	0.0	0.0
32	3.900E 01	0.0	3.300E 01	0.0	0.0	0.0
33	3.000E 01	0.0	0.0	0.0	0.0	0.0

19 1044 LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM VERSION 1.1 (721220) 12 FEB 1974 PAGE 8

****

VALUES ASSOCIATED VARIABLE DEFINED (UNIT 5)

VALUES SPECIFIED FOR FIGURES--

FIGURE	WATER
1	5.000E-01
3	1.000E 00
12	8.000E-01
20	6.500E-01

19 1044 LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM VERSION 1.1 (721220) 12 FEB 1974 PAGE 9

****

ALLOCATION MODE 2 ALLOCATION (ASSOCIATED VAR. WATER) (UNIT 5)

FIGURES ALLOCATED TO GRID BY MODE 2

VARIABLE NAME(S): KFORM KLINK KRCODE

USING: FIGURE	WATER TYPE	EXTENT	KFORM	KLINK	KRCODE
3	A	4.813E-01	1.900E 01	0.0	1.400E 01
12	A	2.000E-01	1.900E 01	0.0	1.300E 01
20	A	3.250E-01	1.000E 01	0.0	0.0

19 1044 LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM VERSION 1.1 (721220) 12 FEB 1974 PAGE 10

****

GRID LISTING FOR VARIABLE KFORM :

	1	2	3	4	5
3	0.0	0.0	10.00	10.00	0.0
2	0.0	0.0	19.00	0.0	0.0
1	0.0	0.0	19.00	19.00	0.0

19 1044 LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM VERSION 1.1 (721220) 12 FEB 1974 PAGE 11

****

GRID LISTING FOR VARIABLE KLINK :

	1	2	3	4	5
3	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0
1	0.0	0.0	0.0	0.0	0.0

19 1044 LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM VERSION 1.1 (721220) 12 FEB 1974 PAGE 12

****

GRID LISTING FOR VARIABLE KRCODE :

	1	2	3	4	5
3	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	14.00	0.0	0.0
1	0.0	0.0	14.00	13.00	0.0

Figure 36 Contd.

```
 19  1044     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            12 FEB 1974            PAGE  13
**************************************************************************************************************************

                    GRID PLOT FOR VARIABLE KFORM    1

             1    2    3    4    5

        3              ----------             3
                       ----------
                       ----------
                       ----------
                       -----
        2              -----                  2
                       -----
                       -----
                       ----------
        1              ----------             1
                       ----------
                       ----------

             1    2    3    4    5


           LEVEL DESIGNATIONS...

             1         2         3         4         5         6
                     .....     -----     =====     +++++     XXXXX
                     .....     -----     =====     +++++     XXXXX
                     .....     -----     =====     +++++     XXXXX
                     .....     -----     =====     +++++     XXXXX
CELL COUNT:  10        0         5         0         0         0
VALUE:       0.0      0.0      77.00      0.0       0.0       0.0

MAXIMUM:     0.00    10.00     25.00     40.00     55.00
MINIMUM:              0.00     10.00     25.00     40.00     55.00
 19  1044     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            12 FEB 1974            PAGE  14
**************************************************************************************************************************

                    GRID PLOT FOR VARIABLE KLINK    1

             1    2    3    4    5

        3                                     3


        2                                     2


        1                                     1


             1    2    3    4    5


           LEVEL DESIGNATIONS...

             1         2         3         4         5         6
                     .....     -----     =====     +++++     XXXXX
                     .....     -----     =====     +++++     XXXXX
                     .....     -----     =====     +++++     XXXXX
                     .....     -----     =====     +++++     XXXXX
CELL COUNT:  15        0         0         0         0         0
VALUE:       0.0      0.0       0.0       0.0       0.0       0.0

MAXIMUM:     0.00    10.00     25.00     40.00     55.00
MINIMUM:              0.00     10.00     25.00     40.00     55.00
 19  1044     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            12 FEB 1974            PAGE  15
**************************************************************************************************************************

                    GRID PLOT FOR VARIABLE KRCODE   1

             1    2    3    4    5

        3                                     3


                       -----
        2              -----                  2
                       -----
                       -----
                       ----------
        1              ----------             1
                       ----------
                       ----------

             1    2    3    4    5


           LEVEL DESIGNATIONS...

             1         2         3         4         5         6
                     .....     -----     =====     +++++     XXXXX
                     .....     -----     =====     +++++     XXXXX
                     .....     -----     =====     +++++     XXXXX
                     .....     -----     =====     +++++     XXXXX
CELL COUNT:  12        0         3         0         0         0
VALUE:       0.0      0.0      41.00      0.0       0.0       0.0

MAXIMUM:     0.00    10.00     25.00     40.00     55.00
MINIMUM:              0.00     10.00     25.00     40.00     55.00

END OF PROGRAM.
```

Figure 36 Contd.

2.5.5 Test Case 5: Mode 3 Allocation

This LANTRAN test case demonstrates the use of a Mode 3 allocation. This allocation is used to create gridded air quality data from the concentration values calculated by MARTIK.

Job Control Language

The test run requires the following datasets:

FT11 is the temporary dataset where the figures are held.

FT12 is the VALUES package created by the MARTIK test case #2. This package holds the concentration of CO and NOX due to the background sources and the land use emissions.

FT13 is a dataset which will hold the GRID package which LANTRAN will create from the MARTIK created VALUES package.

Keyword Package Input

The first package input is a PARAMETERS package. The output unit JC=13, and the grid is defined by:

NX=5, NY=3, ORIGIN=578., 4520.. (The SCALE unit remains the default of 1 km.)

Finally, HEADR=.FALSE.. This means that LANTRAN will create GRID packages on output, rather than the default of SRCE packages. HEADR should be .TRUE. whenever emissions sources are being created. This will result in the creation of SRCE packages which can be read by MARTIK. The default is .TRUE. so all of the previous LANTRAN runs, which created emissions information, created SRCE packages. This run is meant to create a GRID package for use in IMPACT. For this purpose, HEADR must be .FALSE. to suppress the SRCE card in front of the GRID card. LANTRAN will now be creating GRID packages.

After setting the PARAMETERS the POINTS are input. The POINTS package is described in Section 2.2.3. This POINTS package is identical to the POINTS package used in the MARTIK run to specify the receptor locations. The purpose in inputting it into LANTRAN is to tell LANTRAN the locations for which the MARTIK VALUES were calculated. The POINTS must be the same.

Having input the locations of the points where values were calculated, the VALUES package containing the values is input. The input card specifies that the VALUES package will be found on FT12. FT12 contains the VALUES package containing the total air quality calculated in the MARTIK test case #2. This card image dataset is read in from FT12. Page 3 of the output tabulates the values that have been input.

The values are then allocated by Mode 3, interpolation. See Section 2.1.1 for a description of allocation modes. After the values have been calculated, by interpolation from the six points specified, they LISTed and PLOTted. Pages 5 through 8 gives the resulting lists and plots.

The values have now been placed in a "gridded" form. There is an interpolated value for each grid cell. These values have been interpolated from the six points where MARTIK calculated values.

The gridded air quality data is OUTPUT in a GRID format. OUTPUT specifies that CO and NOX are to be output. JC=13 so the output file is FT13. Because HEADR=.FALSE. this package is in GRID format. It is intended for IMPACT and must be in GRID format. No units conversions have been made; CO and NOX entered LANTRAN and have been OUTPUT by LANTRAN in ppm and ug/m^3, respectively.

The job is ended by an ENDJOB card.

```
//ERTHACK3 JOB (38202440000,ERT--,101,---,MKEEFE,219---------,4610),XX,X
// MSGLEVEL=1
/*PARMS  COPIES=03
// EXEC FORTHLG,PARM.LKED='LET,MAP,LIST',REGION.GO=198K,TIME.GO=2
//LKED.SYSLIN DD *
 CHANGE INPUT(READER)
 INCLUDE ERT(INPUT,INE,HEADR,ERRX,SEQNO,TXLOC,GTABU,ICHAR,GPLOT)
 CHANGE INPUT(READER)
 INCLUDE LAN(MAIN,BLOCK,INPARM,INFIGS,INPTS,EVALS,FGRID,INGRDS)
 INCLUDE LAN(COMP,INAC,OUTS,PLANIM,PERIM,ALLOCF,ASPG)
/*
//LKED.ERT DD DSN=ERT4610.P9990000.ERTLIB,DISP=SHR
//LKED.LAN DD DSN=LANTRAN,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO.FT09F001 DD DSN=C461002.ER701.LOGDATA,DISP=SHR,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AVC016)
//GO.FT11F001 DD UNIT=SYSDA,SPACE=(CYL,1),
// DCB=(RECFM=VSB,LRECL=448,BLKSIZE=4484)
//GO.FT12F001 DD DSN=AQUAL,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO.FT13F001 DD DSN=INTERP,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO.FT05F001 DD *
PARAMETERS            MODE 3 AIR QUALITY ALLOCATION
 &INPUT
 JC=13, HEADR=.FALSE.,
 NX=5,NY=3,ORIGIN=578.0,4520.0,
 &END
POINTS                MARTIK RECEPTOR GRID
          1 578.5      4520.5
          2 578.5      4522.5
          3 580.5      4520.5
          4 580.5      4522.5
          5 582.5      4520.5
          6 582.5      4522.5
99999
VALUES         12     TOTAL AIR QUALITY
ALLOCATION            MODE 3 ALLOCATION (INTERPOLATION)
MODE   3   CO         NOX
LIST       CO         NOX
PLOT      2CO         NOX
99999
OUTPUT                INTERPOLATED AIR QUALITY
           CO         NOX
99999
ENDJOB
/*EOF
```

Figure 37 LANTRAN Test Case 5, Deck Setup

```
//ERTTEST3 JOB (S8200244000,ERT**,101,***,MKEEFE,219*********,4610),XX,X JOB 625
// MSGLEVEL=1
***PARMS COPIES$04                                                          ACCEPTED
// EXEC FORTHLG,PARM,LKED='LET,MAP,LIST',REGION,GO=198K,TIME,GO=2
XX        PROC PR=A                                                         00000010
XXLKED EXEC     PGM=IEWL,PARM='MAP,LET,LIST',                              X00000020
XX              REGION=100K                                                 00000030
XXSYSPRINT DD   SYSOUT=&PR,DCB=(LRECL=121,BLKSIZE=1573),                   X00000040
IEF653I SUBSTITUTION JCL - SYSOUT=A,DCB=(LRECL=121,BLKSIZE=1573),
XX              SPACE=(1573,(24,48))                                        00000050
XXSYSLIB   DD   DSNAME=SYS1,FORTLIB,DISP=SHR                                00000060
XX         DD   DSNAME=SYS1,DOUBLEP,DISP=SHR                                00000070
XXSYSUT1 DD UNIT=SYSDA,SPACE=(CYL,(2,1))                                    00000080
XXSYSLMOD  DD   DSN=&GOSET(FHXXMAIN),UNIT=SYSDA,DISP=(,PASS),               00000090
XX              SPACE=(CYL,(15,,1))                                         00000100
//LKED,SYSLIN DD *
//LKED,ERT DD DSN=ERT4610,P9990000,ERTLIB,DISP=SHR
//LKED,LAN DD DSN=LANTRAN,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
IEF236I ALLOC, FOR ERTTEST3 LKED
IEF237I 081   ALLOCATED TO SYSPRINT
IEF237I 256   ALLOCATED TO SYSLIB
IEF237I 257   ALLOCATED TO
IEF237I 250   ALLOCATED TO SYSUT1
IEF237I 250   ALLOCATED TO SYSLMOD
IEF237I 065   ALLOCATED TO SYSLIN
IEF237I 255   ALLOCATED TO ERT
IEF237I 103   ALLOCATED TO LAN
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS1,FORTLIB                                   KEPT
IEF285I   VOL SER NOS= ACS101,
IEF285I   SYS1,DOUBLEP                                   KEPT
IEF285I   VOL SER NOS= ACS102,
IEF285I   SYS74112,T080432,RV000,ERTTEST3,R0006082       DELETED
IEF285I   VOL SER NOS= ACS000,
IEF285I   SYS74112,T080432,RV000,ERTTEST3,GOSET          PASSED
IEF285I   VOL SER NOS= ACS000,
IEF285I   ERT4610,P9990000,ERTLIB                        KEPT
IEF285I   VOL SER NOS= USER00,
IEF285I   LANTRAN                                        KEPT
IEF285I   VOL SER NOS= AIRMAP,
IEF373I STEP /LKED    / START 74112,1813
IEF374I STEP /LKED    / STOP  74112,1814 CPU   0MIN 20,38SEC MAIN  98K LCS   0K
XXGO   EXEC    PGM=*,LKED,SYSLMOD,COND=(5,LT,LKED)                          00000110
XXFT06F001 DD  SYSOUT=&PR,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1596)           00000120
IEF653I SUBSTITUTION JCL - SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1596)
//GO,FT09F001 DD DSN=C461002,ER701,LOGDATA,DISP=SHR,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AVC016)
//GO,FT11F001 DD UNIT=SYSDA,SPACE=(CYL,1),
// DCB=(RECFM=VSB,LRECL=448,BLKSIZE=4484)
//GO,FT12F001 DD DSN=AQUAL,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO,FT13F001 DD DSN=INTERP,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO,FT05F001 DD *
//
IEF236I ALLOC, FOR ERTTEST3 GO
IEF237I 250   ALLOCATED TO PGM=*,DD
IEF237I 081   ALLOCATED TO FT06F001
IEF237I 121   ALLOCATED TO FT09F001
IEF237I 250   ALLOCATED TO FT11F001
IEF237I 103   ALLOCATED TO FT12F001
IEF237I 103   ALLOCATED TO FT13F001
IEF237I 067   ALLOCATED TO FT05F001
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS74112,T080432,RV000,ERTTEST3,GOSET          PASSED
IEF285I   VOL SER NOS= ACS000,
IEF285I   C461002,ER701,LOGDATA                          KEPT
IEF285I   VOL SER NOS= AVC016,
IEF285I   SYS74112,T080432,RV000,ERTTEST3,R0006085       DELETED
IEF285I   VOL SER NOS= ACS000,
IEF285I   AQUAL                                          KEPT
IEF285I   VOL SER NOS= AIRMAP,
IEF285I   INTERP                                         KEPT
IEF285I   VOL SER NOS= AIRMAP,
IEF373I STEP /GO      / START 74112,1814
IEF374I STEP /GO      / STOP  74112,1815 CPU   0MIN 07,13SEC MAIN 176K LCS   0K
IEF285I   SYS74112,T080432,RV000,ERTTEST3,GOSET          DELETED
IEF285I   VOL SER NOS= ACS000,
IEF375I  JOB /ERTTEST3/ START 74112,1813
IEF376I  JOB /ERTTEST3/ STOP  74112,1815 CPU   0MIN 27,51SEC
```

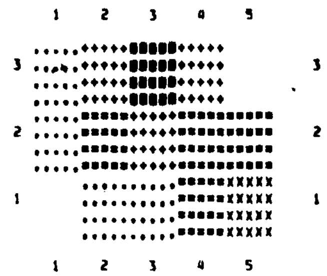
Figure 38 LANTRAN Test Case 5 Printed Output

```
BEGIN LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1,1 LEVEL 721220 RUN   1058
TABLE COUNT= 44

 19  1058     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1,1  (721220)          22 APR 1974            PAGE   1
******************************************************************************************************************************

        PARAMETERS          MODE 3 AIR QUALITY ALLOCATION

               SCALE UNIT= 1,000E 03 METERS

               GRID ORIGIN:   578,000, 4520,000 UNITS

               GRID DIMENSIONS:  5 CELLS(X) BY  3 CELLS(Y)

               CELL DIMENSIONS(UNITS):     1,00(X) BY     1,00(Y)

               OUTPUT TAPE= 13

               MIN, RAD**2= 1,000E-04 UNITS**2
 19  1058     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1,1  (721220)          22 APR 1974            PAGE   2
******************************************************************************************************************************

POINTS             MARTIK RECEPTOR GRID                                          (UNIT  5)

        FIGURE     X-COORD    Y-COORD            NAME

          1         578,50    4520,50
          2         578,50    4522,50
          3         580,50    4520,50
          4         580,50    4522,50
          5         582,50    4520,50
          6         582,50    4522,50

**** END OF FILE, TAPE 11****

 19  1058     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1,1  (721220)          22 APR 1974            PAGE   3
******************************************************************************************************************************

               TAPE12    LABEL=TOTAL AIR QUALITY


VALUES             MARTIK RUN   3023   DATE 22 APR 1974                          (UNIT 12)

        VALUES SPECIFIED FOR FIGURES--

        FIGURE     CO           NOX              C O          HYDROC,        N OX          S O2

          1        4,455E-02    2,475E 00      0,0          0,0            0,0           0,0
          2        5,748E-02    1,837E 00      0,0          0,0            0,0           0,0
          3        5,363E-02    5,122E 00      0,0          0,0            0,0           0,0
          4        1,273E-01    4,074E 00      0,0          0,0            0,0           0,0
          5        8,882E-02    6,300E 00      0,0          0,0            0,0           0,0
          6        4,546E-02    5,131E 00      0,0          0,0            0,0           0,0
 19  1058,    LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1,1  (721220)          22 APR 1974            PAGE   4
******************************************************************************************************************************

ALLOCATION         MODE 3 ALLOCATION (INTERPOLATION)                            (UNIT  5)


        FIGURES ALLOCATED TO GRID BY MODE  3

        VARIABLE NAME(S):   CO          NOX
        FIGURE    TYPE                  EXTENT       CO          NOX

          1         P                  1,000E 00   4,455E-02   2,475E 00

          2         P                  1,000E 00   5,748E-02   1,837E 00

          3         P                  1,000E 00   5,363E-02   5,122E 00

          4         P                  1,000E 00   1,273E-01   4,074E 00

          5         P                  1,000E 00   8,882E-02   6,300E 00

          6         P                  1,000E 00   4,546E-02   5,131E 00
 19  1058     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1,1  (721220)          22 APR 1974            PAGE   5
******************************************************************************************************************************

               GRID LISTING FOR VARIABLE CO


                      1          2          3          4          5

            3        0,06       0,08       0,13       0,08       0,05

            2        0,06       0,07       0,08       0,08       0,07

            1        0,04       0,06       0,05       0,07       0,09
```

Figure 38 Contd.

```
19  1058     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            22 APR 1974            PAGE   7
```

GRID PLOT FOR VARIABLE CO   :



LEVEL DESIGNATIONS...

	1	2	3	4	5	6	7	8	9	10
		.....	-----	=====	+++++	XXXXX	OOOOO	[illegible]	[illegible]	[illegible]
CELL COUNT:	2	4	0	4	3	1	0	0	0	1
VALUE:	0.09	0.23	0.0	0.29	0.25	0.09	0.0	0.0	0.0	0.13
MAXIMUM:	0.05	0.06	0.07	0.08	0.09	0.09	0.10	0.11	0.12	
MINIMUM:		0.05	0.06	0.07	0.08	0.09	0.09	0.10	0.11	0.12

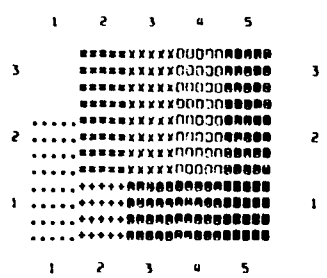
```
19  1058     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            22 APR 1974            PAGE   8
```

GRID LISTING FOR VARIABLE NOX   :

	1	2	3	4	5
3	1.84	3.28	4.07	4.59	5.13
2	2.71	3.59	4.41	4.88	5.37
1	2.48	3.82	5.12	5.29	6.30

```
19  1058     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            22 APR 1974            PAGE   8
```

GRID PLOT FOR VARIABLE NOX   :



LEVEL DESIGNATIONS...

	1	2	3	4	5	6	7	8	9	10
		.....	-----	=====	+++++	XXXXX	OOOOO	[illegible]	[illegible]	[illegible]
CELL COUNT:	1	2	0	2	1	2	2	4	0	1
VALUE:	1.84	5.19	0.0	6.87	3.82	8.48	9.48	20.91	0.0	6.30
MAXIMUM:	2.28	2.73	3.18	3.62	4.07	4.52	4.96	5.41	5.85	
MINIMUM:		2.28	2.73	3.18	3.62	4.07	4.52	4.96	5.41	5.85

```
19  1058     LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM  VERSION   1.1  (721220)            22 APR 1974            PAGE   9

OUTPUT              INTERPOLATED AIR QUALITY                                         (UNIT  5)

                    GRID VALUES FOR CO        ,NOX       ,
                    OUTPUT TO TAPE 13 BEGINNING SEQUENCE NUMBER 10580010

END OF PROGRAM.
```

Figure 38   Contd.

2.5.6 Test Case 6: Mode 4 Allocation

This test case has been included to demonstrate the Mode 4 allocation procedure, even though this mode was not used in the Hackensack Meadowlands study. The only output from this run will be the printout of the allocated values. This might have been done in practice if the user has wanted to see what the allocated values were; and not use these values in any later runs.

Job Control Language

The datasets needed are much the same as in the Mode 3 allocation test case.

FTo9 is the run log file.

FT11 is the internal dataset for holding figures.

FT12 is the VALUES package created by MARTIK.

Keyword Package Input

The PARAMETERS package establishes the same grid description that has been used in all the other runs in other test cases. All other parameters remain at their default.

The POINTS package defining the location of the MARTIK points is readin. These are the exact points for which MARTIK calculated values.

Another VALUES read unit 12. This contains the VALUES package created by MARTIK. There are now values for each point where MARTIK calculated concentrations.

With values defined for each point, an ALLOCATION is begun. CO and NOX are allocated with Mode 4. Each cell is given the concentration of the point nearest its centroid. These values for grid cells are then LISTed and PLOTed. The plot has N2 set to 2. This means that the plot uses the range of values of the grid cells being plotted to determine the range for the plot value intervals. Page 7 and 8 demonstrate the result.

No further use is being made of this information after it has been listed and plotted for the user, so the run is terminated with an ENDJOB.

```
//ERTHACKX JOB (98202440000,ERT==,101,===,MKEEPE,219=========,4610),XX,X
// MSGLEVEL=1
/*PARMS  COPIES=03
// EXEC FORTHLG,PARM.LKED='LET,MAP,LIST',REGION.GO=198K,TIME.GO=2
//LKED.SYSLIN DD *
 CHANGE INPUT(READER)
 INCLUDE ERT(INPUT,INE,HEADR,ERRX,SEQNO,TXLOC,GTABU,ICHAR,GPLOT)
 CHANGE INPUT(READER)
 INCLUDE LAN(MAIN,BLOCK,INPARM,INFIGS,INPTS,EVALS,FGRID,INGRDS)
 INCLUDE LAN(COMP,INAC,OUTS,PLANIM,PERIM,ALLOCF,ABEG)
/*
//LKED.ERT DD DSN=ERT4610,P9990000,ERTLIB,DISP=SHR
//LKED.LAN DD DSN=LANTRAN,DISP=OLD,


// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO.FT09F001 DD DSN=C461002,ERT01.LOGDATA,DISP=SHR,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AVC016)
//GO.FT11F001 DD UNIT=SYSDA,SPACE=(CYL,1),
// DCB=(RECFM=VSB,LRECL=448,BLKSIZE=4484)
//GO.FT12F001 DD DSN=AQUAL,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO.FT05F001 DD *
PARAMETERS             MODE 4 ALLOCATION TEST
 &INPUT
 NX=5,NY=3,ORIGIN=578.0,4520.0,
 &END
POINTS                 MATRIX RECEPTOR GRID
         1 578.5        4520.5
         2 578.5        4522.5
         3 580.5        4520.5
         4 580.5        4522.5
         5 582.5        4520.5
         6 582.5        4522.5
99999
VALUES          12     TOTAL AIR QUALITY
ALLOCATION             MODE 4 ALLOCATION (PROXIMITY)
MODE  4    CO          NOX
LIST       CO          NOX
PLOT      2CO          NOX
99999
ENDJOB
/*EOF
**
```

Figure 39 LANTRAN Test Case 6, Deck Setup

```
//ERTTEST4 JOB (38200244000,ERT==,101,===,MKEEFE,219=========,4610),XX,X JOB 626
// MSGLEVEL=1
***PARMS COPIES=04                                                        ACCEPTED
// EXEC FORTHLG,PARM,LKED='LET,MAP,LIST',REGION,GO=198K,TIME,GO=2
XX          PROC PR=A                                                     00000010
XXLKED EXEC      PGM=IEWL,PARM='MAP,LET,LIST',                           X00000020
XX               REGION=100K                                              00000030
XXSYSPRINT DD  SYSOUT=&PR,DCB=(LRECL=121,BLKSIZE=1573),                  X00000040
IEF653I SUBSTITUTION JCL - SYSOUT=A,DCB=(LRECL=121,BLKSIZE=1573),
XX               SPACE=(1573,(24,48))                                     00000050
XXSYSLIB    DD  DSNAME=SYS1,FORTLIB,DISP=SHR                              00000060
XX          DD  DSNAME=SYS1,DOUBLEP,DISP=SHR                              00000070
XXSYSUT1 DD UNIT=SYSDA,SPACE=(CYL,(2,1))                                  00000080
XXSYSLMOD  DD  DSN=&GOSET(FHXXMAIN),UNIT=SYSDA,DISP=(,PASS),              00000090
XX               SPACE=(CYL,(15,,1))                                      00000100
//LKED.SYSLIN DD *
//LKED.ERT DD DSN=ERT4610.P9990000.ERTLIB,DISP=SHR
//LKED.LAN DD DSN=LANTRAN,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
IEF236I ALLOC. FOR ERTTEST4 LKED
IEF237I 081   ALLOCATED TO SYSPRINT
IEF237I 256   ALLOCATED TO SYSLIB
IEF237I 257   ALLOCATED TO
IEF237I 250   ALLOCATED TO SYSUT1
IEF237I 251   ALLOCATED TO SYSLMOD
IEF237I 068   ALLOCATED TO SYSLIN
IEF237I 255   ALLOCATED TO ERT
IEF237I 103   ALLOCATED TO LAN
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS1.FORTLIB                                     KEPT
IEF285I   VOL SER NOS= ACS101.
IEF285I   SYS1.DOUBLEP                                     KEPT
IEF285I   VOL SER NOS= ACS102.
IEF285I   SYS74112.T080432.RV000.ERTTEST4.R0006088         DELETED
IEF285I   VOL SER NOS= ACS000.
IEF285I   SYS74112.T080432.RV000.ERTTEST4.GOSET            PASSED
IEF285I   VOL SER NOS= ACS001.
IEF285I   ERT4610.P9990000.ERTLIB                          KEPT
IEF285I   VOL SER NOS= USER00.
IEF285I   LANTRAN                                          KEPT
IEF285I   VOL SER NOS= AIRMAP.
IEF373I STEP /LKED    / START 74112.1813
IEF374I STEP /LKED    / STOP  74112.1815 CPU    0MIN 20.77SEC MAIN  98K LCS    0K
XXGO    EXEC     PGM=*.LKED.SYSLMOD,COND=(5,LT,LKED)                      00000110
XXFT06F001 DD  SYSOUT=&PR,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1596)          00000120
IEF653I SUBSTITUTION JCL - SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1596)
//GO.FT09F001 DD DSN=C461002.ER701.LOGDATA,DISP=SHR,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AVC016)
//GO.FT11F001 DD UNIT=SYSDA,SPACE=(CYL,1),
// DCB=(RECFM=VSB,LRECL=448,BLKSIZE=4484)
//GO.FT12F001 DD DSN=AQUAL,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO.FT05F001 DD *
//
IEF236I ALLOC. FOR ERTTEST4 GO
IEF237I 251   ALLOCATED TO PGM=*.DD
IEF237I 085   ALLOCATED TO FT06F001
IEF237I 121   ALLOCATED TO FT09F001
IEF237I 250   ALLOCATED TO FT11F001
IEF237I 103   ALLOCATED TO FT12F001
IEF237I 069   ALLOCATED TO FT05F001
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS74112.T080432.RV000.ERTTEST4.GOSET            PASSED
IEF285I   VOL SER NOS= ACS001.
IEF285I   C461002.ER701.LOGDATA                            KEPT
IEF285I   VOL SER NOS= AVC016.
IEF285I   SYS74112.T080432.RV000.ERTTEST4.R0006091       . DELETED
IEF285I   VOL SER NOS= ACS000.
IEF285I   AQUAL                                            KEPT
IEF285I   VOL SER NOS= AIRMAP.
IEF373I STEP /GO      / START 74112.1815
IEF374I STEP /GO      / STOP  74112.1816 CPU    0MIN 06.34SEC MAIN 174K LCS    0K
IEF285I   SYS74112.T080432.RV000.ERTTEST4.GOSET            DELETED
IEF285I   VOL SER NOS= ACS001.
IEF375I  JOB /ERTTEST4/ START 74112.1813
IEF376I  JOB /ERTTEST4/ STOP  74112.1816 CPU    0MIN 27.11SEC
```

Figure 40 LANTRAN Test Case 6, Printed Output

BEGIN LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM VERSION 1.1 LEVEL 721220 RUN 1059
TABLE COUNT= 44

19 1059 LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM VERSION 1.1 (721220) 22 APR 1974 PAGE 1
****

PARAMETERS MODE 4 ALLOCATION TEST

SCALE UNIT= 1.000E 03 METERS

GRID ORIGIN: 578.000, 4520.000 UNITS

GRID DIMENSIONS: 5 CELLS(X) BY 3 CELLS(Y)

CELL DIMENSIONS(UNITS): 1.00(X) BY 1.00(Y)

OUTPUT TAPE= 0

MIN. RAD**2= 1.000E-04 UNITS**2

19 1059 LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM VERSION 1.1 (721220) 22 APR 1974 PAGE 2
****

POINTS MARTIK RECEPTOR GRID (UNIT 5)

FIGURE	X-COORD	Y-COORD	NAME
1	578.50	4520.50	
2	578.50	4522.50	
3	580.50	4520.50	
4	580.50	4522.50	
5	582.50	4520.50	
6	582.50	4522.50	

**** END OF FILE, TAPE 11****

19 1059 LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM VERSION 1.1 (721220) 22 APR 1974 PAGE 3
****

TAPE12 LABEL=TOTAL AIR QUALITY

VALUES MARTIK RUN 3023 DATE 22 APR 1974 (UNIT 12)

VALUES SPECIFIED FOR FIGURES--

FIGURE	CO	NOX	C O	HYDROC.	N OX	S O2
1	4.455E-02	2.475E 00	0.0	0.0	0.0	0.0
2	5.748E-02	1.837E 00	0.0	0.0	0.0	0.0
3	5.363E-02	5.122E 00	0.0	0.0	0.0	0.0
4	1.273E-01	4.074E 00	0.0	0.0	0.0	0.0
5	8.882E-02	6.300E 00	0.0	0.0	0.0	0.0
6	4.546E-02	5.131E 00	0.0	0.0	0.0	0.0

19 1059 LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM VERSION 1.1 (721220) 22 APR 1974 PAGE 4
****

ALLOCATION MODE 4 ALLOCATION (PROXIMITY) (UNIT 5)

FIGURES ALLOCATED TO GRID BY MODE 4

VARIABLE NAME(S): CO NOX

FIGURE	TYPE	EXTENT	CO	NOX
1	P	1.000E 00	4.455E-02	2.475E 00
2	P	1.000E 00	5.748E-02	1.837E 00
3	P	1.000E 00	5.363E-02	5.122E 00
4	P	1.000E 00	1.273E-01	4.074E 00
5	P	1.000E 00	8.882E-02	6.300E 00
6	P	1.000E 00	4.546E-02	5.131E 00

19 1059 LAND-USE DATA ANALYSIS & TRANSFORMATION PROGRAM VERSION 1.1 (721220) 22 APR 1974 PAGE 5
****

GRID LISTING FOR VARIABLE CO :

	1	2	3	4	5
3	0.06	0.06	0.13	0.13	0.05
2	0.04	0.04	0.05	0.05	0.09
1	0.04	0.04	0.05	0.05	0.09

Figure 40 Contd.

```
*********************************************************************************************************************************
```

GRID LISTING FOR VARIABLE NOX :

	1	2	3	4	5
3	1.84	1.84	4.07	4.07	5.13
2	2.48	2.48	5.12	5.12	6.30
1	2.48	2.48	5.12	5.12	6.30


```
*********************************************************************************************************************************
```

GRID PLOT FOR VARIABLE CU :

```
      1    2    3    4    5

   ..........██████████
 3 ..........██████████          3
   ..........██████████
   ..........██████████
             ..........XXXXX
 2           ..........XXXXX     2
             ..........XXXXX
             ..........XXXXX
             ..........XXXXX
 1           ..........XXXXX     1
             ..........XXXXX
             ..........XXXXX

      1    2    3    4    5
```

LEVEL DESIGNATIONS...

	1	2	3	4	5	6	7	8	9	10
		.....	-----	=====	+++++	XXXXX	OOOOO	@@@@@	█████	█████
		.....	-----	=====	+++++	XXXXX	OOOOO	@@@@@	█████	█████
		.....	-----	=====	+++++	XXXXX	OOOOO	@@@@@	█████	█████
		.....	-----	=====	+++++	XXXXX	OOOOO	@@@@@	█████	█████
CELL COUNT:	5	6	0	0	0	2	0	0	0	2
VALUE:	0.22	0.33	0.0	0.0	0.0	0.18	0.0	0.0	0.0	0.25
MAXIMUM:	0.05	0.06	0.07	0.08	0.09	0.09	0.10	0.11	0.12	
MINIMUM:		0.05	0.06	0.07	0.08	0.09	0.09	0.10	0.11	0.12


```
*********************************************************************************************************************************
```

GRID PLOT FOR VARIABLE NOX :

```
      1    2    3    4    5

             XXXXXXXXXX@@@@@
 3           XXXXXXXXXX@@@@@     3
             XXXXXXXXXX@@@@@
             XXXXXXXXXX@@@@@
   ..........@@@@@@@@@@█████
 2 ..........@@@@@@@@@@█████     2
   ..........@@@@@@@@@@█████
   ..........@@@@@@@@@@█████
   ..........@@@@@@@@@@█████
 1 ..........@@@@@@@@@@█████     1
   ..........@@@@@@@@@@█████
   ..........@@@@@@@@@@█████

      1    2    3    4    5
```

LEVEL DESIGNATIONS...

	1	2	3	4	5	6	7	8	9	10
		.....	-----	=====	+++++	XXXXX	OOOOO	@@@@@	█████	█████
		.....	-----	=====	+++++	XXXXX	OOOOO	@@@@@	█████	█████
		.....	-----	=====	+++++	XXXXX	OOOOO	@@@@@	█████	█████
		.....	-----	=====	+++++	XXXXX	OOOOO	@@@@@	█████	█████
CELL COUNT:	2	4	0	0	0	2	0	5	0	2
VALUE:	3.67	9.90	0.0	0.0	0.0	8.15	0.0	25.62	0.0	12.60
MAXIMUM:	2.28	2.73	3.18	3.62	4.07	4.52	4.96	5.41	5.85	
MINIMUM:		2.28	2.73	3.18	3.62	4.07	4.52	4.96	5.41	5.85

END OF PROGRAM.

Figure 40 Contd.

3. MARTIN-TIKVART DIFFUSION MODELING PROGRAM (MARTIK) P2

3.1 Program Description

3.1.1 Introduction

The Martin-Tikvart diffusion modeling program (MARTIK) provides the means for study of air-pollution in an urban area. The program is based upon a diffusion model developed by Martin and Tikvart (1968). Basic input to the program consists of a description of the emission sources located within the region of interest, together with meteorological data appropriate to the region. The program computes mean pollutant concentrations as a function of position within the region at specified points known as receptors. Up to six pollutants may be considered in a single calculation. Single-wind cases may be calculated in addition or instead of long-term averages; e.g., to examine "worst case" conditions. A number of optional program modes enable the application of backgrounds and calibration factors at each receptor site for each pollutant, to use previously created data banks, and to pass the results on to other programs.

3.1.2 Summary Description of the Model

A theoretical discussion of the meteorological basis for the model is to be found in the Task 2 Study Report. Only the essential features of the model need be considered here:

1. Sources are described as being "point", "line" or "area" in nature. In the case of a point source, a steady emission rate in grams/sec. is assumed from one single point of zero extent. This point may be elevated

to take into account the height of a stack in the case of an industrial source. In the case of a line source, a straight-line segment at constant height is assumed. The coordinates of the end points define the segment. The emission rate for a line source is specified in the form of a mean density; i.e., in grams/meter sec. In the case of an area source, a rectangular region with axes oriented east-west and north-south is assumed. The region is assumed to be at constant height, and emissions for the source are distributed as a mean area density; i.e., in grams/m^2-sec. Point, line and area sources may be mixed in any order within one calculation.

2. Up to 100 receptor points may be specified. The horizontal coordinates and height above the reference plane are given for each. In addition, a background and calibration scale factor may be supplied for each receptor for each of the pollutants to be considered.

3. The meteorological data consists of the set of relative frequencies for 480 meteorological conditions, representing five stability classes, 16 wind directions (the points of the compass with 1 = North) and 6 wind-speed classes. In addition, information regarding the ambient temperature, ambient pressure and mixing-layer depth are specified.

4. The concentration at a given receptor point is the arithmetic sum of the concentrations due to all individual sources. The contribution of each source is summed for all meteorological conditions weighted by the relative probability of occurrence. Only those conditions corresponding to non-zero probabilities and source upwind of the receptor are considered. The transfer function describing the relationship between emission at the source point and concentration at the receptor point is the Gifford-Pasquill (1961) plume equation, in which the vertical distribution of concentration

close to each source-point is represented as a gaussian function. The standard deviation of the distribution is taken to be a stability-dependent power-law function of the downwind distance. The distance at which this coefficient is 0.47 times the effective mixing layer depth is the "trapping distance" at which suppression of vertical diffusion by the elevated stable layer begins to become effective. Beyond a distance of twice the trapping distance, uniform vertical mixing is assumed within the mixing layer depth. Between the trapping distance and twice the trapping distance, the vertical distribution is taken to be a linear interpolation between those at the two distances. The horizontal distribution function is based upon the assumption of a uniform distribution of wind directions within each of the 16 (22-1/2°) wind sectors. The result is a linear interpolation between results in adjacent wind sectors weighted by the angular distance between sector centerlines.

5. In the determination of the vertical distribution, the effective height of release of the source effluent is used instead of the actual physical stack height. The added height reflects the vertical rise of the plume from the stack due to buoyancy effects and upward momentum of the stack gases. The added height is computed as a function of stability class and wind-speed using a "plume rise factor" specified for each source. This factor may be defined as the height (in meters), above the height of release at which the plume becomes horizontal under stability class 4 conditions with a wind speed of 1 meter/sec. In the case of elevated sources,the vertical distribution at distances less than the trapping distance is actually the sum of two terms: the first representing the direct emission from the source and the second representing that reflected from the ground plane (assumed to be an infinite, horizontal, non-absorbing plane).

3.1.3 Special Features of the ERT Model

1. Integration over area-source distributions is accomplished numerically by subdivision into elemental sources. This approach is inherently capable of higher accuracy than the use of "virtual point source" methods applied in some models (e.g., see AQDM, 1969) for area sources.

2. Accuracy may be weighed vs. computation time by adjusting parameters which determine the number of source subdivision elements and the number of terms in series expansions.

3. Coordinates are stored internally in meters. Gridded data may be used for input, but sources and receptors are not defined in terms of fixed grid "cells" but instead are represented in terms of their own geometry.

4. Local discontinuities and "ripple" due to the integration procedure are minimized by taking into account the receptor-source orientation when assigning the integration subelements. This procedure allows small receptor displacements without the introduction of step discontinuities.

5. The program has been designed to be as general as possible. All parameters within the program are accessible to the user via a FORTRAN IV namelist (PARAMETERS) package. Hence, for example, the number, names and units of the pollutants chosen for a study may be entered as data to the program. Coordinates for card-input data may be in any self-consistent set of units to be scaled by a given factor at run time. The emission inventory may be entered using a card-input procedure, or it may be preprocessed and put onto a data set by a previous program. The use of the program is not, therefore, restricted to any specific emission inventory format. A non-standard set of wind conditions may be input and the plume dispersion coef-

ficients may be changed. The computation parameters which determine the tradeoff between accuracy and running time may be specified, or default values used instead.

6. Program output is in the form of computed total concentrations at each receptor point presented in tabular form and, optionally, as an output data set in card-image format. This format is compatible with inputs used by the SYMAP computer mapping program, making it possible to follow MARTIK calculations directly by SYMAP runs in which computed concentrations are displayed graphically.

3.1.4 Keyword Package Summary

Program input is organized along the keyword package structure described in Section 1.3. In the AQUIP version of MARTIK the following keyword packages have been implemented.

PARAMETERS

This card directs the reading of a parameter namelist &INPUT in which all run options and computation parameters are specified. The number of pollutants, their names, units and conversion factors, the coordinate scale unit, data set reference numbers and wind parameters are frequently specified in this manner. All parameters have defaults, and need be specified only when they are to be changed. Some internal program parameters are also accessible to the user through the &INPUT namelist. A list of parameters appears in Section 3.2.1.

POINTS

This card causes receptor data to be read and tabulated. Each card contains horizontal and vertical coordinates (in the specified coordinate scale unit) of one receptor, its height in meters, and an optional field for a 20-character descriptor name to be printed in the table. If the number is blank, it takes on the next unspecified value. Up to 100 receptors are allowed. If the number is specified, data for the indicated receptor is replaced by that on the card.

RCAL

This card initiates the reading of calibration factors for the receptors, which have default values of 1.0. Each card contains a number, identifying the receptor to which the factors apply, and 6 factors corresponding to the six pollutants. If the identifying number is not specified, the values are applied to all receptors. Previously stored values for these factors are replaced by those on the card.

VALUES

This card initiates the reading of background concentrations for the receptors. Each card of the data set contains a reference number and six background values (in "output" units) for the six pollutants. The default values for backgrounds are taken to be 0, and are not reset except by reading of a VALUES package, or by specification of RSTORE=.TRUE. in the PARAMETERS package. This latter specification causes the results of a previous calculation to be used as backgrounds in the next calculation.

METD

This card initiates the reading of the wind rose. The first card of the package contains a "1" in the column 10 (indicating that this is a type 1 wind rose). Columns 41-70 contain a descriptive title for the wind rose, to be printed with the tabulated arithmetic mean concentrations. The title should therefore contain information as to the period over which the meteorological data applies (e.g., "annual", "winter", etc.). The wind frequency array F is initialized to zero at the beginning of execution of the METD package and only those conditions for which F is non-zero need be read in the data set. Each card contains frequencies for 6 wind speed classes for one stability class (1-5) and one wind direction class (1-16). Up to 80 cards may be required, therefore, to specify the full (480 condition) wind-rose.

The wind rose is tabulated by stability class, and checked for normalization. An error is assumed if the sum over the array is not within 1% of a given normalization value (normally unity). Provision is made for scaling the wind rose as it is read to renormalize or to partition the wind rose.

SRCE

This card causes emissions data to be read in from cards in internal units. Normally, the emission inventory is to be resident on a data set specified in the PARAMETERS package, UNIT (1). This package allows the creation of this data set at run time. Each source requires up to 3 cards, and may be one of the three types "POINT", "LINE", or "AREA". Each source group is initiated by a card containing the type and a name for printing. The second and third cards contain coordinate and emission information for the first source in the group. If additional sources exist for the group, they are represented by additional cards, singly or in pairs. Emissions are as given in internal units (grams, meters and seconds) and may be expressed as positive or negative quantities depending upon whether absolute or differential effects are being studied. Gridded area source data may be entered in "GRID" package format.

RCON

This card ends the input stream for a given diffusion model run, and initiates the computation of receptor concentrations based on the data sets read in so far. No further cards are read until after computations are finished and output is printed. Arithmetic mean concentrations are tabulated by pollutant for each receptor.

COMMENTS

This card initiates a package designed for the convenience of annotating the output with comments. Any number of comments cards may follow, each with a carriage control character (blank, 0 or 1) in column 15, and the comments line in columns 21-70. A non-blank character in column 72 indicates that an additional comment card is to follow. Comments are read and printed until the last card read contains a blank in columns 71-72.

COMPUTE

This package has been provided to enable the MARTIK program to be adapted easily to special cases in which user-designated calculations and data set manipulations are to be done at intermediate stages of a job. The COMPUTE card calls a user-written subroutine COMP, which may perform calculations, additional input-output, and manipulation of data sets as required by the specific program applications.

ENDJOB

This card causes termination of the program with the message "END OF PROGRAM".

These packages are discussed in detail in Section 3.2, with the exception of COMMENTS and ENDJOB, which are discussed in Section 1.3, and COMPUTE which is covered in Section 3.3.

3.1.5 Program Output

The normal output of MARTIK consists of:

1. A listing of program options and run parameters when a PARAMETERS package is encountered.

2. A listing of receptor coordinates and names as read in.

3. A listing of receptor background and calibration factors if entered with VALUES or RCAL packages.

4. A listing of the wind-rose, tabulated by stability for each class whose total frequency of occurrence is non-zero.

5. A listing of emission source data as read in, if input from cards using an SRCE package.

6. A listing of source total emission rates, by source at the beginning of each source loop in the computation of concentrations.

7. Tabulated arithmetic mean concentrations given by pollutant for each receptor.

3.2 Keyword Packages

3.2.1 PARAMETERS

The format of the MARTIK PARAMETERS package is as given in Section 1.3.3. The name, type, dimension, default value and a brief description of meaning is given for each parameter currently by the namelist &INPUT:

Name	Type	Dim.	Default	Meaning
SCALE	R	1	1000.	Coordinate scale unit, meters
UNIT	I	3	11	UNIT(1); logical unit for source dataset
			12	UNIT(2); logical unit for optional output (OUTP=.TRUE.)
ORIGIN	R	2	0,0	Origin of receptor coordinator system, scale u. east and scale u north.
REWIND	I	10	10*0	Units to be rewound before further use.
OUTP	L	1	F	True if receptor concentrations are to be output in VALUES card-format on dataset number UNIT(2).
PRINT	L	1	T	True if data packages are to be printed as read in-
STNDRD	L	1	T	True if standard set of met. conditions is to be used.
RSTORE	L	1	F	True if previously computed receptor concentrations are to be used as backgrounds in the next run.
NCOMP	I	1	50	Computation parameter in GPASQ: determines the maximum number of elements into which a line or area source may be divided. Max. value = 100.
TMIN	R	1	0.01	Minimum value of an argument X in EXP(X) such that the exponential is evaluated. For X less than TMIN EXP(-X) is set to (1-X).
TMAX	R	1	30.0	Maximum value of X such that EXP(-X) is evaluated. For X greater than TMAX, EXP(-X) is set to 0.
A,B	R	5		not used
C,D	R	5	*	The set of constants C,D for each of 5 stability classes used to compute the plume dispersion coefficients.
XMIN	R	1	100.0	Downwind distance, in meters, within which plume dimension is assumed constant.

*See Section 3.2.1, Item 1.

Name	Type	Dim.	Default	Meaning
XTR	R	5	*	The set of trapping distances in meters for each of 5 stability classes.
DMX	R	5	*	The set of mixing depths in meters for each of 5 stability classes.
NR	I	1	0	Receptor count. Can be set to zero to clear out previous receptor set.
F	R	6,16,5	480*0	Meteorological array. Specification of F=480*0. clears previous wind rose.
WD	R	16	*	Array of wind direction angles measured clockwise from North.
U	R	6	*	Array of wind speeds, in meters/sec.
KS	I	5	*	Array of stability classes.
NS	I	1	5	Number of stability classes to be considered (up to 5).
NW	I	1	16	Number of wind directions to be considered (up to 16).
NU	I	1	6	Number of wind speeds to be considered (up to 6).
NQQ	I	1	6	Number of pollutants in set (up to 6).
QNAM	R*8	6	*	Array of pollutant names (up to 6) in form 'XXXXXXXX' for printing and column headings in tables.
QUNIT	R*8	6	*	Array of pollutant output units in form 'XXXXXXXX' for column headings in tables.
RFACT	R	6	*	Conversion factors to convert input emission units to units given in QUNIT.
DCAY	R	6	6*0	Decay half life for each pollutant, in hours. If zero, decay factors are not applied.

*See Section 3.2.1, Item 1.

3.2.1.1 Reference Data for PARAMETERS Package

1. Default Values for Meteorological Arrays

WD Wind-Direction Array - The 16 elements of WD take on as default values the angular displacement, in degrees from north, of each of the 16 points of the compass, beginning with north (0.,22.5,...,315.0,337.5).

KS Stability-Class Array - The 5 elements of KS take on the default values 1,2,3,4,5.

U Wind-Speed Array - The 6 elements of U take on values as given by the following table:

Wind-Speed Class	Range (knots)	Value, U (m/sec.)
1	0 - 3	0.67
2	4 - 6	2.46
3	7 - 10	4.47
4	11-16	6.93
5	17-21	9.61
6	>21	12.52 = 25.5 kts.

2. Meteorological Constants

The standard deviation SIGZ used to describe the vertical distribution in the gaussian plume equation are calculated according to the expression

SIGZ = (C)*(X**D) (X = downwind distance, meters)

The "trapping distance" XTR is defined as that distance for which SIGZ = 0.47*DMX where DMX is the mixing layer depth in meters. The constants C,D and DMX may be specified in &INPUT. Default values are:

Stability Class, KS	C	D	DMX	XTR
1	0.022	1.44	1500.	1400.
2	0.064	1.12	1000.	2900.
3	0.150	0.86	1000.	11000.
4	0.270	0.68	820.	40000.
5	0.372	0.58	100.	4000.

3. Unit Conversion Factors

Source internal units are g /sec for point sources, g/m-sec for line sources and g/m^2-sec for area sources. Concentrations are in g/m^3 x RFACT, where RFACT is specified in the PARAMETERS package for each pollutant, and depends upon the desired output units (specified in QUNIT).

QUNIT	RFACT
'GM/M**3'	1.0
'MG/M**3'	1.0 E 03
'UG/M**3'	1.0 E 06

To specify output in parts per million ('PPM'), the value of RFACT used is a function of the ambient temperature. Values for five pollutants at 5 temperatures are given below:

Pollutant	$0^{o}C$	$60^{o}F$	$70^{o}F$	$20^{o}C$	$25^{o}C$
Sulfur dioxide	349.869	369.793	376.910	375.486	381.891
Carbon monoxide	800.184	845.753	862.029	858.773	873.421
Ozone	466.968	493.560	503.058	501.158	509.707
Methane	1397.093	1476.654	1505.071	1499.386	1524.961
Nitrogen dioxide	487.194	514.938	524.848	522.866	531.784

If input emissions data are in other than g, m, and sec as required internally, conversion may be achieved by multiplying RFACT by an appropriate factor; e.g.,

Numerator	Denominator	Factor
g/sec	pounds/year tons/year	1.45 E-05 2.90 E-02
g/m-sec	pounds/km-day tons/kmi-day	3.26 E-09 6.52 E-06

4. Pollutant Information

The default names (QNAM) for the six pollutants, as compiled in the current MARTIK version are 'PARTIC.','S 02','C O','HYDROC.','N OX', and '(blank)'. Default names for printed units (QUNIT) are 'UG/M**3' for all but SO_2 and CO, which are 'PPM'. RFACT values, however, are defaulted to 1.0 E+6 for all pollutants (the conversion to $\mu g/m^3$). Hence the actual values for SO_2 and CO will <u>not</u> be in ppm unless values for RFACT are supplied for them in the PARAMETERS package. See Section 3.3.3 for further discussion.

3.2.2 POINTS

This package initiates the reading of receptor coordinates and names for printing. NOTE that the card format for 'POINTS' is identical to that used in LANTRAN (Section 2.2.3). The number of recepters in a second or later POINTS package cannot exceed the number given in a preceding POINTS package.

FIRST CARD - Keyword card 'POINTS' in standard format (Section 1.3.2).

FOLLOWING CARDS - One for each receptor:

Columns	Variable	Format	Meaning
1 - 7			Must be blank
8 - 10	N	I3	Number of receptor for which coordinates are read in (1 to 100). If blank or 0, N is given the next available number in sequence.
11-20	RH	F10.5	Receptor horizontal coord., in SCALE units.
21-30	RV	F10.5	Receptor vertical coord., in SCALE units.
31-40	RZ	F10.5	Receptor height, in meters.
41-70		7A4,A2	Optional 30-character receptor name for printing.

LAST CARD - Delimiter card '99999'

Specification of the ORIGIN parameter in the PARAMETERS package enables the coordinates of a POINTS package to be displaced such that:

$$x \leftarrow x_o + \text{ORIGIN}(1)$$
$$y \leftarrow y_o + \text{ORIGIN}(2) \quad \text{Scale Units}$$

where x_o, y_o are the receptor coordinates as read from the card and x,y the relocated receptor points. This option is of use if a large receptor grid is to be filled out by multiple runs with smaller grids.

3.2.3 RCAL

This package reads in calibration factors to be applied to selected receptors for up to 6 pollutants. Receptor coordinates must have been previously initialized by a 'POINTS' package before reading a 'RCAL' package.

FIRST CARD - Keyword card 'RCAL' in standard format (Section 1.3.2)

SECOND CARD - Pollutant Name Card

Columns	Variable	Format	Meaning
1-10			Must be blank
11-20	QN(1)	A8,2X	
.	.	.	Names of pollutants (must be identical to QNAM array).
.	.	.	
61-70	QN(6)	A8,2X	

FOLLOWING CARDS - One or more data cards:

Columns	Variable	Format	Meaning
1-8			Must be blank
8-10	N	I3	Number of receptor for which factors are to be applied.
11-20	RCAL(1,N)	F10.5	Cal. factors for 6 pollutants
.	.	.	
.	.	.	
61-70	RCAL(6,N)	F10.5	

LAST CARD - Delimiter card '99999'

If N is blank or zero, the same calibration factor is applied to all receptors. Hence if the first data card contains N=0 the following cards need only refer to those receptors whose value is different from the generally applied calibration factor.

3.2.4 VALUES

This package reads in receptor background levels (in output units) for selected receptors for up to 6 pollutants. Receptor coordinates must have been previously initialized by a 'POINTS' package before reading a 'VALUES' package. Note that the card format for 'VALUES' is identical to that used in LANTRAN (Section 2.2.4).

FIRST CARD - Keyword card 'VALUES' in standard format (Section 1.3.2)

SECOND CARD - Pollutant Name Card

Columns	Variable	Format	Meaning
1-10			Must be blank
11-20	QN(1)	A8,2X	Names of pollutants (must be identical to QNAM array).
.	.	.	
.	.	.	
61-70	QN(6)	A8,2X	

FOLLOWING CARDS - One or more data cards

Columns	Variable	Format	Meaning
1-7			Must be blank
9-10	N	I3	Number of receptor to which backgrou[nd] is to be added.
11-20	RBKG(1,N)	F10.5	Values for 6 pollutants (output units)
.	.	.	
.	.	.	
61-70	RBKG(6,N)	F10.5	

LAST CARD - Delimiter Card '99999'

If N is blank or zero, the same background value is added to all receptors. Hence if the first data card contains N = 0 the following cards need only refer to those receptors whose value is different from the generally added background value.

3.2.5 METD

This package reads in the meteorological array, checks for normalization and tabulates the wind rose by stability class. The entire array is set to zero before the package is read in.

FIRST CARD - Keyword card 'METD' in standard format (Section 1.3.2)

SECOND CARD - Parameter card:

Columns	Variable	Format	Meaning
1-9			Must be blank
10	'1'	I1	Wind rose type: must be 1
11-20	DEPTH	F10.5	Climatological value of mixing depth, meters, for use with classes 2,3, or zero if DMX array is to be read on following card.
21-30	TAMB	F10.5	Ambient temperature, deg.K
31-40	PAMB	F10.5	Ambient pressure, millibars.
41-70	TITLE	7A4,A2	Averaging period, etc., for printing.

THIRD CARD - (Used only if DEPTH field on second card is omitted)

Columns	Variable	Format	Meaning
1-10			Must be blank
11-20	DMX(1)	F10.5	Mixing depth, meters, to be used for classes 1 to 5.
.	.	.	
.	.	.	
51-60	DMX(5)	F10.5	

OPTIONAL CARD - (Used only to scale input data or change the sum over the array):

Columns	Variable	Format	Meaning
1-10			Must be blank
11-20	FNORM	F10.5	Normalization constant. Initially 1.0. Error number 350 in INC results if the normalized summation over the F-array is not within 1.% of FNORM.
21-30	FACT	F10.5	Scale factor to be applied to all values read after this card. Initially 1.0.
31-70			Not used.

FOLLOWING CARDS - One or more data cards:

Columns	Variable	Format	Meaning
1-5			Must be blank.
6-7	L	I2	Stability class (1 to 5)
8-10	K	I3	Wind direction class (1 to 16)
11-20	F(1,K,L)	F10.5	Frequency of occurrence of wind speed classes 1 to 6 for stability class L, direction K.
.	.	.	
.	.	.	
61-70	F(6,K,L)	F10.5	

LAST CARD - Delimiter card '99999'

NOTE: Cards for which F is all zero may be omitted. Each card read assigns six frequencies corresponding to the 6 wind-speed classes for stability L and wind direction class K.

Specification of the mixing depth parameter DEPTH causes the following set of mixing depths to be generated for the 5 stability classes:

Class	Value
1	1.5* DEPTH (meters)
2	1.0* DEPTH
3	1.0* DEPTH
4	0.8* DEPTH + 20.
5	100

3.2.6 MSG

This package allows communication with the computer operator through the console typewriter, and may be used to request the mounting of tapes, changes of form, etc.

FIRST CARD - Keyword Card 'MSG' in standard format (Section 1.3.2)

The IFORM parameter (punched right-justified in column 18) is used by this package, with

IFORM = 0 to print one or more lines of text on the console teletype without pause, or

IFORM = 1 to print one or more lines of text on the console teletype with a PAUSE. The operator must type "C" before continuation.

The JF parameter (columns 71-72) on the keyword card must be punched with a non-blank character if additional lines of text are to follow.

FOLLOWING CARDS - One or more cards in comments-card format. (Section 1.3.2).

LAST CARD - A comments card with columns 71-72 blank.

3.2.7 SRCE

This package reads in emissions data from cards and transfers them to the data set with data-set reference number UNIT(1). This package may be omitted if emission sources have been previously stored on UNIT(1) in the required format (Section 3.2.7.1).

FIRST CARD - Keyword card 'SRCE' in standard format (Section 1.3.2).

FOLLOWING CARDS - Data Cards in one of three formats (A, B, or C).

LAST CARD - Delimiter card '99999'

A. Single Source Format

Three cards for each source, according to the following:

FIRST CARD - Source I.D. Card

Columns	Variable	Format	Meaning
1-5	TYPE	A4,1X	'POINT', 'LINE' or 'AREA'
9-10	NN	I2	Blank or zero for single-source format.
21-70	SNAME	12A4,A2	50-character source name, for printing.

SECOND CARD - Coordinate Card

Columns	Variable	Format	Meaning
1-10		10X	Not used
11-20	SH1	F10.5	Hor. coord. #1, scale u.
21-30	SV1	F10.5	Ver. coord. #1, scale u.
31-40	SH2	F10.5	Hor. coord. #2, scale u.
41-50	SV2	F10.5	Ver. coord. #2, scale u.
51-60	H	F10.5	Stack height, meters
61-70	P	F10.5	Plume rise factor, m^2/sec.

THIRD CARD - Emissions Card

Columns	Variable	Format	Meaning
9-10	MM	I2	Blank or zero for single-source format.
11-20	Q(1)	G10.5	
21-30	Q(2)	G10.5	Emission rates for 6 pollutants in
.	.	.	g , m, sec (positive or negative).
.	.	.	
61-70	Q(6)	G10.5	

The four coordinates SH1, SV1, SH2, SV2 are shown for the three types of sources in Figure 41.

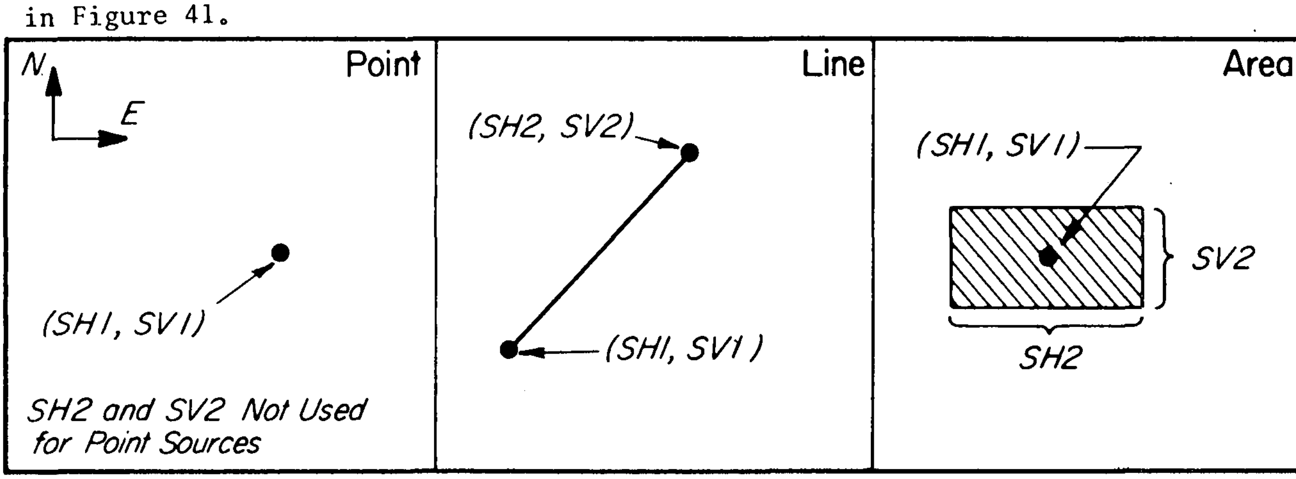


Figure 41 Coordinate Specification for Three Types of Emission Sources in MARTIK

B. Multisource Format

Four or more cards (two or more sources).

In some cases it is convenient to group sources together under a single source I.D. card (e.g., highways with multiple links). To specify multiple sources, a non-zero number is punched for the variable NN representing the number of coordinate cards (i.e., the number of sources in the group) to follow. Each coordinate card is followed by an emissions card unless MM is non-zero, in which case MM represents the number of sources to which the same emissions apply.

Example:

Consider a highway consisting of 10 links differing only in coordinates (i.e., having the same emission densities on all links). Using the single-source format, a total of 30 cards would be required, of which 18 would be duplicates. Using the multisource format, only 12 are required: one source I.D. card with NN = 10, followed by the coordinate card of the first link, followed by the emissions card with MM = 10, finally followed by 9 cards representing the additional 9 links.

NOTE: that the number of sources actually generated and transferred to the internal source data set is equal to the number of coordinate cards.

C. Gridded Area Source Format:

Three or more cards.

In many cases a large number of discrete point, line and small area sources may be allocated together into a grid system. This format allows data defined on such a grid to be entered directly into MARTIK, which converts each cell of the grid to an 'AREA' source and writes it to UNIT(1). Two simplifying assumptions are made in this process:

(1) There is no plume-rise associated with the sources; and

(2) All cells of the grid system are at the same height, which is therefore the effective stack height of all sources generated.

The format for gridded area source data is a LANTRAN 'GRID' package (see Section 2.2.5) in its entirety, with the first card replacing the source I.D. card of format A above. Note that the last card of the 'GRID' package is a '99999' card, which will terminate the 'SRCE' package. For this reason, a 'GRID' package usually follows the 'POINT', 'LINE' or 'AREA' source groups within the 'SRCE' package. If additional 'POINT' 'LINE' or 'AREA' cards are to follow the 'GRID' package, or if more than one 'GRID' package is to be included, use an '88888' as a delimiter for the 'GRID' packages, with a '99999' as a delimiter for the 'SRCE' package.

NOTE that the second card of a 'GRID' package contains the pollutant names. These must agree exactly with those of the QNAM array.

3.2.7.1 Internal Format for Emissions Data Set

The form of the internal data set on which the inventory resides during execution is that of a sequential file made up of unformatted fixed-length blocked records of 52 bytes each. The internal format on the data set is:

Word	Bytes	Name	Meaning
1	1-4	KTYPE	1,2,3 for point, line or area source.
2	5-8	SH1	Hor. coord. #1, meters
3	9-12	SV1	Ver. coord. #1, meters
4	13-16	SH2	Hor. coord. #2, meters
5	17-20	SV2	Ver. coord. #2, meters

Word	Bytes	Name	Meaning
6	21-24	H	Physical height of source, meters
7	25-28	P	Plume-rise factor, m^2/sec.
8	29-32	Q(1)	Emission rate, pollutant 1 (g, m, sec)
9	33-36	Q(2)	Emission rate, pollutant 2 (g, m, sec)
10	37-40	Q(3)	Emission rate, pollutant 3 (g, m, sec)
11	41-44	Q(4)	Emission rate, pollutant 4 (g, m, sec)
12	45-48	Q(5)	Emission rate, pollutant 5 (g, m, sec)
13	49-52	Q(6)	Emission rate, pollutant 6 (g, m, sec)

3.2.8 RCON

This package initiates the computation of receptor concentrations. No further card input takes place until after the completion of the computation loops and final tabulation of results. At entry into subroutine LOOPS, (which performs the summations over source, wind direction, stability class, and wind speed for each receptor and pollutant) the so-called "cycle-count" is set to zero. The cycle-count is incremented by unity with every entry into the highest frequency loop; i.e., the inner computation algorithm. For each type of source (point, line or area) the cpu time spent in LOOPS is proportional to the cycle count, and hence this variable is useful in estimation of execution times. See section 3.3.5 for further discussion on the estimation of running times.

CARD FORMAT - One card, keyword 'RCON'. No delimiter.

3.3 AQUIP System Implementation

The MARTIK program (Version 3.4, level 720515) has been adapted to the needs of the Hackensack Meadowlands study by: (1) development of a COMP routine which contains the application-dependent computations; (2) setting up model-parameter data sets appropriate to the Hackensack Meadowlands region; and (3) selection of program and computation parameters. These three topics are discussed in the following sections.

3.3.1 COMPUTE Routines

COMPUTES 0 and 1 are used for the variable wind field with height. Normally, MARTIK uses a wind speed that is constant with height. This is modified by providing MARTIK with the information needed to compute the variation of the wind with height.

IFORM=0 is used after a variation has been set. It clears the previous vertical variation parameters, and reset the values back to a constant wind field with height. The parameters Z1 and EX are set to zero. This requires only the keyword card.

IFORM=1 is used to specify the parameters Z1 and EX in the vertical variation equations. One card follows the keyword card, with Z1 and EX punched in columns 11-20 and 21-30 (format 2G10.0). When these values have been set the vertical wind field is varied as described below.

In the MARTIK program, the "standard" subroutine PRISE has been replaced by an entry PRISE into subroutine COMP. This routine performs the computation of plume-rise (or effective stack height) as a function of stability class and wind speed. The formula for the effective stack-height is

$$H = H_s + (1.4 - 0.1 \cdot L) \cdot P/u_r \tag{3-1}$$

and

$$\left.\begin{array}{lll} u_r = u_1 & & H_s \le Z_1 \\ u_r = u_1 \, (H_s/Z_1)^{EX} & & H_s > Z_1 \end{array}\right\} \tag{3-2}$$

where

L = stability class

u_1 = wind speed at ground level, m/sec.

u_r = wind speed at point of release, m/sec.

H_s = physical stack height, meters

Z_1 = reference height (height of anemometer at Newark airport in this case), meters

EX = power law exponent

P = plume-rise factor, m^2/sec.

H = effective stack height, meters

The ventilation velocity, u, used by subroutine LOOPS for the determination of the concentration, is computed in PRISE to be

$$u = \frac{u'}{(1+EX)} \tag{3-3}$$

with

$$\left.\begin{array}{lll} u' = u_1 & & H \le Z_1 \\ u' = u_1 \, (H/Z_1)^{EX} & & H > Z_1 \end{array}\right\} \tag{3-4}$$

The PRISE routine uses Eq. (3-1) with $u_r = u_1$ (i.e., the formula without modification) if the parameters Z_1 and EX are zero (as they are initially). They are set to non-zero values by a 'COMPUTE' keyword package.

The remainder of the MARTIK COMPUTES are used to manipulate data. MARTIK has the following arrays of values for each receptor:

RCON	-	Calculated concentrations. Filled by RCON package RBKG should = 0 before using the RCON package.
RBKG	-	Background concentrations. Filled either by VALUES or PARAMETERS with RSTORE=.TRUE.
RCAL	-	Calibration factors. Set by RCAL package.
RCONB	-	Work array where values may be stored between calculations.
COMPUTEs	-	2 through 9 manipulate the values in these arrays. All of these computes require only the COMPUTE keyword card.

IFORM=2: Zeros the RBKG array. The array of background values, RBKG, is set to zero. RBKG = 0

IFORM=3: Moves the RBKG array into the RCONB array.

IFORM=4: This COMPUTE will be used to add values saved in RBKG to already existing values in RCONB. It is equivalent to RCONB=RCONG+RBKG for all array elements.

IFORM=5: Subtracts the RBKG array from the work array RCONB. This is the same as IFORM=4 except that the values are subtracted.

IFORM=6: Moves the RBKG array into the RCONArray. This will permit later tabulation of the values presently in RBKG; or can be used to zero the RCON array after zeroing the RBKG array.

IFORM=7: Adds the RBKG array to the RCON array. This is the same as the IFORM=4, except that the destination array is RCON. It would then be directly available for printing.

IFORM=8: Adds RCON to RCONB, and then multiplies the sum by the calibration factor in RCAL, RCON = (RCON+RCONB)*RCAL. With the final calculations in RCON the resulting values are added together and the total is multiplied by the calibration factor for the model. The calibration factors must be found empirically for the region being modeled.

IFORM=9: Tabulates the RCON array in MARTIK output format. This output follows exactly the same form as the output from a RCON package. If OUTP=.TRUE. a VALUES package will be created in exactly the same manner as it would by RCON.

Arrays should be zeroed before use unless the existing values are to be used.

3.3.2 Data Flow, Diffusion Analysis

The purpose of this section is to relate the MARTIK program to the overall AQUIP system as shown schematically in Figure 2 of Section 1.1. The analogous schematic data flow system for diffusion analysis is shown in Figure 19. The same conventions have been used for the naming of input data sets (I), model data sets (M), computed data sets (C), programs (P) and internal data sets (D). Each box of Figure 2 had been detailed to represent the card decks (keyword packages) which make it up. These card decks will be described in detail in Section 3.3.4.

In principle, one MARTIK run would suffice to perform the diffusion analysis for one plan. Since a large number of sources are involved, however, this approach is impractical due to excessive running times for the program (about 12 hours per plan on the Spectra 70/45). The usual procedure is therefore to run the program with one of the four 'SRCE' packages shown in Figure 19 and produce an output 'VALUES' package which may either be used as a background to the next run (with another 'SRCE' package) or, if each 'SRCE' package produces its own output 'VALUES' package, the set can be added together by a sequence of 'VALUES' and 'COMPUTE' operations in MARTIK. The background emissions, for example, need be run once and for all, and each of the data sets I2, I3 or C1 only when they are first created or modified.

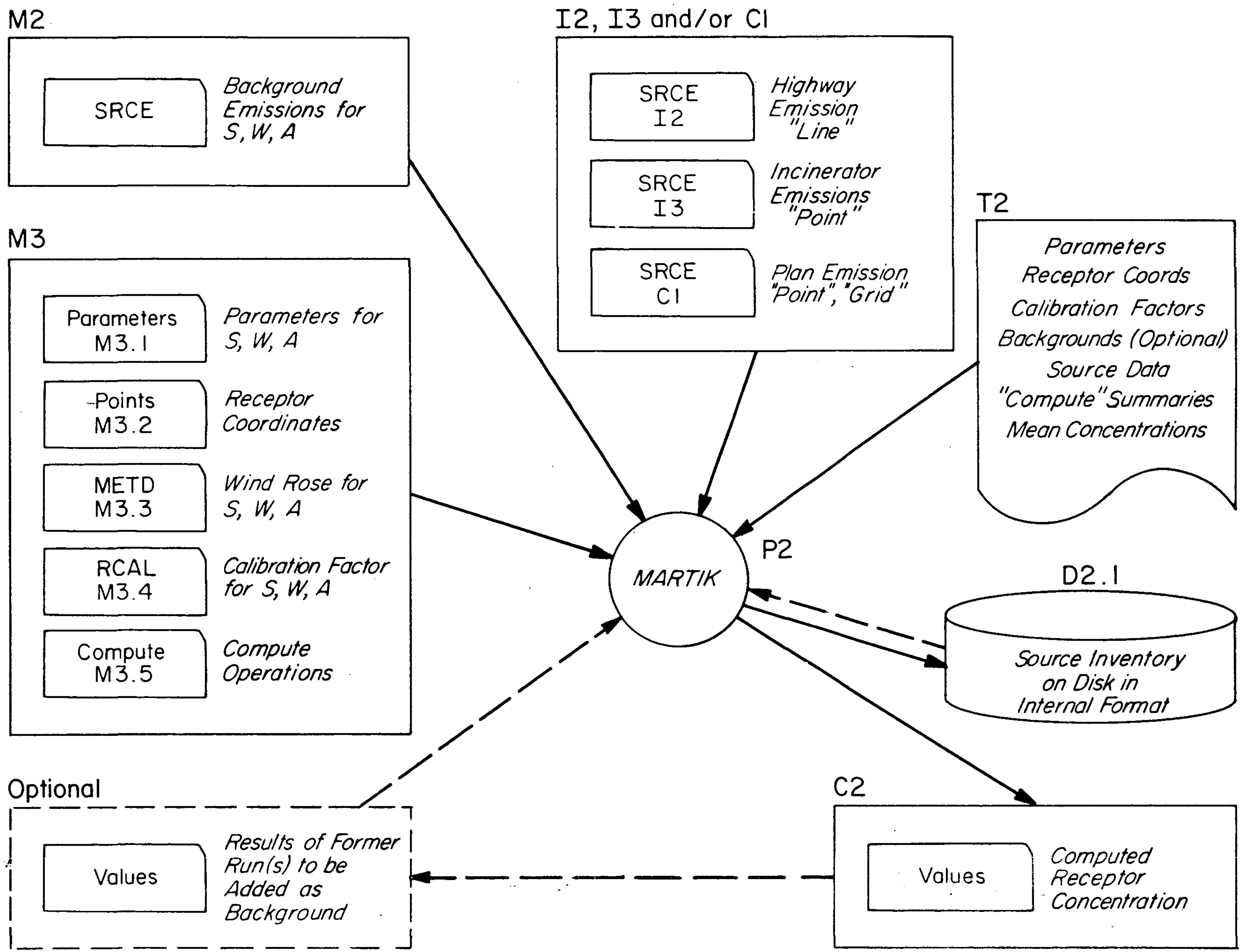


Figure 42 Analogous Schematic Data Flow System for Diffusion Analysis

Deck setups for four modes of operation are given as follows:

A. Source Data Set with No Background to be Added

PARAMETERS		Initialize program parameters for season
POINTS		Read in receptor coordinates
RCAL		Read in calibration factors for season
METD		Read in wind rose for season
COMPUTE	1	Read parameters for vertical wind profile
SRCE		Read source data set from cards
RCON		Compute and calibrate concentrations, add background values, tabulate and output 'VALUES' package.
ENDJOB		Call program exit.

B. Source Data Set with Background to be Added

PARAMETERS		As per above (A)
POINTS		As per above (A)
RCAL		As per above (A)
VALUES		Read background values
METD		As per above (A)
COMPUTE	1	As per above (A)
SRCE		As per above (A)
RCON		As per above (A)
ENDJOB		

C. Source Data Set on Disk

At the end of any run with MARTIK, the emission source resides on a disk data set (D2.1 in Figure 42) in internal format. This inventory is not destroyed and may be used again in the next MARTIK run by omitting the 'SRCE' package.

D. To Combine Calibrated 'VALUES' Packages

PARAMETERS		Initialize program parameters
POINTS		Initialize receptor coordinates
VALUES		Read in the first 'VALUES' package
COMPUTE	3	Move first package to RCONB
VALUES		Read in the second 'VALUES' package
COMPUTE	4	Add second package to RCONB array
VALUES		Read in the third 'VALUES' package
COMPUTE	4	Add to RCONB array
.		.
.		.
COMPUTE	4	Add last 'VALUES' package to RCONB array
COMPUTE	2	Zero the RBKG array
COMPUTE	6	Move RBKG array to RCON array
COMPUTE	8	Move RCONB array to RCON array
COMPUTE	9	Tabulate RCON array, punch a new 'VALUES' package
ENDJOB		Call program exit

NOTE that if the results are to be multiplied by a calibration factor, an RCAL package is included after the POINTS package.

3.3.3 Parameters for the Hackensack Meadowlands Study

At least one PARAMETERS package is required for each MARTIK run involving actual diffusion calculations or punched output. This is because the default values cannot take into account the seasonal differences. Some of the parameters (such as the plume dispersion coefficients) have been modified specifically for this study and were not therefore compiled into the program as default values. PARAMETERS packages appropriate to the three seasons: summer (S), winter (W) and annual (A) are given as follows:

A. Winter (W)

```
PARAMETERS
 &INPUT
 NQQ = 5, QNAM = 'TSP-W','SOx-W','CO-W','HC-W','NOX-W',
 RFACT(2) = 3.50E+02,8.00E+02,DCAY(2)=3.0,
 U=0.89,2.46,4.47,6.93,9.61,12.52
 C=0.072,0.072,0.169,1.070,1.010,
 D=1.220,1.220,1.010,0.682,0.554
 NCOMP=5,TMIN=0.2,TMAX=7.0,
 &END
```

B. Summer (S)

```
PARAMETERS
 &INPUT
 NQQ=5,QNAM='TSP-S','SOX-S','CO-S','HC-S','NOX-S',
 RFACT(2)=3.77E+02,8.62E+02,DCAY(2)=3.0,
 U=0.89,2.46,4.47,6.93,9.61,12.52,
 C=0.072,0.072,0.169,1.070,1.010,
 D=1.220,1.220,1.010,0.682,0.554,
 NCOMP=5,TMIN=0.2,TMAX=7.0,
 &END
```

C. Annual (A)

```
PARAMETERS
 &INPUT
 NQQ=5,QNAM='TSP-A','SOX-A','CO-A','HC-A','NOX-A',
 RFACT(2)=3.70E+02,8.46E+02,DCAY(2)=3.0,
 U=0.89,2.46,4.47,6.93,9.61,12.52,
```

```
C=0.072,0.072,0.169,1.070,1.010,
D=1.220,1.220,1.010,0.682,0.554,
NCOMP=5,TMIN=02,TMAX=7.0,
&END
```

The internal data set UNIT(1) has a default reference number of 11. The default for the logical variable OUTP is .FALSE. indicating that a 'VALUES' package is not to be created as output. If a 'VALUES' package is to be created, then specify OUTP=.TRUE. with UNIT(2) equal to the reference number of the output data set. If 7 is specified, the output data set will be punched on cards.

Default values for calibration factors are compiled to be 1.0 for all pollutants, for all receptors. The results of the model validation procedures (discussed in the Task 2 study report) have led to the adoption of the following calibration factors (Table 3), applicable to all receptors within the Hackensack Meadowlands study region:

TABLE 3 CALIBRATION FACTORS

	Summer(S)	Winter(W)	Annual(A)
1. Particulates	1.45	0.826	1.19
2. Sulfur dioxide	0.875	0.602	0.66
3. Carbon monoxide	1.25	2.31	1.70
4. Hydrocarbons	1.99	2.23	2.03
5. NO_X	0.750	0.616	0.614

Finally, the two parameters read by the COMPUTE 1 package, which initializes for the vertical wind velocity profile are:

Z1 = 6.00

EX = 0.20

These two parameters are punched in G10.0 format in columns 11-20 and 21-30 on the card immediately following the 'COMPUTE' keyword card with IFORM=1.

3.3.4 Data Set Description

This section describes in some detail the actual card decks making up the data sets of Figure 2.

I2 Highway Emissions Data

A keyword 'SRCE' package in which links of highways are coded as 'LINE' sources. Preparation involves assigning vehicle counts to each straight-line link of the system, multiplying these traffic counts by emission factors to obtain the source emission densities in g/m-sec for each link.

I3 Point Source Emissions Data

A keyword 'SRCE' package in which sources such as power plants or incinerators, in addition to those generated by the land-use plan, are coded as 'POINT' sources. Preparation involves determination of the physical stack height, plume rise factor, and emission rates in g/sec for each source.

C1 Point and Grid Area Source (Plan Emissions) Data

A keyword 'SRCE' package generated for a single land-use plan by LANTRAN (see Section 2.3.2). The package is made up of 'POINT' sources generated by the LANTRAN COMP routines, and a 'GRID' package representing the area-source emission densities for the study-area system. These densities are expressed as rates per square scale unit, and are converted to g/m^2-sec in MARTIK.

M2 Background Emissions by Season (S,W,A)

A keyword "SRCE' package containing point, line and area sources in combination, and representing the projected emissions from all regions lying outside the study area. Modification of this data set requires source-by-source changes.

M3 MARTIK Model Data Sets by Season (S,W,A)

M3.1 PARAMETERS - As discussed in Section 3.3.3.

M3.2 POINTS - A deck of receptor coordinates. For this study, the "Hackensack 1-km receptor grid" was used. The 100 receptor points making up this grid are shown in Figure 43.

M3.3 METD - A deck of cards representing a Newark 1990 wind rose for the season of interest. The 1990 wind rose represents a 10-year average (performed by the METCON program) for the years 1956-65.

M3.4 RCAL - A three-card data set for the season of interest, applying calibration factors to all receptors. Values for these calibration factors are given in Section 3.3.3.

M3.5 COMPUTE - One or more cards controlling one of 10 functions selected by IFORM. One COMPUTE 1 package is required for runs involving diffusion analysis (an RCON package). Values for the COMPUTE 1 input parameters Z1, EX are given in Section 3.3.3.

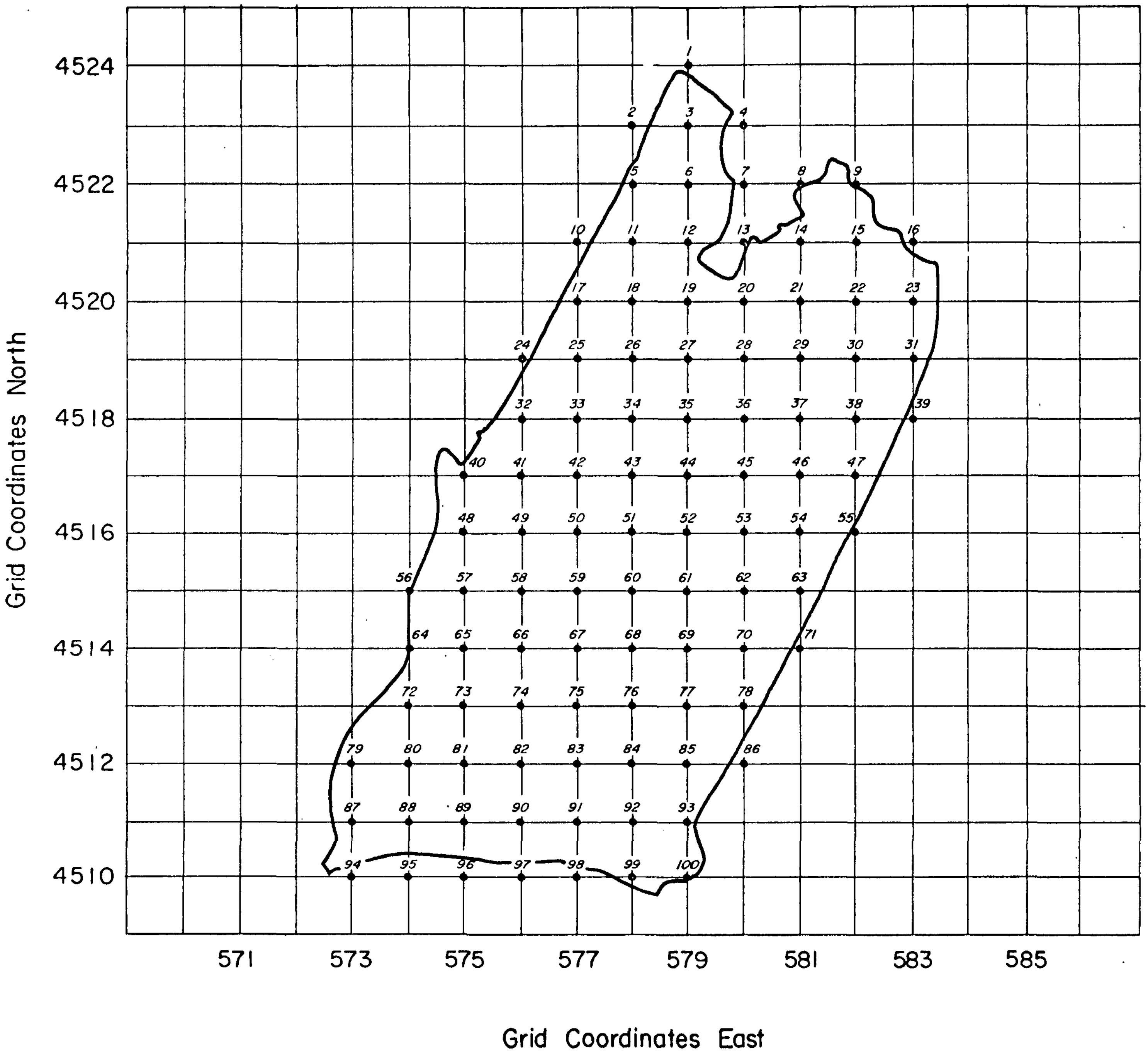


Figure 43 Hackensack Meadowlands 1-km Grid

5155

C2 Computed Receptor Concentrations

A keyword 'VALUES' package created by MARTIK as a result of execution of an RCON package. Used as input to SYMAP (Section 5.2.5) and to LANTRAN (Section 3.2.4). This data set may optionally be used as an input to MARTIK, in which case its values are added to those computed.

D2.1 Source Inventory in Internal Format

A binary file containing one record for each source read in the last 'SRCE' package input to MARTIK. This file may be re-used if the inventory is not to be changed. Record formats for this file are discussed in Section 3.2.7.1.

T2 Printed Output

The printed output for one MARTIK run, including tabulation of all input data sets as read in, a listing of source total emission rates during computation of concentrations, and a tabulation of mean concentrations by pollutants for each receptor.

3.3.5 MARTIK and the Planning Process

The above discussions have been concerned with the mechanics of setting up the data sets and specification of the program options for a MARTIK diffusion analysis. This section is concerned with the role of MARTIK as a tool in the planning process. Several types of analyses are discussed with examples; in each case, the data flow pattern follows the form of Figure 42, although the data sets themselves are of course dependent upon the particular type of study.

1. Total Air Quality for a Given Land-Use Plan

This is the most obvious role of the diffusion model, exemplified by the analysis of the four plans: 1, 1A, 1B, 1C for the Hackensack Meadowlands Region in the year 1990. This has been an important result of this study. In this case, the model is used with a "complete" source inventory - accounting for all emissions which are of influence upon the study region - and mean concentrations are computed for the season of interest using an appropriate wind rose. Large-scale spatial variations are demonstrated by computing the concentrations at spacings sufficiently close to preserve the resolution of the inventory itself. Long-term temporal patterns are reflected in differences in results computed for the different seasons, resulting from changes in the inventory (e.g., due to space-heating in winter) and in changes in prevailing meteorological conditions. Small-scale spatial and short-term temporal variations are not captured in this case. It is, however, compatible with the nature of the total plan data, which tend to be expressed in terms of spatial zones and mean periods of time.

In AQUIP, source emissions data for the land-use plan are provided as an output of the LANTRAN program (data set C1). LANTRAN is not essential to the process of inventory estimation but instead formalizes a complicated methodology for translating the activity information expressed in planning terms (e.g., density of dwelling units or classification of manufacturing) - into actual emission rates. Some portion of this inventory may be prepared directly by other means. Such point sources as power plants or incinerators, and line sources based on highway projections are examples. These are discussed in the Task 1 report for the Meadowlands data. The background emission inventory, an important part of the contribution to total air quality represents a substantial effort in the gathering and projection of emissions data. These data are also discussed in the Task 1 report. It is likely that this emissions data set, regarded as a part of the model, will, for the most part, be considered as "ground truth", providing for constraints upon the emissions which may result from a plant - and therefore upon the activities - in order to meet standards.

2. Contributions to Total Air Quality for a Given Plan

This case is an expansion of the first. The same inventory is used, but subsets of the total inventory are analyzed separately to determine their effect in relation to the total. Examples of subsets which might be run separately are: highways (line sources), incinerators and power plants (point sources), residential land uses only, and industrial only. The background is usually run separately anyway. In principle, the entire inventory could still be run in a single job submission, with each subset calculated and tabulated using an RCON package, using COMPUTE packages to accumulate and print the total.

3. Mean Contribution of Single or Small Complexes of Sources

This case represents perhaps one of the most frequent uses of the model, in which proposed localized land-uses such as new highway, power plant or shopping centers are analyzed for their impact on air-quality. A proposed land-use of this sort involves one or more emissions sources, with emission rates determined for each season if differences are anticipated. Since only a small number of sources is involved, MARTIK runs can be made in a relatively short running time, and thus the effect of design alternatives may be readily displayed. The immediate result of a MARTIK run is,in this case,the added contribution of the mean total air quality. The new total can also be obtained if the total without the proposed addition is input to MARTIK as a 'VALUES' package, and used as a background in the computation.

4. Worst Case Analysis for Single or Small Complexes of Sources

This case is similar to the previous one, except that a seasonal wind rose is not used, but, instead, only a single wind condition is examined, to estimate the contribution made by the sources under "worst case" conditions. The hypothetical case considered is this: The wind speed is assumed to be constant with the direction distributed throughout the given wind sector as

$$f(\theta) = (\theta_o - \theta) / \theta_o^2 \quad (3\text{-}5)$$

where θ is the angular displacement from the sector centerline and θ_o the angular sector width ($22\text{-}1/2^o$).* To perform a worst-case analysis, only a single wind-frequency card is included in the 'METD' package, with a frequency of 1.0 punched for the desired worst-case condition, and zero fields for all others.

5. Differential Effects

In this case the differential effect on air quality due to changes in source configuration is displayed directly. An example is the effect of relative placement of sources, or of relocating a source to take into account prevailing wind conditions and other factors. Two methods may be employed to arrive at the difference:

a. The data cards for the "existing" configuration are removed from the inventory, and repunched with negative emission rates. These are then included together with the data cards for the alternative configuration in an 'SRCE' package. The concentrations computed by the 'RCON' package are the differential concentrations, with positive values representing increases and negative values decreases.

*NOTE that in the actual model calculation, the angular quantities of Eq. (3-5) are replaced by linear displacements from the sector centerline (see Task 2 study report).

b. The data cards for the "existing" configuration are removed from the inventory, but are not repunched with negative rates. Instead they are included as the first of two 'SRCE' packages. The concentrations due to the first are computed and tabulated, and then, using 'COMPUTE' operations, entered as negative values into the RCONB array. The concentrations due to the second 'SRCE' package, representing the alternate configuration are then computed and tabulated, and again using 'COMPUTE' operations, added to the RCONB array, which is then tabulated. This procedure, although more complicated in deck setup has the advantage that absolute values for existing and alternative configurations are presented, as well as the differential effect.

3.3.6 Estimation of Running Times

Of all the programs in the AQUIP system, MARTIK is the only one which may require large computation times. This is due to the fact that the program must accumulate the weighted concentration due to each source, wind direction, stability class, and wind-speed for each receptor and pollutant. These computations are structures within a set of "loops" (subroutine LOOPS). The highest frequency loop is referred to in the program as a "cycle". It is the number of cycles, together with the single-cycle execution time (which depends upon the source type and the computation parameters) which determines the total running time. Tests are made in the program to make sure that null or redundant computations are avoided. Specifically, all wind conditions for which the frequency of occurrence is zero, are bypassed, as are source receptor orientations such that the receptor is upwind of the source. The loop over wind speed is not computed for sources with a zero "plume-rise factor", since in this case the transfer function simply scales inversely as the wind speed. Similarly, the loop over pollutant only occurs if decay half-lives are specified, since only in this case is the transfer function dependent upon pollutant. Hence the "cycle count" may be interpreted as the number of non-zero and non-redundant computations involving a single source-receptor concentration and a single meteorological condition. Single-cycle execution times for line and area sources are dependent upon the parameter NCOMP, which specifies the maximum number of sub-elements into which each source is divided for integration purposes. The following table gives the approximate single-cycle execution times for NCOMP=5 as determined for the IBM 360/65:

Source Type	Single-Cycle Execution Time (msec)
Point	2.6
Line	6.5
Area	6.5

The estimated number of cycles, C, in a run is

$$C = NS \times NR \times M \tag{3-6}$$

where NS is the number of sources, NR the number of receptors, and M the mean number of meteorological conditions for which an independent computation occurs. Estimates of M may be made from the following table:

	Single Wind Condition	Wind Rose - No Plume Rise	Wind Rose with Plume Rise
POINT (typical)	~ 1/16	5	30
LINE AREA (typical)	~ 1/8	6-12	~ 60
LINE AREA (maximum)	1	80	480

where the maximum conditions apply when all receptors receive a contribution from all sources for all wind directions considered. As an example, an actual MARTIK run with the Newark 10-year average annual wind rose involved 100 receptors and 75 line sources. A total cycle count of 89240 (M=11.9) and a total cpu time on the IBM 360/65 of 9 minutes and 22 seconds (562 seconds).

NOTE that increased precision results from using higher values of NCOMP for line and area sources, but at the expense of sharply increased running times. The chief effect of increasing NCOMP is to reduce the residual "ripple" or computation noise which occurs with small displacements in receptor position. An increase in NCOMP to 50 results in about 10% increase in computed values, and about a factor of 5 increase in cycle time. Increasing NCOMP to 100 has little effect on the computed values, but doubles the cycle time for NCOMP=50. The value NCOMP=5 was selected as the best compromise between accuracy and speed of computation on the basis of sensitivity tests performed as a part of the model validation procedure. This value was used for all validation runs and all 1990 plan runs. The final calibration factors used in the study were based on this value of NCOMP.

3.4 Numbered Error Messages

The following table constitutes the set of conditions checked in the present level of implementation of the MARTIK program, listed by routine, number and cause:

<u>INPUT</u>

10	Unexpected '99999' encountered in job stream
80	Control card keyword cannot be identified.
800	Unexpected End-of-File encountered.

<u>INA</u>

20	TMIN,TMAX or XMIN specified out of range.
25	Unit to be rewound lies in invalid range 5-7.
45	Invalid output data set number.
800	Card read error in namelist &INPUT.
900	End of deck detected while reading namelist &INPUT; no &END card in namelist; &INPUT card read as comments card or missing; mis-punched namelist parameter.

<u>INB</u>

120	Attempt to exceed 100 receptors; given receptor number outside range 1-100.
210	For 'RCAL' or 'VALUES' packages, referenced receptors must have been previously read in with a 'POINTS' package.
240	More than 100 entries in Receptor output table for 'RCAL' or 'VALUES' package.
600	Same as 240.
710	Pollutant names on second card of 'VALUES' package don't agree with those of QNAM array.

INC

100 Type 1 wind rose requires a "1" in column 10 of the first card.

104 Constants C, or D for plume dispersion coefficient SIGZ must be positive and non-zero.

120 Stability class specified outside range 1-5.

130 Wind direction class specified outside range 1-16.

220 Wind frequency must be positive or zero; negative value detected.

350 Wind rose is not normalized; total frequency of occurence is not within 1% of normalization constant.

IND

10 Invalid logical unit number for emissions data set; negative or zero value detected.

20 Invalid logical unit number for emissions data set: one of the following detected: 3,4,6 or 7.

110 Invalid same type.

122 Emission factors not implemented in this version.

420 For 'GRID' input package, pollutant names don't match those specified for program, with QNAM parameter.

INE

20 Invalid carriage-control character detected in column 15 of a comments card: must be 'b','0','1'. ('b' = blank).

LOOPS

10 Invalid logical unit number for emissions data set: negative or zero value detected.

12 Invalid logical unit number for emissions data set: one of the following detected: 3,5,6, or 7.

30 Type parameter for emissions source lies outside range (1=point, 2=line, 3=area).

1100 Instantaneous mode not implemented in this version.

OUTPUT

20 Attempt to exceed 100 entries in output table.

3.5 MARTIK Test Cases

Three MARTIK test cases were run. The first two test cases are part of the system of runs for evaluation of the land use. The third MARTIK run is provided to demonstrate a feature of MARTIK which is not used in the system of runs.

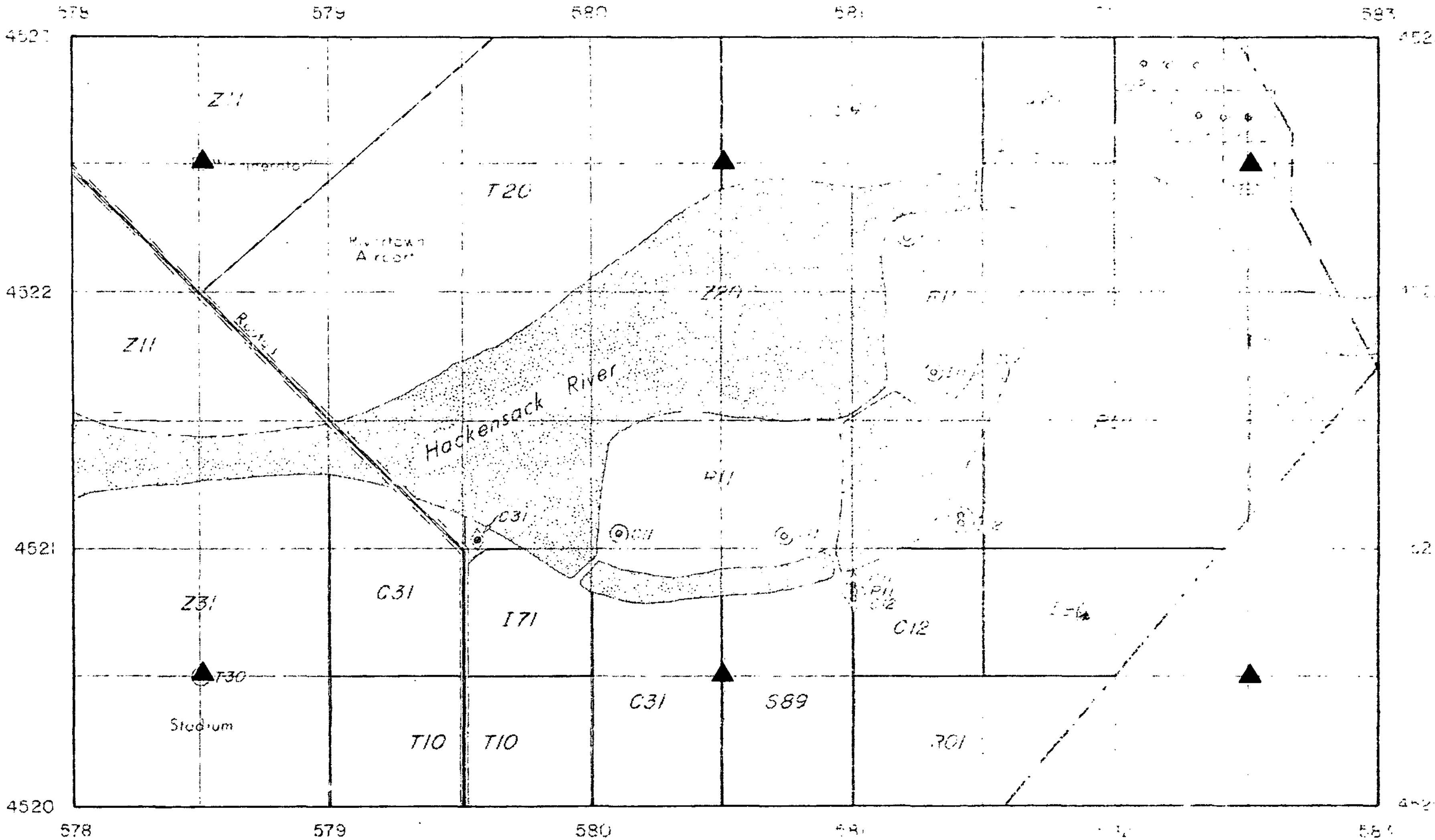
The first MARTIK run creates the background VALUES. This means the concentration values due to all the sources outside the region of interest. In this test case the background source used is a large area source, centered at 580.5, 4517.5, a square 5 km on a side. This represents a general course of pollutants which will be independent of the land use plan being considered. In other circumstances the background source(s) could be a city, a general population region, or other emissions source external to the land use plan. The concentration values resulting from the background sources are saved for further use.

The next MARTIK run is the run to complete the evaluation of the land use plan under evaluation. The specially calculated emissions from highways, incinerator, etc. are used to obtain the concentration due to them. The land use plan emissions are also input to determine concentrations. The sum of the background concentrations from the previous run, the special concentrations and the land use concentrations is output in another VALUES package for use in later programs. This output is the total air quality due to all the sources. The receptors used for the test case are shown in Figure .

The third MARTIK run demonstrates the ability to run a single weather condition. In this case the same complete emissions are used; but the calculations are set to give the resulting concentrations under a single weather condition. This would be done when there is interest in knowing the concentrations that would result from some especially interesting weather conditions.

3.5.1 MARTIK Test Case 1

The MARTIK test case #1 is a run to create a background VALUES package holding the pollutant concentrations at the receptors chosen, due to background sources.



▲ – *MARTIK Receptor Location*

Figure 44 Base Map With Martik Receptors

Job Control Language

MARTIK resides on a load library. For this run only four datasets will be required.

FT06 is the print file.

FT09 is the run-log dataset that must be included for every run of any program in the AQUIP system.

FT11 is a temporary dataset that is used to hold the source information in internal form.

FT12 is a card-image dataset that will hold a VALUES package that will be created in this run.

Keyword Package Input

The first package is the PARAMETERS package providing the following parameter values:

The pollutant names are : 'CO' and 'NO_X'.

2 pollutants are being modeled.

The output units are 'PPM' and 'UG/M**3', respectively.

The REACT conversion from g/m^3 are 846. and 1.0 E + 6, respectively.

UNIT (1), where the source data is held, is unit 11.

UNIT (2), used for the optional VALUES output, is unit 12.

NCOMP = 5 for reduced calculation time.

TMIN = 0.2, TMAX = 7.0 for reduced calibration time.

XMIN = 10., and

The RCON package will create the optional VALUES package on the output unit after calculating the values for each receptor because OUTP=.TRUE.. See Section 3.2.1 of the Task 5 Report for a description of the PARAMETERS package.

Page 1 of the output tabulates all the information that was input in PARAMETERS or that defaulted.

Following the PARAMETERS package POINTS package was used to set the locations where concentrations are to be calculated. The coordinate system of the receptors and sources must be the same. In this case UTM coordinates are being used. As can be seen in the list of receptors on page 2, six receptors were specified. All six were at ground level. See Figure 44 for the locations.

Next, the meteorological data is input using a standard MARTIK wind rose. The form of a wind rose is described in Section 3.2.5. The print on pages 3 through 7 tabulates the probability of occurrence for each weather condition. Each page has the values for one stability class, and the Table 1 gives the occurrence for each wind direction and wind speed within that stability class. This wind rose is an annual wind rose, so the frequencies of occurrence are the annual average frequency of occurrence for each of the weather conditions.

A COMPUTE 1 is used to establish the form of the wind variation with height. The equations that are used for wind variation with height are given in Section 3.3.1. Page 8 gives the reference height where the wind measurement were taken, and the exponent to be used for variation with height. Section 3.3.1 describes how these are input. If this compute had not been used the program would have assumed that there was no variation of wind speed with height.

Ths source data is then input with a SRCE package, see Section 3.2 7. In this case the background concentrations are due to one large area source centered at, 580.5, 4517.5, which is 5 km on each side. The emissions rate for the two pollutants is input. This information is stored on the temporary file on FT11. All previous sources on FT11 are deleted before the new ones are added; SRCE packages replace rather than add to one another.

The page 9 print lists the characteristics of the sources input.

With weather data, source data, and receptors present, the calculations can be performed by the keyword RCON. The methods used are described in the Task 2 Report. RCON first tallies a list, on page 10, of each source that has been considered for concentration calculations at each receptor. The COUNT information gives cycle counts that can be used to estimate program run time after some experience on the computer being used. The emissions that were calculated for each source are tallied to permit a user error check.

Page 11 is the table output by RCON giving the final calculated CO and NO_X concentrations at each receptor. The units for each pollutant are the output units that were specified in the PARAMETERS package. For each receptor the locations and concentrations are tabulated. Because OUTP=.TRUE. a VALUES package is created by RCON. As indicated on page 11, it is output on 12, UNIT (2)=12. This package begins with a VALUES keyword card which identifies the MARTIK run number and the date of creation. This permits later identification of the exact run which created the VALUES package. Then, using the receptors that have been specified and using output units the values for each pollutant receptor are created on unit 12 in card image form. This package conforms completely to the description of a VALUES package in Section 3.2.4.

With the VALUES package created there now is a VALUES package in the file FT12, DSNAME=VALUES, which holds the values due to the background sources. This information can be input into any following run which wants it. This was the purpose of the MARTIK run.

The run is terminated by an ENDJOB keyword.

3.5.2 MARTIK Test Case 2

This test case illustrates the use of the emissions data set executed in LANTRAN test case 2, together with other information input on cards, to generate the total air quality for this configuration.

Job Control Language

MARTIK resides on a program load module library at ERT. After the STEPLIB cards, the JCL describes the datasets needed in this test case.

FT06 is a print file.

FT09 is the run-log dataset that must be included for any run of a program in the AQUIP system.

FT11 is a temporary dataset where sources are held. This file must be provided for any run of MARTIK.

FT12 is a dataset that holds a VALUES package which was created in a previous run. In this case, it is the background VALUES created in test case #1, the Area Sources Background.

```
//ERTMACK3 JOB (88202440000,ERT**,101,***,MKEEFE,219*********,4610),XX,X
// MSGLEVEL=1,CLASS=B
/*PARMS  COPIES=03
//MARTIK EXEC PGM=MARTIK,REGION=120K,TIME=3
//STEPLIB DD DSN=NJMART(MARTIK),DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//FT06F001 DD SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1596)
//FT09F001 DD DSN=C461002.ERT01.LOGDATA,DISP=SHR,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AVC016)
//FT11F001 DD UNIT=SYSDA,SPACE=(TRK,1),
// DCB=(RECFM=VBR,LRECL=56,BLKSIZE=1124)
//FT12F001 DD DSN=VALUES,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//FT05F001 DD *
PARAMETERS             MARTIK TEST CASE #1 (ANNUAL WIND ROSE)
 &INPUT
 QNAM='CO','NOX', NQQ=2, QUNIT='PPM','UG/M**3', RFACT=846.,1.0E+6,
 U(1)=0.89, NCOMP=5, TMIN=0.2, TMAX=7.0, XMIN=10.0,
 C=0.072,0.072,0.169,1.070,1.010,D=1.220,1.220,1.010,0.682,0.554,
 OUTP=.TRUE.,
 &END
POINTS                 TEST RECEPTOR GRID
         1 578.5     4520.5
         2 578.5     4522.5
         3 580.5     4520.5
         4 580.5     4522.5
         5 582.5     4920.5
         6 582.5     4522.5
99999
METD                   NEWARK ANNUAL WIND ROSE                                  70000100
         1   700.0     285.6   1013.25  NEWARK   1970 ANNUAL      (8 OBS)       70000200
      1  3   .0        .000342  .0       .0        .0         .0                70000300
      1  6   .0        .000342  .0       .0        .0         .0                70000400
      1 11   .000342   .000342  .00      .0        .0         .0                70000500
      2  1   .000342   .0       .001027  .0        .0         .0                70000600
      2  2   .000342   .001370  .000342  .0        .0         .0                70000700
      2  3   .001027   .001370  .000685  .0        .0         .0                70000800
      2  4   .000342   .001712  .000685  .0        .0         .0                70000900
      2  5   .0        .001027  .000685  .0        .0         .0                70001000
      2  6   .000685   .001712  .000342  .0        .0         .0                70001100
      2  7   .000685   .000685  .002397  .0        .0         .0                70001200
      2  8   .000342   .001370  .001027  .0        .0         .0                70001300
      2  9   .000685   .0       .000342  .0        .0         .0                70001400
      2 10   .000685   .000685  .001027  .0        .0         .0                70001500
      2 11   .000342   .002055  .000342  .0        .0         .0                70001600
      2 12   .000685   .000685  .001370  .0        .0         .0                70001700
      2 13   .0        .001370  .000685  .0        .0         .0                70001800
      2 14   .0        .000342  .000685  .0        .0         .0                70001900
      2 15   .0        .000342  .000342  .0        .0         .0                70002000
      2 16   .0        .000685  .000342  .0        .0         .0                70002100
      3  1   .000703   .000685  .004452  .000685   .0         .0                70002200
      3  2   .000032   .002397  .004110  .0        .0         .0                70002300
      3  3   .000014   .001027  .002055  .0        .0         .0                70002400
      3  4   .000009   .000685  .001370  .0        .0         .0                70002500
      3  5   .000005   .000342  .001027  .0        .0         .0                70002600
      3  6   .000370   .001712  .001712  .000342   .0         .0                70002700
      3  7   .000717   .001712  .004452  .002397   .0         .0                70002800
      3  8   .000009   .000685  .004795  .000685   .0         .0                70003000
      3  9   .001074   .002397  .003082  .000342   .0         .0                70003100
      3 10   .000375   .002055  .001712  .000342   .0         .0                70003200

      3 11   .000370   .001712  .005479  .002397   .0         .0                70003300
      3 12   .000379   .002397  .005822  .003082   .0         .0                70003400
      3 13   .000703   .000685  .007192  .002397   .0         .0                70003500
      3 14   .000713   .001370  .002740  .001027   .000342    .0                70003600
      3 15   .0        .0       .001712  .001027   .0         .0                70003700
      3 16   .000005   .000342  .001370  .000342   .0         .0                70003800
      4  1   .000018   .003082  .019178  .019863   .001370    .0                70003900
      4  2   .000717   .004795  .022260  .016438   .002055    .000342           70004000
      4  3   .000369   .004110  .011301  .007877   .000342    .0                70004100
      4  4   .001070   .006164  .007192  .005479   .000342    .0                70004200
      4  5   .001432   .009247  .012329  .008219   .000342    .0                70004300
      4  6   .002113   .007877  .013356  .006507   .000685    .0                70004400
      4  7   .001765   .007192  .014726  .007877   .0         .0                70004500
      4  8   .002111   .007534  .007877  .004795   .000685    .0                70004600
      4  9   .003179   .013356  .023288  .008219   .000685    .0                70004700
      4 10   .001070   .006164  .008562  .005822   .000342    .000342           70004800
      4 11   .001769   .007877  .017808  .018836   .001712    .0                70004900
      4 12   .002464   .008904  .018836  .025000   .003082    .000685           70005000
      4 13   .001408   .005137  .012329  .025685   .005137    .001712           70005100
      4 14   .000355   .001712  .008219  .034247   .019178    .004110           70005200
      4 15   .000014   .002397  .008562  .028425   .006164    .001370           70005300
      4 16   .000008   .001370  .004452  .013699   .001712    .000685           70005400
      5  1   .001523   .006507  .005137  .0        .0         .0                70005500
      5  2   .001602   .010616  .003425  .0        .0         .0                70005600
      5  3   .000745   .002397  .001712  .0        .0         .0                70005700
      5  4   .001087   .002055  .000685  .0        .0         .0                70005800
      5  5   .000751   .002740  .000685  .0        .0         .0                70005900
      5  6   .001127   .004110  .000685  .0        .0         .0                70006000
      5  7   .001463   .003425  .002055  .0        .0         .0                70006100
      5  8   .000785   .004452  .000685  .0        .0         .0                70006200
      5  9   .003803   .016096  .006164  .0        .0         .0                70006300
      5 10   .001340   .015068  .007192  .0        .0         .0                70006400
      5 11   .003231   .022603  .012671  .0        .0         .0                70006500
      5 12   .003527   .019863  .013699  .0        .0         .0                70006600
      5 13   .003118   .016781  .008904  .0        .0         .0                70006700
      5 14   .001516   .006164  .017466  .0        .0         .0                70006800
      5 15   .000389   .002055  .006164  .0        .0         .0                70006900
      5 16   .000362   .000685  .004110  .0        .0         .0                70007000
99999
COMPUTE            1
          6.0       0.2
SRCE                 AREA SOURCE BACKGROUND
AREA                 REGIONAL BACKGROUND
         580.5     4517.5          5.0         5.0
           2.0E-06   2.5E-07
99999
RCON
ENDJOB
/*EOF
**
```

Figure 45 MARTIK Test Case 1 Deck Setup

```
//ERTHACKS JOB (8ncu2440000,ERT**,101,***,MKEEFE,219**********,4610),XX,X JOB 567
// MSGLEVEL=1,CLASS=B
***PARMS COPIES=03                                                             ACCEPTED
//MARTIK EXEC PGM=MARTIK,REGION=120K,TIME=5
//STEPLIB DD DSN=NJMART(MARTIK),DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//FT06F001 DD SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1596)
//FT09F001 DD DSN=C461002,ER701,LOGDATA,DISP=SHR,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AVC016)
//FT11F001 DD UNIT=SYSDA,SPACE=(TRK,1),
// DCB=(RECFM=VSB,LRECL=56,BLKSIZE=1124)
//FT12F001 DD DSN=VALUES,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//FT05F001 DD *
//
IEF236I ALLOC. FOR ERTHACKS MARTIK
IEF237I 101    ALLOCATED TO STEPLIB
IEF237I 080    ALLOCATED TO FT06F001
IEF237I 121    ALLOCATED TO FT09F001
IEF237I 251    ALLOCATED TO FT11F001
IEF237I 101    ALLOCATED TO FT12F001
IEF237I 062    ALLOCATED TO FT05F001
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   NJMART                                      KEPT
IEF285I   VOL SER NOS= AIRMAP,
IEF285I   C461002,ER701,LOGDATA                       KEPT
IEF285I   VOL SER NOS= AVC016,
IEF285I   SYS74044,T075013,RV000,ERTHACKS,R0005144    DELETED
IEF285I   VOL SER NOS= ACS001,
IEF285I   VALUES                                      KEPT
IEF285I   VOL SER NOS= AIRMAP,
IEF373I STEP /MARTIK  / START 74044,1815
IEF374I STEP /MARTIK  / STOP  74044,1815 CPU   0MIN 06,99SEC MAIN  94K LCS   0K
IEF375I  JOB /ERTHACKS/ START 74044,1815
IEF376I  JOB /ERTHACKS/ STOP  74044,1815 CPU   0MIN 06,99SEC

BEGIN MARTIN TIKVART DIFFUSION MODELING PROGRAM       VERSION   3,5 LEVEL 730208 RUN   3013
TABLE COUNT= 58

 15  3013     MARTIN TIKVART DIFFUSION MODELING PROGRAM        VERSION   3,5  (730208)            13 FEB 1974            PAGE   1
*************************************************************************************************************************************

                  MARTIK TEST CASE #1 (ANNUAL WIND ROSE)                              (UNIT  5)


                  AVERAGING MODE,

                  POLLUTANT=CO      , NOX     ,

                  UNITS=    PPM     ,UG/M**3 ,

                  FACTORS=   8,46E 02, 1,00E 06,

                  COORDINATE SCALE UNIT (METERS)=  1000,000

                  STABILITY CLASS= 1, 2, 3, 4, 5,

                  WIND DIRECTION CLASS= 1, 2, 3, 4, 5, 6, 7, 8, 9,10,11,12,13,14,15,16,

                  WINDSPEED CLASS= 1, 2, 3, 4, 5, 6,

                  WIND SPEED=  0,89,   2,46,   4,47,   6,93,   9,61,  12,52,

                  - - - - OPTIONS - - - -

                  SOURCE INPUT UNIT=    11
                  STATISTICAL OUTPUT=      F
                  STORE RESULTS=       F
                  OUTPUT RESULTS=       T
                  OUTPUT UNIT=   12


                  - - - - MODEL PARAMETERS - - - -

                                                  STABILITY CLASS
                                      1          2          3          4          5
                  COEFFICIENT A     0,032      0,097      0,266      0,348      0,413
                  COEFFICIENT B     1,400      1,120      0,860      0,680      0,580
                  COEFFICIENT C     0,072      0,072      0,169      1,070      1,010
                  COEFFICIENT D     1,220      1,220      1,010      0,682      0,554

                  NCOMP=    5, THIN= 2,000E-01, THAX= 7,000E 00, XMIN= 1,000E 01
 15  3013     MARTIN TIKVART DIFFUSION MODELING PROGRAM        VERSION   3,5  (730208)            13 FEB 1974            PAGE   2
*************************************************************************************************************************************


                  RECEPTOR INPUT DATA

                  TEST RECEPTOR GRID                                                  (UNIT  5)

                    RECEPTOR   X-COORD   Y-COORD   HEIGHT          NAME
                     NUMBER    SCALE U   SCALE U   METERS

                     1         578,50    4520,50    0,0
                     2         578,50    4522,50    0,0
                     3         580,50    4520,50    0,0
                     4         580,50    4522,50    0,0
                     5         582,50    4520,50    0,0
                     6         582,50    4522,50    0,0
```

Figure 46   MARTIK Test Case 1 Printed Output

METEOROLOGICAL INPUT DATA
NEWARK ANNUAL WIND ROSE (UNIT 5)

TYPE 1 WIND ROSE NEWARK 1970 ANNUAL (8 OBS)
AMBIENT TEMP= 285,60 DEG K AMBIENT PRESSURE= 1013,25 MB

STABILITY CLASS 1 DMX= 1050,0, XTR= 1393,9

WINDSPEED CLASS

WIND DIR.	1	2	3	4	5	6	SUM
N	0,0	0,0	0,0	0,0	0,0	0,0	0,0
NNE	0,0	0,0	0,0	0,0	0,0	0,0	0,0
NE	0,0	0,000342	0,0	0,0	0,0	0,0	0,000342
ENE	0,0	0,0	0,0	0,0	0,0	0,0	0,0
E	0,0	0,0	0,0	0,0	0,0	0,0	0,0
ESE	0,0	0,000342	0,0	0,0	0,0	0,0	0,000342
SE	0,0	0,0	0,0	0,0	0,0	0,0	0,0
SSE	0,0	0,0	0,0	0,0	0,0	0,0	0,0
S	0,0	0,0	0,0	0,0	0,0	0,0	0,0
SSW	0,0	0,0	0,0	0,0	0,0	0,0	0,0
SW	0,000342	0,000342	0,0	0,0	0,0	0,0	0,000684
WSW	0,0	0,0	0,0	0,0	0,0	0,0	0,0
W	0,0	0,0	0,0	0,0	0,0	0,0	0,0
WNW	0,0	0,0	0,0	0,0	0,0	0,0	0,0
NW	0,0	0,0	0,0	0,0	0,0	0,0	0,0
NNW	0,0	0,0	0,0	0,0	0,0	0,0	0,0
SUM	0,000342	0,001026	0,0	0,0	0,0	0,0	0,001368

TOTAL FREQUENCY OF OCCURRENCE,CLASS 1 = 0,00137

15 3013 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3,5 (730208) 13 FEB 1974 PAGE 4

STABILITY CLASS 2 DMX= 700,0, XTR= 999,7

WINDSPEED CLASS

WIND DIR.	1	2	3	4	5	6	SUM
N	0,000342	0,0	0,001027	0,0	0,0	0,0	0,001369
NNE	0,000342	0,001370	0,000342	0,0	0,0	0,0	0,002054
NE	0,001027	0,001370	0,000685	0,0	0,0	0,0	0,003082
ENE	0,000342	0,001712	0,000685	0,0	0,0	0,0	0,002739
E	0,0	0,001027	0,000685	0,0	0,0	0,0	0,001712
ESE	0,000685	0,001712	0,000342	0,0	0,0	0,0	0,002739
SE	0,000685	0,000685	0,002397	0,0	0,0	0,0	0,003767
SSE	0,000342	0,001370	0,001027	0,0	0,0	0,0	0,002739
S	0,000685	0,0	0,000342	0,0	0,0	0,0	0,001027
SSW	0,000685	0,000685	0,001027	0,0	0,0	0,0	0,002397
SW	0,000342	0,002055	0,000342	0,0	0,0	0,0	0,002739
WSW	0,000685	0,000685	0,001370	0,0	0,0	0,0	0,002740
W	0,0	0,001370	0,000685	0,0	0,0	0,0	0,002055
WNW	0,0	0,000342	0,000685	0,0	0,0	0,0	0,001027
NW	0,0	0,000342	0,000342	0,0	0,0	0,0	0,000684
NNW	0,0	0,000685	0,000342	0,0	0,0	0,0	0,001027
SUM	0,006162	0,015410	0,012325	0,0	0,0	0,0	0,033897

TOTAL FREQUENCY OF OCCURRENCE,CLASS 2 = 0,03390

15 3013 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3,5 (730208) 13 FEB 1974 PAGE 5

STABILITY CLASS 3 DMX= 700,0, XTR= 1806,1

WINDSPEED CLASS

WIND DIR.	1	2	3	4	5	6	SUM
N	0,000703	0,000685	0,004452	0,000685	0,0	0,0	0,006525
NNE	0,000032	0,002397	0,004110	0,0	0,0	0,0	0,006539
NE	0,000014	0,001027	0,002055	0,0	0,0	0,0	0,003096
ENE	0,000009	0,000685	0,001370	0,0	0,0	0,0	0,002064
E	0,000005	0,000342	0,001027	0,0	0,0	0,0	0,001374
ESE	0,000370	0,001712	0,001712	0,000342	0,0	0,0	0,004136
SE	0,000717	0,001712	0,004452	0,002397	0,0	0,0	0,009278
SSE	0,000009	0,000685	0,004795	0,000685	0,0	0,0	0,006174
S	0,001074	0,002397	0,003082	0,000342	0,0	0,0	0,006895
SSW	0,000375	0,002055	0,001712	0,000342	0,0	0,0	0,004484
SW	0,000370	0,001712	0,005479	0,002397	0,0	0,0	0,009958
WSW	0,000379	0,002397	0,005822	0,003082	0,0	0,0	0,011680
W	0,000703	0,000685	0,007192	0,002397	0,0	0,0	0,010977
WNW	0,000713	0,001370	0,002740	0,001027	0,000342	0,0	0,006192
NW	0,0	0,0	0,001712	0,001027	0,0	0,0	0,002739
NNW	0,000005	0,000342	0,001370	0,000342	0,0	0,0	0,002059
SUM	0,005478	0,020203	0,053082	0,015065	0,000342	0,0	0,094170

TOTAL FREQUENCY OF OCCURRENCE,CLASS 3 = 0,09417

Figure 46 Contd.

15 3013 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3.5 (730208) 13 FEB 1974 PAGE 6

STABILITY CLASS 4 DMX= 580.0, XTR= 3373.4

WINDSPEED CLASS

WIND DIR.	1	2	3	4	5	6	SUM
N	0.000018	0.003082	0.019178	0.019863	0.001370	0.0	0.043511
NNE	0.000717	0.004795	0.022260	0.016438	0.002055	0.000342	0.046607
NE	0.000369	0.004110	0.011301	0.007877	0.000342	0.0	0.023999
ENE	0.001070	0.006164	0.007192	0.005479	0.000342	0.0	0.020247
E	0.001432	0.009247	0.012329	0.008219	0.000342	0.0	0.031569
ESE	0.002113	0.007877	0.013356	0.006507	0.000685	0.0	0.030538
SE	0.001765	0.007192	0.014726	0.007877	0.0	0.0	0.031560
SSE	0.002111	0.007534	0.007877	0.004795	0.000685	0.0	0.023002
S	0.003179	0.013356	0.023288	0.008219	0.000685	0.0	0.048727
SSW	0.001070	0.006164	0.008562	0.005822	0.000342	0.000342	0.022302
SW	0.001769	0.007877	0.017808	0.018836	0.001712	0.0	0.048002
WSW	0.002464	0.008904	0.018836	0.025000	0.003082	0.000685	0.058971
W	0.001408	0.005137	0.012329	0.025685	0.005137	0.001712	0.051408
WNW	0.000355	0.001712	0.008219	0.034247	0.019178	0.004110	0.067821
NW	0.000014	0.002397	0.008562	0.028425	0.006164	0.001370	0.046932
NNW	0.000008	0.001370	0.004452	0.013699	0.001712	0.000685	0.021926
SUM	0.019862	0.096918	0.210275	0.236988	0.043833	0.009246	0.617121

TOTAL FREQUENCY OF OCCURRENCE,CLASS 4 = 0.61712

15 3013 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3.5 (730208) 13 FEB 1974 PAGE 7

STABILITY CLASS 5 DMX= 100.0, XTR= 1024.3

WINDSPEED CLASS

WIND DIR.	1	2	3	4	5	6	SUM
N	0.001523	0.006507	0.005137	0.0	0.0	0.0	0.013167
NNE	0.001602	0.010616	0.003425	0.0	0.0	0.0	0.015643
NE	0.000745	0.002397	0.001712	0.0	0.0	0.0	0.004854
ENE	0.001087	0.002055	0.000685	0.0	0.0	0.0	0.003827
E	0.000751	0.002740	0.000685	0.0	0.0	0.0	0.004176
ESE	0.001127	0.004110	0.000685	0.0	0.0	0.0	0.005922
SE	0.001463	0.003425	0.002055	0.0	0.0	0.0	0.006943
SSE	0.000785	0.004452	0.000685	0.0	0.0	0.0	0.005922
S	0.003803	0.016096	0.006164	0.0	0.0	0.0	0.026063
SSW	0.001340	0.015068	0.007192	0.0	0.0	0.0	0.023600
SW	0.003231	0.022603	0.012671	0.0	0.0	0.0	0.038505
WSW	0.003527	0.019863	0.013699	0.0	0.0	0.0	0.037089
W	0.003118	0.016781	0.008904	0.0	0.0	0.0	0.028803
WNW	0.001516	0.006164	0.017466	0.0	0.0	0.0	0.025146
NW	0.000389	0.002055	0.006164	0.0	0.0	0.0	0.008608
NNW	0.000362	0.000685	0.004110	0.0	0.0	0.0	0.005157
SUM	0.026369	0.135617	0.091439	0.0	0.0	0.0	0.253425

TOTAL FREQUENCY OF OCCURRENCE,CLASS 5 = 0.25342

TOTAL FREQUENCY OF OCCURRENCE,CLASSES 1 TO 5 = 0.99998

15 3013 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3.5 (730208) 13 FEB 1974 PAGE 8

(UNIT 5)

COMPUTATIONS PERFORMED BY ROUTINE 1

Z1= 6.00 EXPONENT= 0.20000

15 3013 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3.5 (730208) 13 FEB 1974 PAGE 9

SOURCE INPUT DATA

AREA SOURCE BACKGROUND (UNIT 5)

```
NO=  1   TYPE=A    CODE=NONE              REGIONAL BACKGROUND
COORDS=   580.50   4517.50     5.00     5.00             HEIGHT=  0.0       P=   0.0
EMISSIONS---       CO      = 2.000E-06 NOX     = 2.500E-07
SOURCE COUNT=    1
TRANSFERRED TO UNIT 11
```

15 3013 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3.5 (730208) 13 FEB 1974 PAGE 10

AREA SOURCE BACKGROUND (UNIT 11)

SOURCE TOTAL EMISSION RATES IN GM/SEC

NUMBER	COUNT	TYPE	CO	NOX
1	0	A	5.000E 01	6.250E 00
		TOTALS	5.000E 01	6.250E 00

Figure 46 Contd.

15 3013 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3.5 (730208) 13 FEB 1974 PAGE 1

ARITHMETIC MEAN POLLUTANT CONCENTRATIONS

COORDINATE SCALE UNIT (METERS)= 1000,000

RECEPTOR NUMBER	X-COORD SCALE U	Y-COORD SCALE U	HEIGHT METERS	CO PPM	NOX UG/M**3
1	578,5	4520,5	0,0	0,0054	0,7996
2	578,5	4522,5	0,0	0,0023	0,3350
3	580,5	4520,5	0,0	0,0075	1,1074
4	580,5	4522,5	0,0	0,0033	0,4883
5	582,5	4520,5	0,0	0,0082	1,2165
6	582,5	4522,5	0,0	0,0038	0,5558

RECEPTOR CONCENTRATIONS OUTPUT TO TAPE 12 BEGINNING' SEQUENCE NUMBER 30130020

END OF RUN, CYCLE COUNT= 176

END OF PROGRAM,

Figure 46 Contd.

FT13 is a dataset that holds a SRCE package created by LANTRAN (test case #2) which holds point sources and a GRID emissions package. This particular dataset holds the ANNUAL emissions created by LANTRAN.

FT14 is a dataset which will hold the calculated concentrations at each receptor. It will be a VALUES package.

NOTE: The units need not have been 12, 13, and 14. If other unit numbers had been given in the keyword cards and PARAMETERS other units would be used.

Keyword Package Input

The first package used is a PARAMETERS package, see Section 3.2 of the Task 5 Report. The input specifies the following changes from the defaults:

The pollutant names are: 'CO' and 'NO_X'

2 pollutants are being modeled.

The output units are 'PPM' and 'UG/M**3', respectively.

The RFACT conversion from g/m^3 are 846. and 1.0 E + 6, respectively.

UNIT (1), where the source data is held, is unit 11.

UNIT (2), used for the optional VALUES output, is unit 14.

NCOMP = 5 for reduced calculation time.

TMIN = 0.2, TMAX = 7.0 for reduced calculation time.

XMIN = 10., and

the C coefficient in determining σz has been changed from the default to the values listed.

The listing on page 1 gives the modified values for the PARAMETERS.

After the PARAMETERS a POINTS package is used to set receptor locations, see Section 3.2.2. In this run six receptor locations are specified.
NOTE: The receptors must use the same coordinate system as the SRCE's.
The receptor numbers and their locations are listed on page 2. There are the locations for which MARTIK will calculate concentrations.

Next, a METD package inputs a standard MARTIK stability wind-rose, see Section 3.2.5. Pages 3 through 7 give a complete listing of the frequency of occurrence for each weather condition.

This run is making use of the correction for wind variation with height, described in Section 3.3.1. This is done with a COMPUTE 1, see Section 3.3.1.

If this had not been done, the values of Z_1, and EX would have remained at their default of zero, indicating no variation of wind with height. This run indicates that the wind measurements were taken at 6 meters and the wind variation is a power law with an exponent of .2.

A SRCE package with two background sources, are POINT and one LINE- is input following the COMPUTE 1. These fit the SRCE description, Section 3.27. The inputs are echoed on page 9 of the output. They are temporarily stored on unit 11 in internal form.

With receptors, weather and sources present, RCON is input to perform the calculations. The page 10 of the output gives the cumulative interation count and total emissions for each source. The iteration count can be used to estimate CPU time requirements after a little experience with the facility being used. The emissions provide a check for possible errors in input. Page 11 tabulates the results of the calculations for each receptor.

Using the prediction methodology described in the Task 2 Report, MARTIK calculates the annual average concentration at each receptor due to the sources previously input. The tabulation indicates the receptor number, location, and the concentration for each pollutant, in the appropriate units.

A PARAMETERS package follows, setting RSTORE=.TRUE., the permit storage of the resulting values for each receptor. Page 12 indicates the change.

The concentration values will be stored by RSTORE from the receptor concentration array RCON into the background array RBKG.

The COMPUTE 3 takes the values saved in RBKG and sets the work array RCONB equal to them. A COMPUTE 2 then zeroes RBKG.

At this stage the concentrations due to the two sources input are in RCOMB. The background array RBKG is zero.

The next package is a SRCE package that uses the emissions calculated in the LANTRAN test case 2. By specifying IC=13 on the SRCE keywork card the program is instructed to look on FT 13 for the SRCE package it will use for the source date. FT 13 is the dataset EMISS1 earlier created by LANTRAN. Note that IC was positive; if some "cards" had already been read off 13, the SRCE package would look at the next "card" in order on this unit. If IC had been -13 the unit would have been rewound to the beginning, and then a SRCE package expected.

LANTRAN creates a SRCE package titled: LANTRAN season POINT AND GRIDDED AREA SOURCE DATA, or GRIDDED AREA SOURCE DATA, depending on whether any point sources had been selected. In the LANTRAN test case #2 one point source was selected, and it is listed in the SRCE listing on page 15.

Next, and finally, the GRID package is read. The GRID format is described in Section 2.2.5. First the gird is defined, then the values for the emissions in each grid cell. The results of these reads are presented on page 15. The output from LANTRAN has now been read into MARTIK and resides in MARTIK internal form on FT11. NOTE: while GRID input gives emissions in gm/(SCALE UNIT), the SRCE tally on page 15 was gm/m^2.

An RCON is then executed. Using the new set of emissions from LANTRAN, concentrations are calculated for each of the receptors. The cycle count and emissions are printed on page 16, and the final resultant values are tabulated on page 17. RSTORE was set to .TRUE. before this run, the values for each receptor are also stored in RBKG. These values are those due to the ANNUAL emissions calculated by LANTRAN.

A PARAMETERS package follows the RCON. This sets OUTP =.TRUE. The other parameters remain unchanged. From this point on any RCON or COMPUTE 9 will produce output in VALUES form on UNIT(2), 14.

A COMPUTE 4 is used to take the values just calculated, in RBKG, and add them to the previously calculated values in RCONB (which are zero in this case).

Next, an RCAL package is used to set the values in the RCAL array, see Section 3.2.3. This sets the calibration factor to be applied to the values for each receptor and pollutant. Page 20 gives a print of the values input. It signifies the fact that the calibrations apply to <u>all</u> receptors by giving a receptor number *****.

After inputing calibrations, the general background concentrations are input in a VALUES package, see Section 3.2.4. The VALUES package resides in card image form on the dataset VALUES, FT12, specified by IC=12.

The VALUES were created in the MARTIK test case #1. The pollutant output units were ppm, and $\mu g/m^3$ in case #1, as they are in this test case. The output units should correspond for both the creating and reading runs to obtain the proper values.

On page 21, the VALUES input are tabulated. These values are the background concentrations created in MARTIK test case #1, now in the RBKG array of MARTIK in tast case #2.

Another COMPUTE 4 is used to take these background values in RBKG, add them to the previously calculated concentration in RCONB, due to the local emissions, and store the result in RCONB. Then a COMPUTE 2 followed by COMPUTE 6 zero the RBKG and then the RCON arrays. This is done to clear the RCON array for future use.

The COMPUTE 8 takes the total of concentration due to the many sources, RCONB, multiplies it by the calibration factors input in the RCAL package, and places the results in RCON. Now RCON contains the calibrated concentrations due to all the sources.

The COMPUTE 9 tabulates the final, calibrated concentration, and, because OUTP=.TRUE., creates a VALUES package on FT14. Both the tabulation and VALUES package use PPM, and ug/m^3 for CO and NO_X units. The VALUES package begins with a keyword card VALUES with a title indicating the MARTIK run number and date of creation, followed by cards obeying the VALUES format.

The MARTIK run is then terminated with an ENDJOB.

3.5.3 MARTIK Test Case 3

This test case demonstrates the calculation of the contravention values that occur in a specific weather condition. Using the same sources as in the previous test case, it calculates the concentrations that would occur under neutral stability, class 4, with a southwest wind in the lowest windspeed class. The difference between this test case and test case #2 are:

A different METD package.

Slight changes in PARAMETERS.

This run will not create any VALUES package for later use.

```
//ERTHACKX JOB (S8202440000,ERT--,101,---,MKEEFE,219---------,4610),XX,X
// MSGLEVEL=1,CLASS=B
/*PARMS  COPIES=03
//MARTIK EXEC PGM=MARTIK,REGION=120K,TIME=3
//STEPLIB DD DSN=NJMART(MARTIK),DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//FT06F001 DD SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1596)
//FT09F001 DD DSN=C461002,ER701,LOGDATA,DISP=SHR,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AVC016)
//FT11F001 DD UNIT=SYSDA,SPACE=(TRK,1),
// DCB=(RECFM=VSB,LRECL=56,BLKSIZE=1124)
//FT12F001 DD DSN=VALUES,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//FT13F001 DD DSN=EMISS1,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO.FT14F001 DD DSN=AQUAL,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//FT05F001 DD *
PARAMETERS          MARTIK TEST CASE #2 (ANNUAL WIND ROSE)
 &INPUT
 QNAME='CO','NOX', NQQ=2, QUNIT='PPM','UG/M**3', RFACT=846.,1.0E+6,
 UNIT=11,14, U(1)=0.89, NCOMP=5, THIN=0.2, THAX=7.0, XMIN=10.0,
 C=0.072,0.072,0.072,0.169,1.070,1.010,D=1.220,1.220,1.010,0.682,0.554,
 &END
POINTS              TEST RECEPTOR GRID
         1 578.5     4520.5
         2 578.5     4522.5
         3 580.5     4520.5
         4 580.5     4522.5
         5 582.5     4520.5
         6 582.5     4522.5
99999
METO                NEWARK ANNUAL WIND ROSE                                   70000100
            1   700.0     285.6   1013.25  NEWARK  1970 ANNUAL    (8 OBS)   70000200
        1  3   .0        .000342   .0        .0        .0        .0         70000300
        1  6   .0        .000342   .0        .0        .0        .0         70000400
        1 11   .000342   .000342   .00       .0        .0        .0         70000500
        2  1   .000342   .0        .001027   .0        .0        .0         70000600
        2  2   .000342   .001370   .000342   .0        .0        .0         70000700
        2  3   .001027   .001370   .000685   .0        .0        .0         70000800
        2  4   .000342   .001712   .000685   .0        .0        .0         70000900
        2  5   .0        .001027   .000685   .0        .0        .0         70001000
        2  6   .000685   .001712   .000342   .0        .0        .0         70001100
        2  7   .000685   .000685   .002397   .0        .0        .0         70001200
        2  8   .000342   .001370   .001027   .0        .0        .0         70001300
        2  9   .000685   .0        .000342   .0        .0        .0         70001400
        2 10   .000685   .000685   .001027   .0        .0        .0         70001500
        2 11   .000342   .002055   .000342   .0        .0        .0         70001600
        2 12   .000685   .000685   .001370   .0        .0        .0         70001700
        2 13   .0        .001370   .000685   .0        .0        .0         70001800
        2 14   .0        .000342   .000685   .0        .0        .0         70001900
        2 15   .0        .000342   .000342   .0        .0        .0         70002000
        2 16   .0        .000685   .000342   .0        .0        .0         70002100
        3  1   .000703   .000685   .004452   .000685   .0        .0         70002200
        3  2   .000032   .002397   .004110   .0        .0        .0         70002300
        3  3   .000014   .001027   .002055   .0        .0        .0         70002400
        3  4   .000009   .000685   .001370   .0        .0        .0         70002500
        3  5   .000005   .000342   .001027   .0        .0        .0         70002600
        3  6   .000370   .001712   .001712   .000342   .0        .0         70002700
        3  7   .000717   .001712   .004452   .002397   .0        .0         70002800
        3  8   .000009   .000685   .004795   .000685   .0        .0         70003000
        3  9   .001074   .002397   .003082   .000342   .0        .0         70003100
        3 10   .000375   .002055   .001712   .000342   .0        .0         70003200
        3 11   .000370   .001712   .005479   .002397   .0        .0         70003300
        3 12   .000379   .002397   .005822   .003082   .0        .0         70003400
        3 13   .000703   .000685   .007192   .002397   .0        .0         70003500
        3 14   .000713   .001370   .002740   .001027   .000342   .0         70003600
        3 15   .0        .0        .001712   .001027   .0        .0         70003700
        3 16   .000005   .000342   .001370   .000342   .0        .0         70003800
        4  1   .000018   .003082   .019178   .019863   .001370   .0         70003900
        4  2   .000717   .004795   .022260   .016438   .002055   .000342    70004000
        4  3   .000369   .004110   .011301   .007877   .000342   .0         70004100
        4  4   .001070   .006164   .007192   .005479   .000342   .0         70004200
        4  5   .001432   .009247   .012329   .008219   .000342   .0         70004300
        4  6   .002113   .007877   .013356   .006507   .000685   .0         70004400
        4  7   .001765   .007192   .014726   .007877   .0        .0         70004500
        4  8   .002111   .007534   .007877   .004795   .000685   .0         70004600
        4  9   .003179   .013356   .023288   .008219   .000685   .0         70004700
        4 10   .001070   .006164   .008562   .005822   .000342   .000342    70004800
        4 11   .001769   .007877   .017808   .018836   .001712   .0         70004900
        4 12   .002464   .008904   .018836   .025000   .003082   .000685    70005000
        4 13   .001408   .005137   .012329   .025685   .005137   .001712    70005100
        4 14   .000355   .001712   .008219   .034247   .019178   .004110    70005200
        4 15   .000014   .002397   .008562   .028425   .006164   .001370    70005300
        4 16   .000008   .001370   .004452   .013699   .001712   .000685    70005400
        5  1   .001523   .006507   .005137   .0        .0        .0         70005500
        5  2   .001602   .010616   .003425   .0        .0        .0         70005600
        5  3   .000745   .002397   .001712   .0        .0        .0         70005700
        5  4   .001087   .002055   .000685   .0        .0        .0         70005800
        5  5   .000751   .002740   .000685   .0        .0        .0         70005900
        5  6   .001127   .004110   .000685   .0        .0        .0         70006000
        5  7   .001463   .003425   .002055   .0        .0        .0         70006100
        5  8   .000785   .004452   .000685   .0        .0        .0         70006200
        5  9   .003803   .016096   .006164   .0        .0        .0         70006300
        5 10   .001340   .015068   .007192   .0        .0        .0         70006400
        5 11   .003231   .022603   .012671   .0        .0        .0         70006500
        5 12   .003527   .019863   .013699   .0        .0        .0         70006600
        5 13   .003118   .016781   .008904   .0        .0        .0         70006700
        5 14   .001516   .006164   .017466   .0        .0        .0         70006800
        5 15   .000389   .002055   .006164   .0        .0        .0         70006900
        5 16   .000362   .000685   .004110   .0        .0        .0         70007000
99999
COMPUTE          1
           6.0        0.2
SRCE                POINT & LINE BACKGROUND
POINT               POINT BACKGROUND
          580.5      4517.5
          4.0        10.0
LINE                LINE BACKGROUND
          578.0      4515.0    583.0      4520.0
          .025       .004
99999
RCON
PARAMETERS          SAVE CONCENTRATIONS IN THE 'RBKG' ARRAY
 &INPUT RSTORE=.TRUE. &END
COMPUTE           3  RBKG(VALUES)->RCONB
COMPUTE           2  ZERO 'RBKG'
SRCE         13      POINT & GRID SOURCES
RCON
PARAMETERS          SAVE CONCENTRATIONS; SPECIFY OUTPUT UNIT
```

Figure 47 MARTIK Test Case 2 Deck Set-Up

```
 &INPUT OUTP=.TRUE., RSTORE=.TRUE. &END
COMPUTE           4  RBKG+RCONB=>RCONB
RCAL                 HACKENSACK REGION--ANNUAL CALIBRATION FACTORS
          CO         NOX
          1.95       0.63
99999
VALUES        12     AREA SOURCE BACKGROUND
COMPUTE           4  RBKG+RCONB=>RCONB
COMPUTE           2  0=>RBKG
COMPUTE           6  RBKG=>RCON=0
COMPUTE           8  RCAL*RCONB=>RCON
COMPUTE           9  TABULATE
ENDJOB
/*EOF
**
```

Figure 47 Contd.

```
//ERTTEST1 JOB (S8200244000,ERT--,101,---,MKEEFE,219---------,4610),XX,x JOB 620
// MSGLEVEL=1,CLASS=B
***PARMS COPIES$04                                                          ACCEPTED
//MARTIK EXEC PGM=MARTIK,REGION=120K,TIME=3
//STEPLIB DD DSN=NJMART(MARTIK),DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//FT06F001 DD SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1596)
//FT09F001 DD DSN=C461002,ER701,LOGDATA,DISP=SHR,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AVC016)
//FT11F001 DD UNIT=SYSDA,SPACE=(TRK,1),
// DCB=(RECFM=VSB,LRECL=56,BLKSIZE=1124)
//FT12F001 DD DSN=VALUES,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//FT13F001 DD DSN=EMISS1,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO.FT14F001 DD DSN=AQUAL,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//FT05F001 DD *
//
IEF236I ALLOC. FOR ERTTEST1 MARTIK
IEF237I 103    ALLOCATED TO STEPLIB
IEF237I 084    ALLOCATED TO FT06F001
IEF237I 121    ALLOCATED TO FT09F001
IEF237I 251    ALLOCATED TO FT11F001
IEF237I 103    ALLOCATED TO FT12F001
IEF237I 103    ALLOCATED TO FT13F001
IEF237I 103    ALLOCATED TO FT14F001
IEF237I 069    ALLOCATED TO FT05F001
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   NJMART                                               KEPT
IEF285I   VOL SER NOS= AIRMAP.
IEF285I   C461002,ER701,LOGDATA                                KEPT
IEF285I   VOL SER NOS= AVC016.
IEF285I   SYS74112.T080432.RV000.ERTTEST1.R0006046             DELETED
IEF285I   VOL SER NOS= ACS001.
IEF285I   VALUES                                               KEPT
IEF285I   VOL SER NOS= AIRMAP.
IEF285I   EMISS1                                               KEPT
IEF285I   VOL SER NOS= AIRMAP.
IEF285I   AQUAL                                                KEPT
IEF285I   VOL SER NOS= AIRMAP.
IEF373I STEP /MARTIK  / START 74112.1804
IEF374I STEP /MARTIK  / STOP  74112.1804 CPU   0MIN 16.63SEC MAIN 102K LCS   0K
IEF375I  JOB /ERTTEST1/ START 74112.1804
IEF376I  JOB /ERTTEST1/ STOP  74112.1804 CPU   0MIN 16.63SEC
```

Figure 48 MARTIK Test Case 2 Printed Output

```
BEGIN MARTIN TIKVART DIFFUSION MODELING PROGRAM        VERSION   3.5 LEVEL 730208 RUN   3023
TABLE COUNT= 44
```



```
MARTIN TEST CASE #2 (ANNUAL WIND ROSE)                        (UNIT  5)

AVERAGING MODE,

POLLUTANT=CO       , NOX      ,

UNITS=   PPM       ,UG/M**3 ,

FACTORS=   8.46E 02, 1.00E 06,

COORDINATE SCALE UNIT (METERS)=  1000.000

STABILITY CLASS= 1, 2, 3, 4, 5,

WIND DIRECTION CLASS= 1, 2, 3, 4, 5, 6, 7, 8, 9,10,11,12,13,14,15,16,

WINDSPEED CLASS= 1, 2, 3, 4, 5, 6,

WIND SPEED=  0.89,   2.46,   4.47,   6.93,   9.61,  12.52,

- - - - OPTIONS - - - -

SOURCE INPUT UNIT=    11
STATISTICAL OUTPUT=        F
STORE RESULTS=          F
OUTPUT RESULTS=         F

- - - - MODEL PARAMETERS - - - -
```

	STABILITY CLASS 1	2	3	4	5
COEFFICIENT A	0.032	0.097	0.266	0.348	0.413
COEFFICIENT B	1.440	1.120	0.860	0.680	0.580
COEFFICIENT C	0.072	0.072	0.169	1.070	1.010
COEFFICIENT D	1.220	1.220	1.010	0.682	0.554

```
NCOMP=    5, TMIN= 2.000E-01, TMAX= 7.000E 00, XMIN= 1.000E 01
```



```
RECEPTOR INPUT DATA

TEST RECEPTOR GRID                                            (UNIT  5)
```

RECEPTOR NUMBER	X-COORD SCALE U	Y-COORD SCALE U	HEIGHT METERS	NAME
1	578.50	4520.50	0.0	
2	578.50	4522.50	0.0	
3	580.50	4520.50	0.0	
4	580.50	4522.50	0.0	
5	582.50	4520.50	0.0	
6	582.50	4522.50	0.0	


```
METEOROLOGICAL INPUT DATA
NEWARK ANNUAL WIND ROSE                                       (UNIT  5)

TYPE 1 WIND ROSE                         NEWARK  1970 ANNUAL     (8 OBS)
AMBIENT TEMP=    285.60 DEG K            AMBIENT PRESSURE=  1013.25 MB

STABILITY CLASS  1                       DMX=    1050.0, XTR=    1393.9
```

WINDSPEED CLASS

WIND DIR.	1	2	3	4	5	6	SUM
N	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NNE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NE	0.0	0.000342	0.0	0.0	0.0	0.0	0.000342
ENE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ESE	0.0	0.000342	0.0	0.0	0.0	0.0	0.000342
SE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SSW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SW	0.000342	0.000342	0.0	0.0	0.0	0.0	0.000684
WSW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0
WNW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NNW	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SUM	0.000342	0.001026	0.0	0.0	0.0	0.0	0.001368

```
TOTAL FREQUENCY OF OCCURRENCE,CLASS  1 =    0.00137
```

Figure 48 Contd.

STABILITY CLASS 2 DMX= 700,0, XTR= 999,7

WINDSPEED CLASS

WIND DIR.	1	2	3	4	5	6	SUM
N	0,000342	0,0	0,001027	0,0	0,0	0,0	0,001369
NNE	0,000342	0,001370	0,000342	0,0	0,0	0,0	0,002054
NE	0,001027	0,001370	0,000685	0,0	0,0	0,0	0,003082
ENE	0,000342	0,001712	0,000685	0,0	0,0	0,0	0,002739
E	0,0	0,001027	0,000685	0,0	0,0	0,0	0,001712
ESE	0,000685	0,001712	0,000342	0,0	0,0	0,0	0,002739
SE	0,000685	0,000685	0,002397	0,0	0,0	0,0	0,003767
SSE	0,000342	0,001370	0,001027	0,0	0,0	0,0	0,002739
S	0,000685	0,0	0,000342	0,0	0,0	0,0	0,001027
SSW	0,000685	0,000685	0,001027	0,0	0,0	0,0	0,002397
SW	0,000342	0,002055	0,000342	0,0	0,0	0,0	0,002739
WSW	0,000685	0,000685	0,001370	0,0	0,0	0,0	0,002740
W	0,0	0,001370	0,000685	0,0	0,0	0,0	0,002055
WNW	0,0	0,000342	0,000685	0,0	0,0	0,0	0,001027
NW	0,0	0,000342	0,000342	0,0	0,0	0,0	0,000684
NNW	0,0	0,000685	0,000342	0,0	0,0	0,0	0,001027
SUM	0,006162	0,015410	0,012325	0,0	0,0	0,0	0,033897

TOTAL FREQUENCY OF OCCURRENCE,CLASS 2 = 0,03390

STABILITY CLASS 3 DMX= 700,0, XTR= 1806,1

WINDSPEED CLASS

WIND DIR.	1	2	3	4	5	6	SUM
N	0,000703	0,000685	0,004452	0,000685	0,0	0,0	0,006525
NNE	0,000032	0,002397	0,004110	0,0	0,0	0,0	0,006539
NE	0,000014	0,001027	0,002055	0,0	0,0	0,0	0,003096
ENE	0,000009	0,000685	0,001370	0,0	0,0	0,0	0,002064
E	0,000005	0,000342	0,001027	0,0	0,0	0,0	0,001374
ESE	0,000370	0,001712	0,001712	0,000342	0,0	0,0	0,004136
SE	0,000717	0,001712	0,004452	0,002397	0,0	0,0	0,009278
SSE	0,000009	0,000685	0,004795	0,000685	0,0	0,0	0,006174
S	0,001074	0,002397	0,003082	0,000342	0,0	0,0	0,006895
SSW	0,000375	0,002055	0,001712	0,000342	0,0	0,0	0,004484
SW	0,000370	0,001712	0,005479	0,002397	0,0	0,0	0,009958
WSW	0,000379	0,002397	0,005822	0,003082	0,0	0,0	0,011680
W	0,000703	0,000685	0,007192	0,002397	0,0	0,0	0,010977
WNW	0,000713	0,001370	0,002740	0,001027	0,000342	0,0	0,006192
NW	0,0	0,0	0,001712	0,001027	0,0	0,0	0,002739
NNW	0,000005	0,000342	0,001370	0,000342	0,0	0,0	0,002059
SUM	0,005478	0,020203	0,053082	0,015065	0,000342	0,0	0,094170

TOTAL FREQUENCY OF OCCURRENCE,CLASS 3 = 0,09417

STABILITY CLASS 4 DMX= 580,0, XTR= 3373,4

WINDSPEED CLASS

WIND DIR.	1	2	3	4	5	6	SUM
N	0,000018	0,003082	0,019178	0,019863	0,001370	0,0	0,043511
NNE	0,000717	0,004795	0,022260	0,016438	0,002055	0,000342	0,046607
NE	0,000369	0,004110	0,011301	0,007877	0,000342	0,0	0,023999
ENE	0,001070	0,006164	0,007192	0,005479	0,000342	0,0	0,020247
E	0,001432	0,009247	0,012329	0,008219	0,000342	0,0	0,031569
ESE	0,002113	0,007877	0,013356	0,006507	0,000685	0,0	0,030538
SE	0,001765	0,007192	0,014726	0,007877	0,0	0,0	0,031560
SSE	0,002111	0,007534	0,007877	0,004795	0,000685	0,0	0,023002
S	0,003179	0,013356	0,023288	0,008219	0,000685	0,0	0,048727
SSW	0,001070	0,006164	0,008562	0,005822	0,000342	0,000342	0,022302
SW	0,001769	0,007877	0,017808	0,018836	0,001712	0,0	0,048002
WSW	0,002464	0,008904	0,018836	0,025000	0,003082	0,000685	0,058971
W	0,001408	0,005137	0,012329	0,025685	0,005137	0,001712	0,051408
WNW	0,000355	0,001712	0,008219	0,030207	0,019178	0,004110	0,067921
NW	0,000014	0,002397	0,008562	0,028425	0,006164	0,001370	0,046932
NNW	0,000008	0,001370	0,004452	0,013699	0,001712	0,000685	0,021926
SUM	0,019862	0,096918	0,210275	0,236988	0,043833	0,009246	0,617121

TOTAL FREQUENCY OF OCCURRENCE,CLASS 4 = 0,61712

Figure 48 Contd.

15 3023 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3,5 (730208) 22 APR 1974 PAGE 7

STABILITY CLASS 5 DMX= 100,0, XTH= 1024,3

WINDSPEED CLASS

WIND DIR.	1	2	3	4	5	6	SUM
N	0,001523	0,006507	0,005137	0,0	0,0	0,0	0,013167
NNE	0,001602	0,010616	0,003425	0,0	0,0	0,0	0,015643
NE	0,000745	0,002397	0,001712	0,0	0,0	0,0	0,004854
ENE	0,001087	0,002055	0,000685	0,0	0,0	0,0	0,003827
E	0,000751	0,002740	0,000685	0,0	0,0	0,0	·,004176
ESE	0,001127	0,004110	0,000685	0,0	0,0	0,0	0,005922
SE	0,001463	0,003425	0,002055	0,0	0,0	0,0	0,006943
SSE	0,000785	0,004452	0,000685	0,0	0,0	0,0	0,005922
S	0,003803	0,016096	0,006164	0,0	0,0	0,0	0,026063
SSW	0,001340	0,015068	0,007192	0,0	0,0	0,0	0,023600
SW	0,003231	0,022603	0,012671	0,0	0,0	0,0	0,038505
WSW	0,003527	0,019863	0,013699	0,0	0,0	0,0	0,037089
W	0,003118	0,016781	0,008904	0,0	0,0	0,0	0,028803
WNW	0,001516	0,006164	0,017466	0,0	0,0	0,0	0,02[illegible]146
NW	0,000389	0,002055	0,006164	0,0	0,0	0,0	0,008608
NNW	0,000362	0,000685	0,004110	0,0	0,0	0,0	0,005157
SUM	0,026369.	0,135617	0,091439	0,0	0,0	0,0	0,253425

TOTAL FREQUENCY OF OCCURRENCE,CLASS 5 = 0,25342

TOTAL FREQUENCY OF OCCURRENCE,CLASSES 1 TO 5 = 0,99998

15 3023 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3,5 (730208) 22 APR 1974 PAGE 8

(UNIT 5)

COMPUTATIONS PERFORMED BY ROUTINE 1

ZI= 6,00 EXPONENT= 0,20000

15 3023 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3,5 (730208) 22 APR 1974 PAGE 9

SOURCE INPUT DATA

POINT & LINE BACKGROUND (UNIT 5)

NO= 1 TYPE=P CODE=NONE POINT BACKGROUND
COORDS= 580,50 4517,50 HEIGHT= 0,0 P= 0,0
EMISSIONS--- CO = 4,000E 00 NOX = 1,000E 01

NO= 2 TYPE=L CODE=NONE LINE BACKGROUND
COORDS= 578,00 4515,00 583,00 4520,00 HEIGHT= 0,0 P= 0,0
EMISSIONS--- CO = 2,500E-02 NOX = 4,000E-03
SOURCE COUNT= 2
TRANSFERRED TO UNIT 11

15 3023 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3,5 (730208) 22 APR 1974 PAGE 10

POINT & LINE BACKGROUND (UNIT 11)

SOURCE TOTAL EMISSION RATES IN GM/SEC

NUMBER	COUNT	TYPE	CO	NOX
1	0	P	4,000E 00	1,000E 01
2	33	L	1,768E 02	2,828E 01
		TOTALS	1,808E 02	3,828E 01

15 3023 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3,5 (730208) 22 APR 1974 PAGE 11

ARITHMETIC MEAN POLLUTANT CONCENTRATIONS

COORDINATE SCALE UNIT (METERS)= 1000,000

RECEPTOR NUMBER	X-COORD SCALE U	Y-COORD SCALE U	HEIGHT METERS	CO PPM	NOX UG/M**3
1	578,5	4520,5	0,0	0,0092	2,2324
2	578,5	4522,5	0,0	0,0068	1,5340
3	580,5	4520,5	0,0	0,0165	4,7976
4	580,5	4522,5	0,0	0,0101	2,8422
5	582,5	4520,5	0,0	0,0346	7,7846
6	582,5	4522,5	0,0	0,0125	2,9213

END OF RUN, CYCLE COUNT= 172

Figure 48 Contd.

```
15  3023     MARTIN TIKVART DIFFUSION MODELING PROGRAM        VERSION   3,5  (730208)            22 APR 1974              PAGE  12
*********************************************************************************************************************************

                  SAVE CONCENTRATIONS IN THE 'RBKG' ARRAY                          (UNIT  5)

                  AVERAGING MODE,

                  POLLUTANT=CO       , NOX      ,

                  UNITS=    PPM      ,UG/M**3 ,

                  FACTORS=   8,46E 02, 1,00E 06,

                  COORDINATE SCALE UNIT (METERS)=  1000,000

                  STABILITY CLASS= 1, 2, 3, 4, 5,

                  WIND DIRECTION CLASS= 1, 2, 3, 4, 5, 6, 7, 8, 9,10,11,12,13,14,15,16,

                  WINDSPEED CLASS= 1, 2, 3, 4, 5, 6,

                  WIND SPEED=  0,89,   2,46,   4,47,   6,93,   9,61,  12,52,

                  - - - - OPTIONS - - - -

                  SOURCE INPUT UNIT=    11
                  STATISTICAL OUTPUT=        F
                  STORE RESULTS=        T
                  OUTPUT RESULTS=       F

                  - - - - MODEL PARAMETERS - - - -

                                                     STABILITY CLASS
                                          1          2          3          4          5
                  COEFFICIENT A         0,032      0,097      0,266      0,348      0,413
                  COEFFICIENT B         1,440      1,120      0,860      0,680      0,580
                  COEFFICIENT C         0,072      0,072      0,169      1,070      1,010
                  COEFFICIENT D         1,220      1,220      1,010      0,682      0,554

                  NCOMP=     5, TMIN= 2,000E-01, TMAX= 7,000E 00, XMIN= 1,000E 01

15  3023     MARTIN TIKVART DIFFUSION MODELING PROGRAM        VERSION   3,5  (730208)            22 APR 1974              PAGE  13
*********************************************************************************************************************************

                  RBKG(VALUES)->RCONH                                              (UNIT  5)

                  COMPUTATIONS PERFORMED BY ROUTINE      3

15  3023     MARTIN TIKVART DIFFUSION MODELING PROGRAM        VERSION   3,5  (730208)            22 APR 1974              PAGE  14
*********************************************************************************************************************************

                  ZERO 'RBKG'                                                      (UNIT  5)

                  COMPUTATIONS PERFORMED BY ROUTINE      2

15  3023     MARTIN TIKVART DIFFUSION MODELING PROGRAM        VERSION   3,5  (730208)            22 APR 1974              PAGE  15
*********************************************************************************************************************************

                  SOURCE INPUT DATA

                  LANTRAN ANNUAL POINT AND GRIDDED AREA SOURCE DATA                (UNIT 13)

                  NO=   1    TYPE=P     CODE=NONE               FIGURE NUMBER      30 CODE    S2041      SEAS        1
                  COORDS=     582,40     4522,70                                      HEIGHT= 30,5          P=  73,20000
                  EMISSIONS---          CO       = 2,656E 00 NOX       = 2,142E 00

                  AREA SOURCE GRID--                LANTRAN    1,1   11 FEB 1974    RUN    1040

                  GRID ORIGIN= 578,00, 4520,00  CELL DIMENSIONS=  1,00 X  1,00       SCALE U= 1000,00 METERS     HEIGHT=  0,0

                    NO   IX   IY       CO              NOX
                     2    1    1    7,878E-07       5,812E-08
                     3    2    1    6,013E-09       7,216E-07
                     4    3    1    4,893E-09       2,005E-07
                     5    4    1    5,176E-08       1,964E-07
                     6    5    1    3,666E-10       4,400E-08
                     7    1    2    2,733E-06       9,111E-08
                     8    2    2    4,101E-06       2,613E-07
                     9    3    2    2,238E-11       2,685E-09
                    10    4    2    4,050E-08       1,591E-08
                    11    5    2    5,108E-08       1,277E-08
                    12    1    3    2,485E-06       8,284E-08
                    13    2    3    1,783E-05       5,944E-07
                    14    3    3    7,289E-06       3,309E-07
                    15    4    3    8,992E-09       3,529E-07
                    16    5    3    5,023E-09       4,708E-07
                  SOURCE COUNT=    16
                  TRANSFERRED TO UNIT 11

15  3023     MARTIN TIKVART DIFFUSION MODELING PROGRAM        VERSION   3,5  (730208)            22 APR 1974              PAGE  16
*********************************************************************************************************************************

                  LANTRAN ANNUAL POINT AND GRIDDED AREA SOURCE DATA                (UNIT 11)

                  SOURCE TOTAL EMISSION RATES IN GM/SEC

          NUMBER     COUNT      TYPE       CO            NOX
             1           0        P     2,656E 00     2,142E 00
             2         168        A     7,878E-01     5,812E-02
             3         297        A     6,013E-03     7,216E-01
             4         386        A     4,893E-03     2,005E-01
             5         516        A     5,176E-02     1,964E-01
             6         606        A     3,666E-04     4,400E-02
             7         737        A     2,733E 00     9,111E-02
             8         820        A     4,101E 00     2,613E-01
             9         928        A     2,238E-05     2,685E-03
            10        1021        A     4,050E-02     1,591E-02
            11        1130        A     5,108E-02     1,277E-02
            12        1215        A     2,485E 00     8,284E-02
            13        1342        A     1,783E 01     5,944E-01
            14        1430        A     7,289E 00     3,309E-01
            15        1559        A     8,992E-03     3,529E-01
            16        1649        A     5,023E-03     4,708E-01

                            TOTALS     3,805E 01     5,579E 00
```

Figure 48 Contd.

15 3023 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3,5 (730208) 22 APR 1974 PAGE 17

ARITHMETIC MEAN POLLUTANT CONCENTRATIONS

COORDINATE SCALE UNIT (METERS)= 1000,000

RECEPTOR NUMBER	X-COORD SCALE U	Y-COORD SCALE U	HEIGHT METERS	CO PPM	NOX UG/M**3
1	578,5	4520,5	0,0	0,0082	0,8967
2	578,5	4522,5	0,0	0,0204	1,0475
3	580,5	4520,5	0,0	0,0035	2,2247
4	580,5	4522,5	0,0	0,0518	3,1359
5	582,5	4520,5	0,0	0,0028	0,9995
6	582,5	4522,5	0,0	0,0071	4,6669

END OF RUN, CYCLE COUNT= 1780

15 3023 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3,5 (730208) 22 APR 1974 PAGE 18

SAVE CONCENTRATIONS; SPECIFY OUTPUT UNIT (UNIT 5)

AVERAGING MODE,

POLLUTANT=CO , NOX ,

UNITS= PPM ,UG/M**3 ,

FACTORS= 8,46E 02, 1,00E 06,

COORDINATE SCALE UNIT (METERS)= 1000,000

STABILITY CLASS= 1, 2, 3, 4, 5,

WIND DIRECTION CLASS= 1, 2, 3, 4, 5, 6, 7, 8, 9,10,11,12,13,14,15,16,

WINDSPEED CLASS= 1, 2, 3, 4, 5, 6,

WIND SPEED= 0,89, 2,46, 4,47, 6,93, 9,61, 12,52,

- - - - OPTIONS - - - -

SOURCE INPUT UNIT= 11
STATISTICAL OUTPUT= F
STORE RESULTS= T
OUTPUT RESULTS= T
OUTPUT UNIT= 14

- - - - MODEL PARAMETERS - - - -

	STABILITY CLASS 1	2	3	4	5
COEFFICIENT A	0,032	0,097	0,266	0,348	0,413
COEFFICIENT B	1,400	1,120	0,860	0,680	0,580
COEFFICIENT C	0,072	0,072	0,169	1,070	1,010
COEFFICIENT D	1,220	1,220	1,010	0,682	0,554

NCOMP= 5, TMIN= 2,000E-01, TMAX= 7,000E 00, XMIN= 1,000E 01

15 3023 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3,5 (730208) 22 APR 1974 PAGE 19

RBKG+RCONM=>RCONM (UNIT 5)

COMPUTATIONS PERFORMED BY ROUTINE 4

15 3023 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3,5 (730208) 22 APR 1974 PAGE 20

RECEPTOR CALIBRATION FACTORS,

HACKENSACK REGION--ANNUAL CALIBRATION FACTORS (UNIT 5)

RECEPTOR NUMBER	X-COORD SCALE U	Y-COORD SCALE U	HEIGHT METERS	CO	NOX
*****	0,0	0,0	0,0	1,9500	0,6300

15 3023 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3,5 (730208) 22 APR 1974 PAGE 21

RECEPTOR BACKGROUND CONCENTRATIONS

MARTIK RUN 3013 DATE 13 FEB 1974 (UNIT 12)

RECEPTOR NUMBER	X-COORD SCALE U	Y-COORD SCALE U	HEIGHT METERS	CO PPM	NOX UG/M**3
1	578,5	4520,5	0,0	0,0054	0,7996
2	578,5	4522,5	0,0	0,0023	0,3350
3	580,5	4520,5	0,0	0,0075	1,1074
4	580,5	4522,5	0,0	0,0033	0,4883
5	582,5	4520,5	0,0	0,0082	1,2165
6	582,5	4522,5	0,0	0,0038	0,5558

Figure 48 Contd.

```
15  3023     MARTIN TIKVART DIFFUSION MODELING PROGRAM        VERSION   3,5  (730208)            22 APR 1974              PAGE  22
*******************************************************************************************************************************

              RBKG+RCONB=>RCONB                                              (UNIT  5)

              COMPUTATIONS PERFORMED BY ROUTINE     4


15  3023     MARTIN TIKVART DIFFUSION MODELING PROGRAM        VERSION   3,5  (730208)            22 APR 1974              PAGE  23
*******************************************************************************************************************************

              0=>RBKG                                                        (UNIT  5)

              COMPUTATIONS PERFORMED BY ROUTINE     2

15  3023     MARTIN TIKVART DIFFUSION MODELING PROGRAM        VERSION   3,5  (730208)            22 APR 1974              PAGE  24
*******************************************************************************************************************************

              RBKG=>RCON=0                                                   (UNIT  5)

              COMPUTATIONS PERFORMED BY ROUTINE     6

15  3023     MARTIN TIKVART DIFFUSION MODELING PROGRAM        VERSION   3,5  (730208)            22 APR 1974              PAGE  25
*******************************************************************************************************************************

              RCAL*RCONB=>RCON                                               (UNIT  5)

              COMPUTATIONS PERFORMED BY ROUTINE     8

15  3023     MARTIN TIKVART DIFFUSION MODELING PROGRAM        VERSION   3,5  (730208)            22 APR 1974              PAGE  26
*******************************************************************************************************************************

              TABULATE                                                       (UNIT  5)

              COMPUTATIONS PERFORMED BY ROUTINE     9

15  3023     MARTIN TIKVART DIFFUSION MODELING PROGRAM        VERSION   3,5  (730208)            22 APR 1974              PAGE  27
*******************************************************************************************************************************

              ARITHMETIC MEAN POLLUTANT CONCENTRATIONS

              COORDINATE SCALE UNIT (METERS)=  1000,000
```

RECEPTOR NUMBER	X-COORD SCALE U	Y-COORD SCALE U	HEIGHT METERS	CO PPM	NOX UG/M**3
1	578,5	4520,5	0,0	0,0446	2,4751
2	578,5	4522,5	0,0	0,0575	1,8374
3	580,5	4520,5	0,0	0,0536	5,1217
4	580,5	4522,5	0,0	0,1273	4,0739
5	582,5	4520,5	0,0	0,0888	6,3004
6	582,5	4522,5	0,0	0,0455	5,1306

```
RECEPTOR CONCENTRATIONS OUTPUT TO TAPE 14 BEGINNING SEQUENCE NUMBER 30230020

END OF PROGRAM,
```

Figure 48 Contd.

Job Control Language

The datasets needed are exactly the same as in test case #2, with the following exception. Because no VALUES package is being created, FT14 is not needed.

Keyword Package Input

The first package used is a PARAMETERS package. It specifies:

The pollutant names are : 'CO' and 'NOX'.

2 pollutants are being modeled.

The output units are 'PPM' and 'UG/M**3', and RFACT is set accordingly.

UNIT(1), for internal storage of sources, is unit 11.

NCOMP, TMIN, TMAX, are set for computation efficiency.

C is set to the values used for New Jersey.

STNDRD=.FALSE., indicating that this is NOT standard weather conditions.

NU=1 to use only the first windspeed class.

U(1)=0.89 m/sec, specifying the first windspeed class.

The last three items are the parameter changes to process the single weather conditions.

The POINTS package is identical to that in the previous test case.

The METD is a non-standard METD. It does fit the description given in Section 3.2.5. Only one frequency card is provided. It sets the frequency of stability class 4, southwest wind, wind speed class 1 to 1.. All other values remain zero. Pages 3 and 4 tabulate the resulting windrose. The frequency of occurrence for all but stability class 4 is zero. These other stability classes are not tabulated, but merely listed as having a zero frequency of occurrence. The stability class 4 tabulations shows the zero frequency of occurrence for all but the one wind direction and speed chosen. Next a COMPUTE 2 is used to specify the variation of wind speed with height.

The point and line background sources are input as in the previous test cases.

RCON is run. Because the only weather condition with a non-zero frequency of occurrence is the one specified, the resulting concentrations, on page 8, are the concentrations that occur during that weather condition, due to these sources.

After calculating the values a PARAMETERS with RSTOR=.TRUE. is used to move the concentrations from RCON into RBKG. Then a COMPUTE 3 and COMPUTE 2 move RBKG into RCONB and zero RBKG.

As in the previous test case SRCE package, RCON, PARAMETERS with RSTOE=.TRUE. are used. OUTP is left .FALSE. so that a VALUES package will not be created by RCON or COMPUTE 9.

From this point on the COMPUTE's, and RCAL are the same as in the previous test case. The net result is that the output of COMPUTE 9, on page 24, is the concentration under the specified weather condition that would result from the given configuration of sources. These values are not annual average.

```
//ERTHACK3 JOB (88202440000,ERT**,101,***,MKEEFE,219*********,4610),XX,X
// MSGLEVEL=1,CLASS=B
/*PARMS  COPIES=03
//MARTIK EXEC PGM=MARTIK,REGION=120K,TIME=3
//STEPLIB DD DSN=NJMART(MARTIK),DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//FT06F001 DD SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1596)
//FT09F001 DD DSN=C461002.FR701.LOGDATA,DISP=SHR,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AVC016)
//FT11F001 DD UNIT=SYSDA,SPACE=(TRK,1),
// DCB=(RECFM=VSB,LRECL=56,BLKSIZE=1124)
//FT12F001 DD DSN=VALUES,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//FT13F001 DD DSN=EMISS1,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//FT05F001 DD *
PARAMETERS            MARTIK TEST CASE #3 (UNIDIRECTIONAL WIND ROSE)
 &INPUT
 NU=1,
 STNDRD=.FALSE.,
 QNAME='CO','NOX', NQQ=2, QUNIT='PPM','UG/M**3', RFACT=R46.,1.0E+6,
 UNIT=11,14, U(1)=0.89, NCOMP=5, TMIN=0.2, TMAX=7.0, XMIN=10.0,
 C=0.072,0.072,0.169,1.070,1.010,D=1.220,1.220,1.010,0.682,0.554,
 &END
POINTS                TEST RECEPTOR GRID
        1 578.5        4520.5
        2 578.5        4522.5
        3 580.5        4520.5
        4 580.5        4522.5
        5 582.5        4520.5
        6 582.5        4522.5
99999
METD                  UNIDIRECTIONAL WINDROSE (SW WIND)
        1  700.        285.6      1013.25
     4 11 1.0
99999
COMPUTE              1
           6.0         0.2
SRCE                  POINT & LINE BACKGROUND
POINT                 POINT BACKGROUND
         580.5         4517.5
         4.0           10.0
LINE                  LINE BACKGROUND
         578.0         4515.0    583.0      4520.0
         .025          .004
99999
RCON
PARAMETERS            SAVE CONCENTRATIONS IN THE 'RBKG' ARRAY
 &INPUT RSTORF=.TRUE. &END
COMPUTE              3  RBKG(VALUES)=>RCONB
COMPUTE              2  ZERO 'RBKG'
SRCE           13       POINT & GRID SOURCES
RCON
PARAMETERS            SAVE CONCENTRATIONS IN THE 'RBKG' ARRAY
 &INPUT RSTORF=.TRUE. &END
COMPUTE              4  RBKG+RCONB=>RCONB
RCAL                  HACKENSACK REGION--ANNUAL CALIBRATION FACTORS
        CO            NOX
        1.95          0.63
99999



VALUES          12      AREA SOURCE BACKGROUND
COMPUTE              4  RBKG+RCONB=>RCONB
COMPUTE              2  0=>RBKG
COMPUTE              6  RBKG=>RCON=0
COMPUTE              8  RCAL*RCONB=>RCON
COMPUTE              9  TABULATE
ENDJOB
/*EOF
**
```

Figure 49 MARTIK Test Case 3 Deck Setup

```
//ERTTEST2 JOB (SA200244000,ERT--,101,---,MKFEFE,219---------,4610),XX,X JOB 621
// MSGLEVEL=1,CLASS=B
***PARMS COPIES=05                                                      ACCEPTED
//MARTIK EXEC PGM=MARTIK,REGION=120K,TIME=3
//STEPLIB DD DSN=NJMART(MARTIK),DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//FT06F001 DD SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1596)
//FT09F001 DD DSN=C461002,ER701,LOGDATA,DISP=SHR,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AVC016)
//FT11F001 DD UNIT=SYSDA,SPACE=(TRK,1),
// DCB=(RECFM=VSB,LRECL=56,BLKSIZE=1124)
//FT12F001 DD DSN=VALUES,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//FT13F001 DD DSN=EMISS1,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//FT05F001 DD *
//
IEF236I ALLOC. FOR ERTTEST2 MARTIK
IEF237I 103    ALLOCATED TO STEPLIB
IEF237I 084    ALLOCATED TO FT06F001
IEF237I 121    ALLOCATED TO FT09F001
IEF237I 251    ALLOCATED TO FT11F001
IEF237I 103    ALLOCATED TO FT12F001
IEF237I 103    ALLOCATED TO FT13F001
IEF237I 069    ALLOCATED TO FT05F001
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   NJMART                                    .   KEPT
IEF285I   VOL SER NOS= AIRMAP.
IEF285I   C461002,ER701,LOGDATA                         KEPT
IEF285I   VOL SER NOS= AVC016.
IEF285I   SYS74112.T080432.RV000.ERTTEST2.R0006049      DELETED
IEF285I   VOL SER NOS= ACS001.
IEF285I   VALUES                                        KEPT
IEF285I   VOL SER NOS= AIRMAP.
IEF285I   EMISS1                                        KEPT
IEF285I   VOL SER NOS= AIRMAP.
IEF373I STEP /MARTIK  / START 74112.1804
IEF374I STEP /MARTIK  / STOP  74112.1805 CPU   0MIN 08.27SEC MAIN 102K LCS    0K
IEF375I  JOB /ERTTEST2/ START 74112.1804
IEF376I  JOB /ERTTEST2/ STOP  74112.1805 CPU   0MIN 08.27SEC
```

Figure 50 MARTIK Test Case 3 Printed Output

```
BEGIN MARTIN TIKVART DIFFUSION MODELING PROGRAM        VERSION   3.5 LEVEL 730208 RUN   3024
TABLE COUNT= 44

 15  3024     MARTIN TIKVART DIFFUSION MODELING PROGRAM        VERSION   3.5  (730208)            22 APR 1974            PAGE   1
*****************************************************************************************************************************

                  MARTIK TEST CASE #3 (UNIDIRECTIONAL WIND ROSE)              (UNIT  5)

                  AVERAGING MODE,

                  POLLUTANT=CO      , NOX      ,

                  UNITS=    PPM      ,UG/M**3 ,

                  FACTORS=   8.46E 02, 1.00E 06,

                  COORDINATE SCALE UNIT (METERS)=  1000.000

                  STABILITY CLASS= 1, 2, 3, 4, 5,

                  WIND DIRECTION CLASS= 1, 2, 3, 4, 5, 6, 7, 8, 9,10,11,12,13,14,15,16,

                  WINDSPEED CLASS= 1,

                  WIND SPEED=  0.89,

                  - - - - OPTIONS - - - -

                  SOURCE INPUT UNIT=    11
                  STATISTICAL OUTPUT=        F
                  STORE RESULTS=        F
                  OUTPUT RESULTS=        F

                  - - - - MODEL PARAMETERS - - - -

                                                      STABILITY CLASS
                                           1          2          3          4          5
                  COEFFICIENT A          0.032      0.097      0.266      0.348      0.413
                  COEFFICIENT B          1.440      1.120      0.860      0.680      0.580
                  COEFFICIENT C          0.072      0.072      0.169      1.070      1.010
                  COEFFICIENT D          1.220      1.220      1.010      0.682      0.554

                  NCOMP=    5, TMIN= 2.000E-01, TMAX= 7.000E 00, XMIN= 1.000E 01

 15  3024     MARTIN TIKVART DIFFUSION MODELING PROGRAM        VERSION   3.5  (730208)            22 APR 1974            PAGE   2
*****************************************************************************************************************************

                  RECEPTOR INPUT DATA

                  TEST RECEPTOR GRID                                           (UNIT  5)

                     RECEPTOR     X-COORD    Y-COORD    HEIGHT          NAME
                      NUMBER      SCALE U    SCALE J    METERS

                       1          578.50    4520.50      0.0
                       2          578.50    4522.50      0.0
                       3          580.50    4520.50      0.0
                       4          580.50    4522.50      0.0
                       5          582.50    4520.50      0.0
                       6          582.50    4522.50      0.0
 15  3024     MARTIN TIKVART DIFFUSION MODELING PROGRAM        VERSION   3.5  (730208)            22 APR 1974            PAGE   3
*****************************************************************************************************************************

                  METEOROLOGICAL INPUT DATA
                  UNIDIRECTIONAL WINDROSE (SW WIND)                            (UNIT  5)

                  TYPE 1 WIND ROSE
                  AMBIENT TEMP=     285.60 DEG K            AMBIENT PRESSURE=   1013.25 MB

                  TOTAL FREQUENCY OF OCCURRENCE,CLASS  1 =     0.0

                  TOTAL FREQUENCY OF OCCURRENCE,CLASS  2 =     0.0

                  TOTAL FREQUENCY OF OCCURRENCE,CLASS  3 =     0.0
```

Figure 50 Contd.

15 3024 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3,5 (730208) 22 APR 1974 PAGE 4

STABILITY CLASS 4 DMX= 580,0, XTR= 3373,4

WINDSPEED CLASS

WIND DIR.	1	2	3	4	5	6	SUM
N	0,0	0,0	0,0	0,0	0,0	0,0	0,0
NNE	0,0	0,0	0,0	0,0	0,0	0,0	0,0
NE	0,0	0,0	0,0	0,0	0,0	0,0	0,0
ENE	0,0	0,0	0,0	0,0	0,0	0,0	0,0
E	0,0	0,0	0,0	0,0	0,0	0,0	0,0
ESE	0,0	0,0	0,0	0,0	0,0	0,0	0,0
SE	0,0	0,0	0,0	0,0	0,0	0,0	0,0
SSE	0,0	0,0	0,0	0,0	0,0	0,0	0,0
S	0,0	0,0	0,0	0,0	0,0	0,0	0,0
SSW	0,0	0,0	0,0	0,0	0,0	0,0	0,0
SW	1,000000	0,0	0,0	0,0	0,0	0,0	1,000000
WSW	0,0	0,0	0,0	0,0	0,0	0,0	0,0
W	0,0	0,0	0,0	0,0	0,0	0,0	0,0
WNW	0,0	0,0	0,0	0,0	0,0	0,0	0,0
NW	0,0	0,0	0,0	0,0	0,0	0,0	0,0
NNW	0,0	0,0	0,0	0,0	0,0	0,0	0,0
SUM	1,000000	0,0	0,0	0,0	0,0	0,0	1,000000

TOTAL FREQUENCY OF OCCURRENCE,CLASS 4 = 1,00000

TOTAL FREQUENCY OF OCCURRENCE,CLASS 5 = 0,0

TOTAL FREQUENCY OF OCCURRENCE,CLASSES 1 TO 5 = 1,00000

15 3024 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3,5 (730208) 22 APR 1974 PAGE 5

(UNIT 5)

COMPUTATIONS PERFORMED BY ROUTINE 1

Z1= 6,00 EXPONENT= 0,20000

15 3024 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3,5 (730208) 22 APR 1974 PAGE 6

SOURCE INPUT DATA

POINT & LINE BACKGROUND (UNIT 5)

```
NO=  1   TYPE=P   CODE=NONE              POINT BACKGROUND
COORDS=   580,50  4517,50                                    HEIGHT=  0,0       P=   0,0
EMISSIONS---      CO       = 4,000E 00 NOX     = 1,000E 01

NO=  2   TYPE=L   CODE=NONE              LINE BACKGROUND
COORDS=   578,00  4515,00    583,00  4520,00                 HEIGHT=  0,0       P=   0,0
EMISSIONS---      CO       = 2,500E-02 NOX     = 4,000E-03
SOURCE COUNT=   2
TRANSFERRED TO UNIT 11
```

15 3024 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3,5 (730208) 22 APR 1974 PAGE 7

POINT & LINE BACKGROUND (UNIT 11)

SOURCE TOTAL EMISSION RATES IN GM/SEC

NUMBER	COUNT	TYPE	CO	NOX
1	0	P	4,000E 00	1,000E 01
2	1	L	1,768E 02	2,828E 01
		TOTALS	1,808E 02	3,828E 01

15 3024 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3,5 (730208) 22 APR 1974 PAGE 8

ARITHMETIC MEAN POLLUTANT CONCENTRATIONS

COORDINATE SCALE UNIT (METERS)= 1000,000

RECEPTOR NUMBER	X-COORD SCALE J	Y-COORD SCALE U	HEIGHT METERS	CO PPM	NOX UG/M**3
1	578,5	4520,5	0,0	0,0	0,0
2	578,5	4522,5	0,0	0,0	0,0
3	580,5	4520,5	0,0	0,0	0,0
4	580,5	4522,5	0,0	0,0	0,0
5	582,5	4520,5	0,0	0,1294	37,2997
6	582,5	4522,5	0,0	0,0119	2,2478

END OF RUN, CYCLE COUNT= 3

Figure 50 Contd.

```
15  3024     MARTIN TIKVART DIFFUSION MODELING PROGRAM        VERSION   3,5  (730208)            22 APR 1974            PAGE   9
*******************************************************************************************************************************

               SAVE CONCENTRATIONS IN THE 'RBKG' ARRAY                         (UNIT  5)

               AVERAGING MODE,

               POLLUTANT=CO       , NOX      ,

               UNITS=    PPM      ,UG/M**3 ,

               FACTORS=   8,46E 02, 1,00E 06,

               COORDINATE SCALE UNIT (METERS)=  1000,000

               STABILITY CLASS= 1, 2, 3, 4, 5,

               WIND DIRECTION CLASS= 1, 2, 3, 4, 5, 6, 7, 8, 9,10,11,12,13,14,15,16,

               WINDSPEED CLASS= 1,

               WIND SPEED=  0,89,

               * * * * OPTIONS * * * *

               SOURCE INPUT UNIT=    11
               STATISTICAL OUTPUT=        F
               STORE RESULTS=           T
               OUTPUT RESULTS=         F

               * * * * MODEL PARAMETERS * * * *

                                                  STABILITY CLASS
                                       1          2          3          4          5
               COEFFICIENT A         0.032      0.097      0.266      0.348      0.413
               COEFFICIENT B         1.440      1.120      0.860      0.680      0.580
               COEFFICIENT C         0.072      0.072      0.169      1.070      1.010
               COEFFICIENT D         1.220      1.220      1.010      0.682      0.554

               NCOMP=     5, TMIN= 2,000E-01, TMAX= 7,000E 00, XMIN= 1,000E 01

15  3024     MARTIN TIKVART DIFFUSION MODELING PROGRAM        VERSION   3,5  (730208)            22 APR 1974            PAGE  10
*******************************************************************************************************************************

               RBKG(VALUES)=>RCONB                                             (UNIT  5)

               COMPUTATIONS PERFORMED BY ROUTINE       3

15  3024     MARTIN TIKVART DIFFUSION MODELING PROGRAM        VERSION   3,5  (730208)            22 APR 1974            PAGE  11
*******************************************************************************************************************************

               ZERO 'RBKG'                                                     (UNIT  5)

               COMPUTATIONS PERFORMED BY ROUTINE       2

15  3024     MARTIN TIKVART DIFFUSION MODELING PROGRAM        VERSION   3,5  (730208)            22 APR 1974            PAGE  12
*******************************************************************************************************************************

               SOURCE INPUT DATA

               LANTRAN ANNUAL POINT AND GRIDDED AREA SOURCE DATA              (UNIT 13)

               NO=   1    TYPE=P     CODE=NONE             FIGURE NUMBER      30 CODE   52041     SEAS       1
               COORDS=     582,40    4522,70                                   HEIGHT= 30,5           P=  73,20000
               EMISSIONS---           CO        = 2,656E 00 NOX       = 2,142E 00

               AREA SOURCE GRID--               LANTRAN   1,1  11 FEB 1974     RUN    1040

               GRID ORIGIN= 578,00, 4520,00  CELL DIMENSIONS=  1,00 x  1,00      SCALE U= 1000,00 METERS     HEIGHT=  0,0

                 NO  IX  IY     CO              NOX
                  2   1   1    7,878E-07       5,812E-08
                  3   2   1    6,013E-09       7,216E-07
                  4   3   1    4,893E-09       2,005E-07
                  5   4   1    5,176E-08       1,964E-07
                  6   5   1    3,666E-10       4,400E-08
                  7   1   2    2,733E-06       9,111E-08
                  8   2   2    4,101E-06       2,613E-07
                  9   3   2    2,238E-11       2,685E-09
                 10   4   2    4,050E-08       1,591E-08
                 11   5   2    5,108E-08       1,277E-08
                 12   1   3    2,485E-06       8,284E-08
                 13   2   3    1,783E-05       5,944E-07
                 14   3   3    7,289E-06       3,309E-07
                 15   4   3    6,992E-09       3,529E-07
                 16   5   3    5,023E-09       4,708E-07
               SOURCE COUNT=    16
               TRANSFERRED TO UNIT 11
```

Figure 50 Contd.

15 3024 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3.5 (730208) 22 APR 1974 PAGE 13

LANTRAN ANNUAL POINT AND GRIDDED AREA SOURCE DATA (UNIT 11)

SOURCE TOTAL EMISSION RATES IN GM/SEC

NUMBER	COUNT	TYPE	CO	NOX
1	0	P	2.656E 00	2.142E 00
2	0	A	7.878E-01	5.812E-02
3	5	A	6.013E-03	7.216E-01
4	6	A	4.893E-03	2.005E-01
5	8	A	5.176E-02	1.964E-01
6	10	A	3.666E-04	4.400E-02
7	11	A	2.733E 00	9.111E-02
8	13	A	4.101E 00	2.613E-01
9	15	A	2.238E-05	2.685E-03
10	17	A	4.050E-02	1.591E-02
11	18	A	5.108E-02	1.277E-02
12	19	A	2.485E 00	8.284E-02
13	20	A	1.783E 01	5.944E-01
14	21	A	7.289E 00	3.309E-01
15	22	A	8.992E-03	3.529E-01
16	23	A	5.023E-03	4.708E-01
		TOTALS	3.805E 01	5.579E 00

15 3024 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3.5 (730208) 22 APR 1974 PAGE 14

ARITHMETIC MEAN POLLUTANT CONCENTRATIONS

COORDINATE SCALE UNIT (METERS)= 1000.000

RECEPTOR NUMBER	X-COORD SCALE J	Y-COORD SCALE U	HEIGHT METERS	CO PPM	NOX UG/M**3
1	578.5	4520.5	0.0	0.0096	0.8334
2	578.5	4522.5	0.0	0.0341	1.3452
3	580.5	4520.5	0.0	0.0001	4.1211
4	580.5	4522.5	0.0	0.1490	9.3040
5	582.5	4520.5	0.0	0.0001	0.9701
6	582.5	4522.5	0.0	0.0013	9.5408

END OF RUN, CYCLE COUNT= 24

15 3024 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3.5 (730208) 22 APR 1974 PAGE 15

SAVE CONCENTRATIONS IN THE 'RHKG' ARRAY (UNIT 5)

AVERAGING MODE,

POLLUTANT=CO , NOX ,

UNITS= PPM ,UG/M**3 ,

FACTORS= 8.46E 02, 1.00E 06,

COORDINATE SCALE UNIT (METERS)= 1000.000

STABILITY CLASS= 1, 2, 3, 4, 5,

WIND DIRECTION CLASS= 1, 2, 3, 4, 5, 6, 7, 8, 9,10,11,12,13,14,15,16,

WINDSPEED CLASS= 1,

WIND SPEED= 0.89,

- - - - OPTIONS - - - -

SOURCE INPUT UNIT= 11
STATISTICAL OUTPUT= F
STORE RESULTS= T
OUTPUT RESULTS= F

- - - - MODEL PARAMETERS - - - -

	STABILITY CLASS 1	2	3	4	5
COEFFICIENT A	0.032	0.097	0.266	0.348	0.413
COEFFICIENT B	1.440	1.120	0.860	0.680	0.580
COEFFICIENT C	0.072	0.072	0.169	1.070	1.010
COEFFICIENT D	1.220	1.220	1.010	0.682	0.554

NCOMP= 5, TMIN= 2.000E-01, TMAX= 7.000E 00, XMIN= 1.000E 01

Figure 50 Contd.

15 3024 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3.5 (730208) 22 APR 1974 PAGE 16

RBKG+RCONB=>RCONB (UNIT 5)

COMPUTATIONS PERFORMED BY ROUTINE 4

15 3024 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3.5 (730208) 22 APR 1974 PAGE

RECEPTOR CALIBRATION FACTORS,

HACKENSACK REGION--ANNUAL CALIBRATION FACTORS (UNIT 5)

RECEPTOR NUMBER	X-COORD SCALE U	Y-COORD SCALE U	HEIGHT METERS	CO	NOX
*****	0.0	0.0	0.0	1.9500	0.6300

15 3024 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3.5 (730208) 22 APR 1974 PAGE

RECEPTOR BACKGROUND CONCENTRATIONS

MARTIK RUN 3013 DATE 13 FEB 1974 (UNIT 12)

RECEPTOR NUMBER	X-COORD SCALE U	Y-COORD SCALE U	HEIGHT METERS	CO PPM	NOX UG/M**3
1	578.5	4520.5	0.0	0.0054	0.7996
2	578.5	4522.5	0.0	0.0023	0.3350
3	580.5	4520.5	0.0	0.0075	1.1074
4	580.5	4522.5	0.0	0.0033	0.4883
5	582.5	4520.5	0.0	0.0082	1.2165
6	582.5	4522.5	0.0	0.0038	0.5558

15 3024 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3.5 (730208) 22 APR 1974 PAGE 19

RBKG+RCONB=>RCONB (UNIT 5)

COMPUTATIONS PERFORMED BY ROUTINE 4

15 3024 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3.5 (730208) 22 APR 1974 PAGE 20

0=>RBKG (UNIT 5)

COMPUTATIONS PERFORMED BY ROUTINE 2

15 3024 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3.5 (730208) 22 APR 1974 PAGE 21

RBKG=>RCONB0 (UNIT 5)

COMPUTATIONS PERFORMED BY ROUTINE 6

15 3024 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3.5 (730208) 22 APR 1974 PAGE 22

RCAL*RCONB=>RCON (UNIT 5)

COMPUTATIONS PERFORMED BY ROUTINE 8

15 3024 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3.5 (730208) 22 APR 1974 PAGE 23

TABULATE (UNIT 5)

COMPUTATIONS PERFORMED BY ROUTINE 9

15 3024 MARTIN TIKVART DIFFUSION MODELING PROGRAM VERSION 3.5 (730208) 22 APR 1974 PAGE 24

ARITHMETIC MEAN POLLUTANT CONCENTRATIONS

COORDINATE SCALE UNIT (METERS)= 1000.000

RECEPTOR NUMBER	X-COORD SCALE U	Y-COORD SCALE U	HEIGHT METERS	CO PPM	NOX UG/M**3
1	578.5	4520.5	0.0	0.0292	1.0288
2	578.5	4522.5	0.0	0.0710	1.0585
3	580.5	4520.5	0.0	0.0148	3.2940
4	580.5	4522.5	0.0	0.2970	6.1692
5	582.5	4520.5	0.0	0.2685	24.8763
6	582.5	4522.5	0.0	0.0330	7.7770

END OF PROGRAM.

Figure 50 Contd.

4. IMPACT ANALYSIS PROGRAM (IMPACT) P3

4.1 Program Description

4.1.1 Introduction

The IMPACT program was written to enable data manipulations to be carried out over an ensemble of elements, with the operations performed on an element-by-element basis. In the present application, the ensemble takes the form of a two-dimensional grid, each cell of which is assigned a value. Each such ensemble is referred to as a "gridded variable". The process of air-pollution impact analysis involves many operations (arithmetic and logical) involving two or more gridded variables. An example is the comparison of air quality levels to standards. A gridded variable Z might be "defined" by the arithmetic expression:

$$Z\ (I,J) = X\ (I,J)\ /Y\ (I,J) \qquad (4\text{-}1)$$

where X is the mean air pollutant concentration and Y the standard. In equation (4.1) the operation is performed for every cell of the grid system; i.e., for every combination of the indices (I,J). In similar fashion, a gridded variable L might be defined by the logical expression:

$$L\ (I,J) = X\ (I,J)\ .GT.\ Y\ (I,J) \qquad (4\text{-}2)$$

in which L takes the value of unity if the expression is true, and zero if false.

The function of the IMPACT program is to allow operations such as those of Equations (4-1) and (4-2) to be specified in a shorthand notation at program run time, using a set of IMPACT 'OPERATIONS' statements. These statements make up a simple "hyper-language" in which the manipulations necessary to examine the results of air-quality computations may be expressed. The operations of Equations (4-1) and (4-2), for example, may be written in the form:

```
.
.
SET  Z   X   /   Y
SET  L   X   GT  Y
.
.
```

After execution of these two statements, each cell of gridded variable Z contains the ratio of the air-pollution concentration in that cell to the standard; L contains unity for every cell in which the standard is exceeded and zero in all others. Additional operations allow interim results of arithmetic or logical operations to be listed or plotted.

It is clear that the logic of the program consists of three simple phases: (1) the definition of input grid variables (through the reading of 'GRID' packages); (2) definition of new grid variables, or redefinition of existing ones using IMPACT 'OPERATIONS' statements; and (3) tabulation and/or plotting of resultant grid variables (and optionally creating output 'GRID' packages).

A grid of up to 400 cells may be specified, and up to 18 gridded variables may exist at any one time in the program. These limitations are imposed by storage requirements. The symbolic names of the variables are defined by 'GRID' packages, or in OPERATIONS statements.

Examples of symbolic names which might be used in impact analysis are 'X-HC' for "excess hydrocarbon concentrations" or 'HC*POP' for population exposure to hydrocarbons.

4.1.2 Summary of the IMPACT Hyperlanguage

Each state in the IMPACT hyperlanguage is of the form:

MODE VAR1 VAR2 OP VAR3

where MODE represents one of a set of operation modes ('SET', 'LIST', 'PLOT', 'DELETE', 'REPLACE'), VAR1, VAR2, and VAR3 are sumbolic names (up to 8-characters) of gridded variables, and OP is a symbol representing an allowed arithmetic or logical operation. VAR2 and VAR3 are the two "operand" variables, and VAR1 the "resultant" variable. Operands may optionally be numeric constants. In the present version of the program, the following modes are implemented:

<u>SET</u> Perform the operation indicated by OP upon VAR2 and VAR3 and place the result in VAR1.

<u>LIST</u> Tabulate all elements of grid VAR1 by row and column

<u>PLOT</u> Plot the grid VAR1, using plotting levels and symbols entered using a PARAMETERS package.

<u>DELETE</u> Delete variable VAR1, and remove its name from the symbol table.

<u>REPLACE</u> Reassign the name VAR1 to the values of grid VAR2, and remove the name VAR2 from the symbol table.

Allowed operations include the set of arithmetic operations (symbols '+', '-', '*', '/' and '**' and the logical operations ('GT', 'GE', 'EQ', 'LE', 'LT', 'NE', 'AND', 'OR', and 'NOT').

4.1.3 Keyword Package Summary

Program input is organized along the keyword package structure described in Section 1.3. In the AQUIP version of IMPACT, the following keyword packages have been implemented:

PARAMETERS

This card directs the reading of a parameter namelist & INPUT in which all run options and computation parameters are specified. All parameters have defaults, and need be specified only when they are changed. Some internal program parameters are also accessible to the user through the &INPUT namelist. A list of currently implemented parameters appears in section 3.

GRID

This card allows the grid systems which correspond to the 18 sets of variables to be initialized for: (1) transformation or (2) manipulation using a COMP subroutine. Up to six variables may be defined or redefined in one GRID package. Each card initializes the specified variables for one single cell of the set. Up to 400 cells may exist in any single set of grids.

OPERATIONS

This card initiates a set of IMPACT hyperlanguage statements of the form described above in Section 4.1.2. Each operation statement is punched on a single card and performs an arithmetic or logical operation, a list or plot function, or an initialization operation (such as 'DELETE' or 'REPLACE').

OUTPUT

This card causes an output data set to be created in GRID format, with six named variables put out,in card-image format,to a specified data set.

CLEAR

This card clears the symbol table, and resets the number of variables to zero. All grid values are set to zero.

COMMENTS

This card initiates a package designed for the convenience of annotating the output with comments. Any number of comments cards may follow, each with a carriage control character (blank, 0 or 1) in column 15, and the comments line in columns 21-70. A non-blank character in column 72 indicates that an additional comment card is to follow. Comments are read and printed until the last card read contains a blank in columns 71-72. An additional feature of the IMPACT data set structure is that for most card data sets, comments may be imbedded in the data by punching a non-blank character in column 72 of the card read before the comments are inserted.

COMPUTE

This package has been provided to enable the IMPACT program to be easily adapted to special cases in which user-designated calculations and data set manipulations are to be done at intermediate stages of a job. The COMPUTE card calls a user-written subroutine COMP, which may perform calculations, additional input-output, and manipulation of data sets as required by the specific program applications.

ENDJOB

This card causes termination of the program with the message "END OF PROGRAM".

These packages are discussed in detail in Section 4.2, with the exception of COMMENTS, ENDJOB which are discussed in Section 1.3, and COMPUTE which is covered in Section 4.3.

4.1.4 Program Output

The regular output of IMPACT consists of:

(1) listing of program parameters;

(2) listing of gridded variable names when read in 'GRID' package format;

(3) A listing of 'OPERATIONS' statements as performed;

(4) grid lists as specified by 'LIST' operations; and

(5) grid plots as specified by 'PLOT' operations.

4.2 Keyword Packages

4.2.1 PARAMETERS

The format of the IMPACT 'PARAMETERS' package is as given in Section 1.3.3. The name, type, dimension, default value and a brief description of meaning is given for each parameter currently accepted by the namelist &INPUT:

Name	Type	Dim	Default	Meaning
SCALE	R4	1	1000.	Coordinate scale unit, meters
JC	I4	1	0	Zero for no output data set; otherwise, output data set reference number.
ORIGIN	R4	2	0.,0.	Horizontal (east-west) and vertical (north-south) coordinates of grid origin in meters (south-west corner of grid cell with indices (1,1).
GX	R4	1	1.0	Horizontal dimension of grid cell, in scale units
GY	R4	1	1.0	Vertical dimension of grid cell,in scale units
NX	I4	1	0	Number of cells in the horizontal direction
NY	I4	1	0	Number of cells in the vertical direction
NLEV	I4	1	10	Number of value levels for PLOT
LEV	R4	10	*	The set of maximum values corresponding to each value range for PLOT
SYMB	R4	10	*	The set of symbols corresponding to each value range for PLOT. Each symbol contains up to 4-characters to be combined by overprinting.

* See list

Default values for the plot parameters are given in the following table:

level number	minimum value	maximum value	symbol
1	---	0.	' ' (blank)
2	0.	1.	'.'
3	1.	2.	'-'
4	2.	5.	'='
5	5.	10.	'+'
6	10.	20.	'X'
7	20.	50.	'O'
8	50.	100.	'O-'
9	100.	200.	'OX'
10	200.	----	'OXAV'

4.2.2 GRID

This package defines a grid system and initializes a subset of the cells of that system with values for up to six variables. Note that the 'GRID' format is identical to that used in LANTRAN, and that a 'GRID' package may be read by a MARTIK 'SRCE' package (Section 3.2.7). Up to 400 cells may be defined.

FIRST CARD--Keyword card 'GRID' in standard format (Section 1.3.2).

SECOND CARD--Variable name card

Columns	Variable	Format	Meaning
1-10			Must be blank
11-20	VN(1)	A8,2X	Name of first variable (assumed to be intensive as read
21-30	VN(2)	A8,2X	Names of variables 2 throug[illegible] 6
.	.	.	
.	.	.	
61-70	VN(6)	A8,2X	

THIRD CARD--Grid parameter card

Columns	Variable	Format	Meaning
1-5	NX	I5	Number of cells in the horizontal direction
6-10	NY	I5	Number of cells in the vertical direction
11-20	ORIGIN(1)	F10.5	Horizontal coordinate of grid origin (south-west corner o[illegible] cell (1,1) scale units)
21-30	ORIGIN(2)	F10.5	Vertical coordinate of grid origin, scale units
31-40	GX	F10.5	Horizontal grid-cell dimension, scale units
41-50	GY	F10.5	Vertical grid-cell dimension scale units
51-60	SCALE	F10.5	Scale unit, meters
61-70	HH	F10.5	Height, meters

Note that up to six variables may be assigned in one 'GRID' package. If less than six are assigned, the name fields for the remaining are left blank.

FOLLOWING CARDS--one for each grid-cell to be initialized			
1-5	IX	I5	horizontal cell index
6-10	IY	I5	Vertical cell index
11-20	GVAL(1)	F10.5	Values for up to six variables
.	.	.	
.	.	.	
61-70	GVAL(6)	F10.5	
LAST CARD--Delimiter Card '99999'			

Note that NX, NY, ORIGIN, GX, GY and SCALE must all be as specified in the PARAMETERS package.

4.2.3 OPERATIONS

This package performs a set of operations as described in Section 4.1.2. Each operation references one or more gridded variables by their symbolic names and performs a function on a cell-by-cell basis.

There is no limit to the number of operations statements in the 'OPERATIONS' package. Each statement is processed and printed as it is read.

FIRST CARD-- Keyword card 'OPERATIONS' in standard format (Section 1.3.2)

FOLLOWING CARDS--IMPACT operation statements (one or more cards):

Columns	Variable	Format	Meaning
1-10	MODE	A8,2X	'SET', 'LIST', 'PLOT', 'DELETE', or 'REPLACE'.
11-20	VAR1	A8,2X	Symbolic name (up to 8-char.) of "resultant" grid variable. This may be a new name, in which case it is added to the symbol table (18 names allowed).

Columns	Variable	Format	Meaning
21-30	VAR2	A8,2X	symbolic name of first operand grid variable, or a numeric constant if all values of VAR1 are to be set (MODE = 'SET')
31-40	OP	A8,2X	symbolic name of operation if MODE = 'SET'. see list
41-50	VAR3	A8,2X	symbolic name of 2nd operand grid variable, or a numeric constant (MODE = 'SET')
51-70	COMM	5A4	comments for printing
LAST CARD -- Delimiter card '99999'			

Discussion of Modes:

'SET'

Currently implemented operations (note: punch left justified in field)

Arithmetic operations: ' ', '-', '*', '/', '**',

Logical operations: 'LT', 'LE', 'EQ', 'GE', 'GT', 'NE', 'OR', 'AND', 'NOT'

Note that for 'AND', 'OR' and 'NOT', logical "1" (".TRUE.") is taken to be any non-zero value. For example, if X and Y are arithmetic variables (with continuous values), the operation

```
SET  L    X    AND  Y
```

places a "1" in each cell of L such that both X and Y are non-zero for that cell.

Similarly,

```
SET  X         NOT  X
SET  L    X    AND  Y
```

places a "1" in each cell of L for which X is zero and Y is non-zero.

'LIST'

Grid variables to be listed are arranged by row and column beginning with the most northerly row. Format for each value is

F9.2,1X   for values less than or equal to 1.0E+06

1PE9.2,1X   for values greater than 1.0E+06

'DISPLAY'

Grid variables to be plotted are arranged by row and column beginning with the most northerly row. The numbers along the borders of the plot (SUBROUTINE GPLOT) are aligned with cell centers, and each cell is exactly 0.5" x 0.5" if 8-lines per inch is specified for the printer.

'DELETE'

The variables name and grid-values are compressed out of the GNAM and G-arrays; i.e., all variable names in higher slots are moved down by one, as are the grid values. The number of variables is decreased by one.

'REPLACE'

The first variable name (VAR1) replaces the second (VAR2) in the symbol table GNAM. All grid values remain unchanged.

4.2.4 OUTPUT

This two-card package creates an output data set for up to six selected variables, and puts it out in card-image format, as a 'GRID' package. If the output unit specified is 7, a 'GRID' package is punched.

FIRST CARD -- Keyword card 'OUTPUT' in standard format (Section 1.3.2)

SECOND CARD -- Variable name card (last card)

Columns	Variable	Format	Meaning
1-10			must be blank
11-20	VN(1)	A8,2X	names of variables to be outputted (up to six)
.	.	.	
.	.	.	
.	.	.	
61-70	VN(6)	A8,2X	

Note that a '99999' card may be used with an 'OUTPUT' package, but is not required.

4.2.5 CLEAR

This single keyword card causes all variable names to be deleted from the symbol table. All grid values are reset to zero, and the variable count is reset to zero.

4.3 AQUIP System Implementation

As in the other programs of the AQUIP system, provision has been made in IMPACT for a user-written subroutine COMP. The functions of IMPACT are so straightforward, however, in relation to the data sets of the present study, that there was no need to incorporate any 'COMPUTE' operations into the impact analysis section of the AQUIP system.

4.3.1 Data Flow, Impact Analysis

The relationship of the IMPACT program to the overall AQUIP system is shown schematically in Figure 51, which details a section of the overall AQUIP schematic of Figure 2 in Section 1.1. The same conventions have been used for naming of input data sets (I), model data sets (M), computed data sets (C), and programs (P). Each box of Figure 2 has been detailed to represent the keyword packages which constitute the relevant data sets.

The execution time and number of pages of printout depend very strongly on the extent of the analysis performed; i.e., the number of operations. The following deck setup is thus regarded as one example of how the program might be used:

PARAMETERS	initialize program parameters.
GRID	define variables for correlation (1-6), data set C4.
GRID	define gridded air quality (7-11), data set C3/
OPERATIONS	impact analysis operations
OUTPUT	punch a resultant 'GRID' package for future use.
ENDJOB	call program exit.

The necessity for the 'DELETE' and 'REPLACE' operations is clear in light of the number of variable names and input arrays which could be (and have been in the Hackensack Meadowlands Study) involved in air pollution impact analyses. It is important to remember that the data set C4, which is an input data set, can also represent a temporary file for storage of interim results (dashed line in Figure 51). Assuming that the output data set reference number has been specified as the disk file #12, we could have the following sequence:

.
.
.

OPERATIONS	impact analysis, defining new variables 1-6
OUTPUT	store variables 1-6 on unit 12
OPERATIONS	define variables 7-12

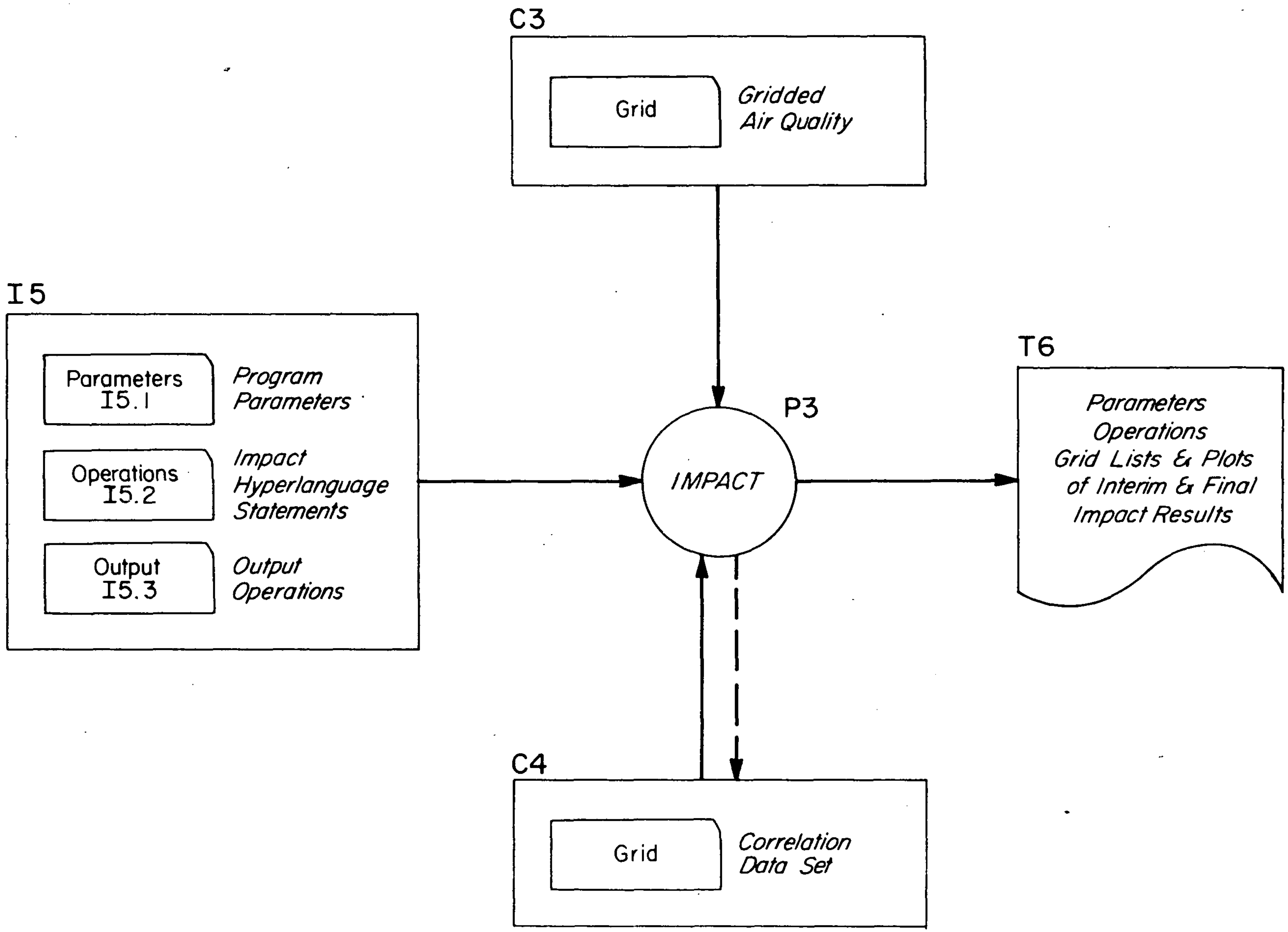


Figure 51 Data Flow Diagram for Impact Analysis

```
OUTPUT                              add them to unit 12
.
.
.
GRID            -12                 rewind unit 12 and read in variables 1-6

GRID             12                 read 7-12

OPERATIONS                          more analyses
.
.
PARAMETERS                          redefine output unit to punch (7)

OUTPUT                              punch final results

ENDJOB                              call program exit
```

The following PARAMETERS package was used in the application of AQUIP to the Hackensack Meadowlands Study:

```
PARAMETERS

 &INPUT
 SCALE=1000.,
 GX=1,GY=1
 NX=12,NY=14
 ORIGIN=572.0,4510.0,
 JC=7,
 &END
```

4.3.2 Data Set Descriptions

This section describes the actual card decks making up the data sets of Figure 4-1.

I5 <u>Impact Criteria</u>

I5.1 <u>Parameters</u> - As given above in Section 4.3.1.

I5.2 <u>Operations</u> - Actually three sets of operations to obtain: (1) compliance with air quality standards; (2) dosage; and (3) land-use compatibility score. These operations packages are described in the study report for Task 3. The LANTRAN COMPUTE package used in conjunction with these data sets is described in Appendix A of the Task 1 Report.

I5.3 - Output - Output packages as required to save results of analyses for future use.

C3 Gridded Air Quality

A keyword 'GRID' package, created by LANTRAN (Section 2.2.5) from computed receptor concentrations. The six gridded variables are the mean concentrations for the pollutants, allocated to the chosen grid system.

C4 Correlation Data Set

A keyword 'GRID' package, also created by LANTRAN from original land-use data (Section 2.3.3). This data set is derived from land-use figures allocated to the grid system, to produce such gridded variables as population density, open space, etc., which may be used for correlation with the gridded air quality data set C3.

T6 Printed Output

The printed output for one IMPACT run, including identification of all input 'GRID' package variables, a listing of operations, grid 'LIST' and 'PLOT' outputs, which constitutes the results of the impact analysis.

4.3.3 IMPACT and the Planning Process

It is the IMPACT program which brings together all of the results of the AQUIP modeling system in a form suitable for the ranking of planning alternatives. As such, it serves as a vital interface between the outputs of the system, expressed as computed emission densities or air-pollution concentrations, and quantitative information (such as integrated population exposure) necessary for the final evaluation. Since the nature of this information and the evaluation criteria are themselves subject to modification, it is important that they be considered as part of the "input" to the system. The IMPACT program has been designed to provide this flexibility, and its role in AQUIP is therefore based upon analysis procedures defined by the planner as he uses the program. Internally, the program merely manipulates gridded data, and hence its potential roles are limited only by the types of data which may meaningfully be expressed on a grid-cell system, and by the types of manipulations which are to be performed. Some examples of the various roles of the program are discussed as follows. In each case, the data flow system is similar to that of Figure 51. The actual procedures used in the ranking of the Hackensack Meadowlands 1990 plans are described in detail in the Task 3 report of this study.

1. Compliance with Ambient Air Quality Standards

In this case, the computed total mean concentration for a given pollutant is compared on a cell-by-cell basis to the standard for that pollutant. This may be accomplished by simply dividing the value in each cell by the standard, such that the result becomes the ratio of the concentration to the standard. If the symbolism used in plotting this result is selected to shade only those cells with values greater than unity, the result is a graphic representation of all cells in violation of the standard. In addition, the number of cells in violation may be read directly from the frequency distribution which is printed below the plot. Only the gridded air quality data set need be used in this example.

2. Subsets of Total Air Quality

The case is similar to (1) above, except that subsets of the total mean concentration are used instead of the total. Examples of such subsets are those discussed in the examples of Section 3.3.5 covering the applications of MARTIK. If a differential diffusion analysis has been performed to display the effect of relocating a highway, for example, IMPACT may be used to determine the change in concentration (positive or negative) relative to total air quality, or relative to standards.

3. Correlation with Subsets of the Grid System

In this example, a correlation data set is used in addition to the gridded air quality data set (C3), with the variables defined such as to partition the grid system. This is accomplished by placing a 1 in all cells of the desired set and a zero elsewhere. After multiplication, only those results applicable to the chosen set are non-zero.

4. Correlation with Land-Use Data

In this example, the correlation data set C4, produced by LANTRAN is used to correlate air quality with some specific class of land use (residential, institutional, industrial, or open space, for example). The figures representing the desired combination of land use, are allocated to the grid system in LANTRAN. If the quantity allocated is the figure overlap or "extent" with each grid cell, then each cell contains the fractional overlap (0 to 1.0) of the desired land use. Multiplication in IMPACT then produces integrated dosage by land-use area. If another variable, such as population density, is used, the result is integrated exposure to population. After plotting, the frequency distribution at the bottom of the graph displays not only the number of cells within each level range, but the total exposure (population times concentration) falling within the range.

5. Analysis of Original Land-Use Data

In this case, only the correlation data set (C4) is used, with operations designed to display such data as population distribution, heating demands, etc.

6. Analysis of Gridded Area Source Emissions Data

As a final example, IMPACT may be used for analysis of the gridded area emissions data set (a subset of C1) produced by LANTRAN for input to the diffusion model. If this data set is used in place of the gridded air quality data set C3, emissions may be correlated with land use data. If it is used in conjunction with the correlation data set C4, then all three data sets, land-use emissions, and air quality may be combined together for analysis. An example might be the display of air quality in all cells with industrial extent greater than 50% and SO_2 emissions in excess of a given rate.

4.4 Numbered Error Messages

The following table constitutes the set of conditions checked in the present level of implementation of the IMPACT program, listed by routine, number and cause:

IMPACT

80	Control-card keyword cannot be identified
20	Invalid data-set number IC for card-image input

INPRM

11	Number of gridded variables out of range
12	Invalid data-set reference number IC
13	Attempt to exceed 400 grid cells
17	Invalid output data set reference number JC
20	Number of levels for 'PLOT' out of range
900	Unexpected end-of-file encountered.

INGRDS

30	Attempt to define more than 18 variables
65	Grid dimensions don't match those of PARAMETERS package
70	Grid origin not consistent with PARAMETERS package.
80	Coordinate scale unit not consistent with PARAMETERS package.
900	Unexpected end-of file encountered.

OPRNS

30	Attempt to define more than 18 variables
50	Invalid use of symbol
140	Operator cannot be identified
182 184 185 186	Undefined Operation
210-225	Invalid arithmetic operation
300	Invalid logical operation
800	Unexpected end-of-file encountered.

DECODE

60	Non-numeric character encountered in numeric field
70	Invalid use of decimal point in numeric field

OUTS

15	Variable name for output cannot be found in symbol table.
25	Improper use of blank field on second card of 'OUTPUT' package (or second card missing)
30	Output data set has not been specified
900	Unexpected end-of-file encountered.

4.5 IMPACT Test Case

The IMPACT test case is the run which evaluates the land use plans pollution impact on people, school pupils, residential area, and commercial areas. Note that the user is not limited to these form groups of "receptors" but can choose other possible distributions which may be useful in evaluating the total impact of the pollution.

The IMPACT run compares the concentrations that have resulted from the test case land use, with the concentrations that are acceptable to the impactees. The concentrations are input from the data prepared by LANTRAN, (Test Case No. 2) and the distribution of "receptor groups" is obtained from a LANTRAN run. The operations performed in this test case result in lists and displays of all the relationships and of the impact of the land use on the air quality.

Job Control Language

IMPACT resides on a linkage library at ERT. The first JCL links IMPACT and begins execution. This test case of IMPACT requires the following datasets:

FT09 is a run log file required by any program in the AQUIP system.

FT12 is the land use dataset created in the LANTRAN test case for Mode 1 Land Use Allocation.

FT13 is the air quality dataset created by the LANTRAN Mode 3 Air Quality Allocation.

Keyword Package Input

The first package used is the PARAMETERS package to set the program parameters. Section 4.2.1 of the Task 5 Report describes the IMPACT PARAMETERS. The parameters changes made were:

NLEV was set to 9 to obtain 9 levels rather than 10.
The levels were reset by LEV.
The symbols for each level were reset in SYMB.

The grid for internal use was defined by NX,NY, and ORIGIN. NX sets the number of cells in the X direction to be 5. NY sets the number of cells in the Y direction to be 3. ORIGIN sets the origin of these cells at 578., 4520. Note that this grid must be the same as the grid used in the creation of the gridded data that will be input. Use of grids that do not match will result in errors.

The PARAMETERS package responds by printing the variables that define the grid being used by IMPACT, page 1 of the output.

Next a GRID package is input to define which of the grid cells are of interest. Examining Figure 52, the grid cells within the dark outline are the region where values are of interest. This region was arbitrarily chosen to illustrate that consideration need not be made of the entire rectangle. If the area of interest only covers a portion of the grid, it is possible to consider only a portion of the grid.

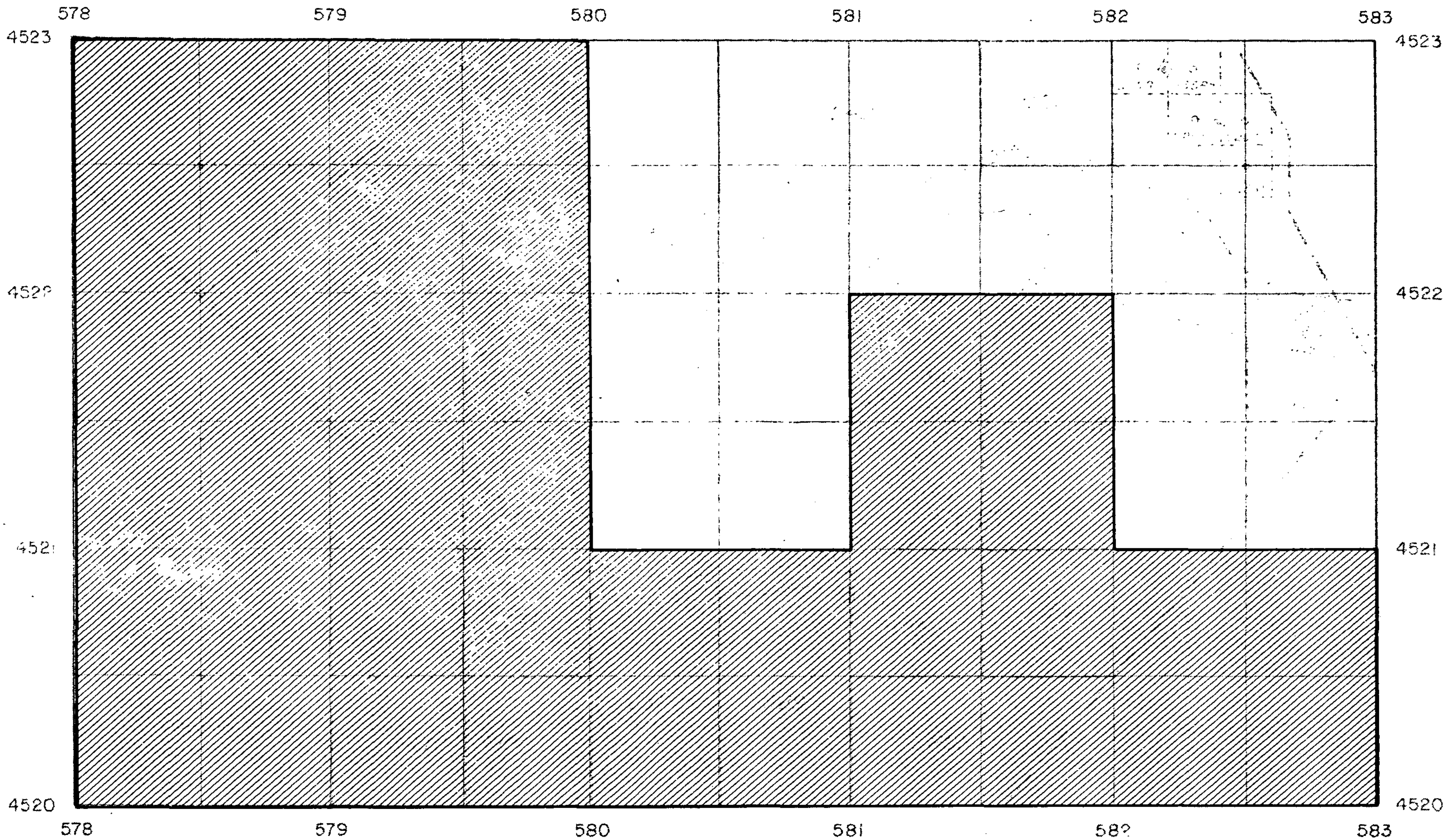


Figure 52 Base Map, IMPACT Grid and Region of Interest

The grid cells within the dark outline are given a value of 1. for the variable REGION. Those outside have a value of 0.. Page 2 of the printout responds from the GRID package by informing the user that the variable REGION has been DEFINED for the grid.

The next GRID package is specified with IFORM=12. This means that the GRID package to be used is on FT12. FT12 is the Land Use GRID package that was created in the LANTRAN Model 1 Land Use allocation. The LANTRAN run specified four variables for output to each cell of the GRID package. The GRID card is labeled identifying it as a LANTRAN output from run 1056. Run 1056 is the LANTRAN test. This run should be saved by the user in the event he needs to know exactly how he created these values.

The four variables on the GRID package are: POP, population, SCHOOLS, school population, Rol, and S. See the LANTRAN test case for the description of how this package was created.

The printout on page 3 informs the user that the four variables have been defined for each cell of the grid.

The next GRID card specified IFORM=13. This will bring in the GRID package containing the gridded Air Quality. The LANTRAN Mode 3 Air Quality Allocation test case created this GRID package. The run number 1057 indicates this on the GRID card beginning the GRID package on FT13. This package holds the gridded values for the variables CO and NOX. There were in units of ppm and $\mu g/m^3$ in the VALUES used by LANTRAN, and they were output into the GRID package in ppm and $\mu g/m^3$.

The net result of these GRID packages has been to create values for the following variables:

REGION	Input from the cards.
POP, SCHOOLS, R01, S	Input from the GRID created by LANTRAN Mode 1 Land Use Allocation.
CO, NOX	Input from the GRID created by LANTRAN Mode 3 Air Quality Allocation.

Now OPERATIONS are used to manipulate the variables.

First CO is manipulated by multiplication by REGION, which will leave it unchanged in the region of interest and 0. outside it. Then the variable CO/STD, the fraction of the CO standard attained by the annual CO value, is computed and listed. Page 5 shows the output from this portion. There are values for all the grid cells of interest. Section 4.2.3 describes the format and rules for instructions in the OPERATIONS package. A DISPLAY finishes the output on this page. CO has been restricted to the area of interest, the values listed, and displayed.

The next four instructions perform a similar set of operations on NOX. NOX is restricted to the region of interest, NOX/STD is created, and its values are listed and displayed on page 6.

The OPERATIONS package is terminated at this point to permit a variation in the parameters. The PARAMETERS package is used to change the levels and symbols for use in the display. The levels are set so that any value above .001 will be in level 2. The symbols are set either blank or dark. In effect this will define a presence of absence of any value. For examples of the sort of problem that the remainder of the test.

For examples of the uses to which this program can be used, see the Task 3 Report. It will make the purpose of the kinds of variables chosen, and the forms of the plots chosen clearer. It does not explain the details of use of IMPACT; it shows some problems and what values and displays were used in answering them. The values and displays were created using IMPACT.

The next set of OPERATIONS used performs DOSAGE operations. The lists and displays are mainly indicators of the presence or absence of any dosage of pollutant to the receiving variable chosen, such as POP or SCHOOLS.

First CO and NOX versus POP are calculated. The variable CO*POP is created, listed, and displayed. Note that in only three grid cells is there a population impacted by CO. Next NOX*POP is similarly calculated, listed and displayed. Again, page 9, there are only three grid cells where population is affected by NOX.

At the end of this, the REPLACE operation is used to change the names CO*POP to CO*SCH and NOX*POP to NOX*SCH. The values for each cell remain unchanged at this point. Next, new values are calculated for CO*SCH, and it is listed and displayed on page 10. The purpose of the REPLACE procedure was to remove the old names CO*POP, and NOX*POP. Those names are no longer needed in the variable name list. The two new names are the new variables needed. This could also have been achieved using the DELETE operation, which would have removed the names AND set the values back to zero.

Following the CO*SCH, NOX*SCH is calculated, listed, and displayed. Notice that there is impact from CO, and COX on SCHOOL in only one grid cell.

The next operation sets R01=R01*240. to convert it into acres. There are 240. acres in a square kilometer. The name R01 is changed to RES without affecting the value.

Now impacts of CO and NOX on RES are calculated. Pages 12 and 13 show the calculation, listing, and display of CO*RES, and NOX*RES.

Names are changed to change the RES to COMM. S is reset to contain acres, and renamed COMM. Again, calculations of CO*COMM, and NOX*COMM are made, and the results are listed and displayed. The CO*COMM operations were accidentally duplicated; pages 14, and 15 both contain the CO*COMM calculation, list and display.

At the end of this OPERATIONS package, RES and COMM are renamed back to their old names of R01, and S. The package has created displays that indicate each cell of the region of interest where there is an air pollutant possibly affecting people, school populations, commercial areas, or residential areas.

A PARAMETER package is now used to change the symbolism and levels again. This symbolism will be used for "score" values. Now four levels are set; with maxima of: .001, 1., 2., 3.0. The symbols used are: blank, 0, and dark, (OXAV).

With the new display symbols set OPERATIONS are begun again. First POP is deleted because it will not be used, and the variable space will be useful.

The first set of operations is used to rank the effects of CO on SCHOOLS, then R01 (residential), then S (commercial). A logical operation, AND, is used to set INTERSEC equal to 1. where there are both CO and SCHOOLS. Then the POLL*LU is set to CO where there are both CO and SCHOOLS. Finally, POLL*LU is normalized by the CO standard, and PSCORE is set equal to 1. everywhere POLL*LU is more than a quarter of the CO standard. Next, a similar operation is performed.

Next a similar set of operations is performed to set TEMP equal to 1. everywhere that the CO exceeds the standards, and there are residences present. TEMP is added to PSCORE. Now PSCORE is zero where neither condition has been violated, 1. where only one of the SCHOOLS and residence criteria have been violated, and 2. where both the SCHOOLS and residential criteria have been violated.

Another set of operations sets TEMP equal to 1. wherever the CO exceeds 1.5 times the standard and there are commercial land uses. TEMP is again added to PSCORE. PSCORE can now be 0., 1., 2., or 3., depending on whether any of the air quality criteria have been violated, and if so, how many.

PSCORE is then LISTED. None of the criteria have been exceeded in the test case; all the values are 0.. The DISPLAY is all blank, there are no violations. SCORE is set to 1. for any cell with any violation.

The comparisons and operations for the NOX criteria are the same as for the CO with one exception. The NOX must exceed twice the standard in a commercially used cell before a violation level will be added to PSCORE. As before the list and display indicate that for the test case run there are no violations of any of the criteria chosen in the area of interest.

SCORE is then incremented by 1. for every cell with violations; again there are no such cells. SCORE is listed and displayed. No violations occurred. Had any violation occurred in either the CO or NOX, this list and display would have spotted the cell(s) where CO or NOX was exceeding a criterion.

With the scoring complete, the job is ended with an ENDJOB.

```
//ERTMACDS JOB (88202440000,ERT--,101,---,MKEEFE,219---------,4610),XX,X
// MSGLEVEL=1,CLASS=A
/*PARMS  COPIES=03
// EXEC FORTHLG,PARM.LKED='LET,MAP,LIST',REGION.GO=98K,TIME.GO=1
//LKED.SYSLIN DD *
 INCLUDE ERT(INE,HEADR,ERRK,INPUT,SEOND,TXLOC,GTABU,ICHAR,OPLOT,DECODE)
 INCLUDE IMP(MAIN,BLOCK,INPARM,OPRNS,ARITHG,BOOLG)
 INCLUDE IMP(INGRDS,OUTS,COMP)
/*
//LKED.ERT DD DSN=ERT4610.P9990000.ERTLIB,DISP=SHR
//LKED.IMP DD DSN=IMPACT,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO.FT09F001 DD DSN=C461002.ER701.LOGDATA,DISP=SHR,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AVC016)
//GO.FT12F001 DD DSN=LANUSE,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO.FT13F001 DD DSN=INTERP,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO.FT05F001 DD *
PARAMETERS             CO AND NOX LEVELS
 &INPUT
 NLEV=9,LEV=0.0001,.4,.45,.5,.55,.6,.65,.7,.75,
 SYMB=' ','.','+','=','X','O','O=','OX=','OXAV',
 NX=5,NY=3, ORIGIN=578.0,4520.0,
 &END
GRID                   LAND USE BOUNDARY
        REGION
    5     3 578.0     4520.0     1.0        1.0         1000.0
    1     1 1.0
    1     2 1.0
    1     3 1.0
    2     1 1.0
    2     2 1.0
    2     3 1.0
    3     1 1.0
    3     2 0.0
    3     3 0.0
    4     1 1.0
    4     2 1.0
    4     3 0.0
    5     1 1.0
    5     2 0.0
    5     3 0.0
99999
GRID          12       LAND USE VARIABLES
GRID          13       AIR QUALITY (POLLUTION) VARIABLES
OPERATIONS             STANDARDS OPERATIONS
SET         CO         CO         *           REGION
SET         CO/STD     CO         /           1.25       CO STANDARD
LIST        CO/STD
DISPLAY     CO/STD
SET         NOX        NOX        *           REGION
SET         NOX/STD    NOX        /           100.0      NOX STANDARD
LIST        NOX/STD
DISPLAY     NOX/STD
99999
PARAMETERS             SYMBOLISM FOR 'DOSAGE'
 &INPUT
 NLEV=2,LEV=0.0001,10.,SYMB=' ','OXAV',
 &END
```

Figure 53 IMPACT Test Case Deck Setup

```
OPERATIONS               DOSAGE OPERATIONS
SET         CO*POP      CO          *           POP
LIST        CO*POP
DISPLAY     CO*POP
SET         NOX*POP     NOX         *           POP
LIST        NOX*POP
DISPLAY     NOX*POP
REPLACE     CO*SCH      CO*POP
REPLACE     NOX*SCH     NOX*POP
SET         CO*SCH      CO          *           SCHOOLS
LIST        CO*SCH
DISPLAY     CO*SCH
SET         NOX*SCH     NOX         *           SCHOOLS
LIST        NOX*SCH
DISPLAY     NOX*SCH
SET         R01         R01         *           240.        CONVERT TO ACRES
REPLACE     RES         R01
SET         CO*RES      CO          *           RES
LIST        CO*RES
DISPLAY     CO*RES
SET         NOX*RES     NOX         *           RES
LIST        NOX*RES
DISPLAY     NOX*RES
REPLACE     CO*COMM     CO*RES
REPLACE     NOX*COMM    NOX*RES
SET         S           S           *           240.        CONVERT TO ACRES
REPLACE     COMM        S
SET         CO*COMM     CO          *           COMM
LIST        CO*COMM
DISPLAY     CO*COMM
SET         CO*COMM     CO          *           COMM
LIST        CO*COMM
DISPLAY     CO*COMM
SET         NOX*COMM    NOX         *           COMM
LIST        NOX*COMM
DISPLAY     NOX*COMM
DELETE      CO*COMM
DELETE      NOX*COMM
REPLACE     R01         RES
REPLACE     S           COMM
99999
PARAMETERS               SYMBOLISM FOR 'SCORE'
 &INPUT
 NLEV=0,LEV=0.0001,1.,2.,3.,SYMB=' ','.','O','OXAV',
 &END
OPERATIONS               LAND USE COMPATIBILITY SCORE
DELETE      POP
SET         INTERSEC    CO          AND         SCHOOLS     SCHOOLS
SET         POLL*LU     CO          *           INTERSEC
SET         POLL*LU     POLL*LU     /           1.25        NORMALIZE BY CO STD.
SET         PSCORE      POLL*LU     GT          0.25        PERMISSIBLE A.Q.
SET         INTERSEC    CO          AND         R01         RESIDENTIAL
SET         POLL*LU     CO          *           INTERSEC
SET         POLL*LU     POLL*LU     /           1.25        NORMALIZE BY CO STD.
SET         TEMP        POLL*LU     GT          1.0         PERMISSIBLE A.Q.
SET         PSCORE      PSCORE      +           TEMP        UPDATE POLL. SCORE
SET         INTERSEC    CO          AND         S           COMMERCIAL
SET         POLL*LU     CO          *           INTERSEC
SET         POLL*LU     POLL*LU     /           1.25        NORMALIZE BY CO STD.
SET         TEMP        POLL*LU     GT          1.5         PERMISSIBLE A.Q.

SET         PSCORE      PSCORE      +           TEMP        UPDATE POLL. SCORE
LIST        PSCORE
DISPLAY     PSCORE
SET         SCORE       PSCORE      GT          0.          INITIALIZE 'SCORE'
SET         INTERSEC    NOX         AND         SCHOOLS     SCHOOLS
SET         POLL*LU     NOX         *           INTERSEC
SET         POLL*LU     POLL*LU     /           100.0       NORMALIZE BY NOX STD.
SET         PSCORE      POLL*LU     GT          0.25        PERMISSIBLE A.Q.
SET         INTERSEC    NOX         AND         R01         RESIDENTIAL
SET         POLL*LU     NOX         *           INTERSEC
SET         POLL*LU     POLL*LU     /           100.0       NORMALIZE BY NOX STD.
SET         TEMP        POLL*LU     GT          1.0         PERMISSIBLE A.Q.
SET         PSCORE      PSCORE      +           TEMP        UPDATE POLL. SCORE
SET         INTERSEC    NOX         AND         S           COMMERCIAL
SET         POLL*LU     NOX         *           INTERSEC
SET         POLL*LU     POLL*LU     /           100.0       NORMALIZE BY NOX STD.
SET         TEMP        POLL*LU     GT          2.0         PERMISSIBLE A.Q.
SET         PSCORE      PSCORE      +           TEMP        UPDATE POLL. SCORE
LIST        PSCORE
DISPLAY     PSCORE
SET         TEMP        PSCORE      GT          0.
SET         SCORE       SCORE       +           TEMP        UPDATE L.U. SCORE
LIST        SCORE
DISPLAY     SCORE
DELETE      SCHOOLS
DELETE      R01
DELETE      S
DELETE      POLL*LU
99999
ENDJOB
/*EOF
**
```

Figure 53 Contd.

```
//ERTTEST6 JOB (98200244000,ERT--,101,---,MKEEFE,219----------,4610),XX,X JOB 648
// MSGLEVEL=1,CLASS=H
***PARMS COPIES$04                                                                ACCEPTED
// EXEC FORTHLG,PARM.LKED='LET,MAP,LIST',REGION.GO=98K,TIME.GO=1
XX          PROC PR=A                                                             00000010
XXLKED EXEC      PGM=IEWL,PARM='MAP,LET,LIST',                                   X00000020
XX               REGION=100K                                                      00000030
XXSYSPRINT DD  SYSOUT=&PR,DCB=(LRECL=121,BLKSIZE=1573),                          X00000040
IEF653I SUBSTITUTION JCL - SYSOUT=A,DCB=(LRECL=121,BLKSIZE=1573),
XX               SPACE=(1573,(24,48))                                             00000050
XXSYSLIB   DD  DSNAME=SYS1.FORTLIB,DISP=SHR                                       00000060
XX         DD  DSNAME=SYS1.DOUBLEP,DISP=SHR                                       00000070
XXSYSUT1 DD UNIT=SYSDA,SPACE=(CYL,(2,1))                                          00000080
XXSYSLMOD  DD  DSN=&GOSET(FMXXMAIN),UNIT=SYSDA,DISP=(,PASS),                      00000090
XX             SPACE=(CYL,(15,,1))                                                00000100
//LKED.SYSLIN DD *
//LKED.ERT DD DSN=ERT4610.P9990000.ERTLIB,DISP=SHR
//LKED.IMP DD DSN=IMPACT,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
IEF236I ALLOC. FOR ERTTEST6 LKED
IEF237I 087    ALLOCATED TO SYSPRINT
IEF237I 256    ALLOCATED TO SYSLIB
IEF237I 257    ALLOCATED TO
IEF237I 251    ALLOCATED TO SYSUT1
IEF237I 250    ALLOCATED TO SYSLMOD
IEF237I 061    ALLOCATED TO SYSLIN
IEF237I 255    ALLOCATED TO ERT
IEF237I 103    ALLOCATED TO IMP
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS1.FORTLIB                                         KEPT
IEF285I   VOL SER NOS= ACS101.
IEF285I   SYS1.DOUBLEP                                         KEPT
IEF285I   VOL SER NOS= ACS102.
IEF285I   SYS74112.T080432.RV000.ERTTEST6.R0007072             DELETED
IEF285I   VOL SER NOS= ACS001.
IEF285I   SYS74112.T080432.RV000.ERTTEST6.GOSET                PASSED
IEF285I   VOL SER NOS= ACS000.
IEF285I   ERT4610.P9990000.ERTLIB                              KEPT
IEF285I   VOL SER NOS= ISR000.
IEF285I   IMPACT                                               KEPT
IEF285I   VOL SER NOS= AIRMAP.
IEF373I STEP /LKED    / START 74112.1939
IEF374I STEP /LKED    / STOP  74112.1939 CPU    0MIN 13.44SEC MAIN   98K LCS    0K
XXGO    EXEC     PGM=*.LKED.SYSLMOD,COND=(5,LT,LKED)                              00000110
XXFT06F001 DD  SYSOUT=&PR,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1596)                  00000120
IEF653I SUBSTITUTION JCL - SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1596)
//GO.FT09F001 DD DSN=CA61002.FR701.LOGDATA,DISP=SHR,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AVC016)
//GO.FT12F001 DD DSN=LANUSE,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO.FT13F001 DD DSN=INTERP,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO.FT05F001 DD *
//
IEF236I ALLOC. FOR ERTTEST6 GO
IEF237I 250    ALLOCATED TO PGM=*.DD
IEF237I 087    ALLOCATED TO FT06F001
IEF237I 121    ALLOCATED TO FT09F001
IEF237I 103    ALLOCATED TO FT12F001
IEF237I 103    ALLOCATED TO FT13F001
IEF237I 062    ALLOCATED TO FT05F001
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS74112.T080432.RV000.ERTTEST6.GOSET                PASSED
IEF285I   VOL SER NOS= ACS000.
IEF285I   CA61002.FR701.LOGDATA                                KEPT
IEF285I   VOL SER NOS= AVC016.
IEF285I   LANUSE                                               KEPT
IEF285I   VOL SER NOS= AIRMAP.
IEF285I   INTERP                                               KEPT
IEF285I   VOL SER NOS= AIRMAP.
IEF373I STEP /GO      / START 74112.1939
IEF374I STEP /GO      / STOP  74112.1939 CPU    0MIN 09.53SEC MAIN   96K LCS    0K
IEF285I   SYS74112.T080432.RV000.ERTTEST6.GOSET                DELETED
IEF285I   VOL SER NOS= ACS000.
IEF375I  JOB /ERTTEST6/ START 74112.1939
IEF376I  JOB /ERTTEST6/ STOP  74112.1939 CPU    0MIN 23.01SEC
```

Figure 54 IMPACT Test Case Printed Output

```
 23  1010     IMPACT ANALYSIS PROGRAM                              VERSION   1.1  (730108)           22 APR 1974          PAGE   1
*****************************************************************************************************************************

        PARAMETERS           CO AND NOX LEVELS                                       (UNIT  5)

                   SCALE UNIT (METERS)=  1000.000

                   GRID DIMENSIONS:  5 CELLS(X) BY  3 CELLS(Y)

                   CELL DIMENSIONS (UNITS):      1.00(X) BY      1.00(Y)

                   GRID ORIGIN, SCALE UNITS: ( 578.00, 4520.00)

                   OUTPUT DATA SET= 7
 23  1010     IMPACT ANALYSIS PROGRAM                              VERSION   1.1  (730108)           22 APR 1974          PAGE   2
*****************************************************************************************************************************

GRID               LAND USE BOUNDARY                                                 (UNIT  5)

                     1       DEFINE     REGION


 23  1010     IMPACT ANALYSIS PROGRAM                              VERSION   1.1  (730108)           22 APR 1974          PAGE   3
*****************************************************************************************************************************

                   TAPE12    LABEL=LAND USE VARIABLES


GRID               LANTRAN   1.1  15 FEB 1974     RUN    1056                        (UNIT 12)

                     1       DEFINE     RLP
                     2       DEFINE     SCHOOLS
                     3       DEFINE     RO1
                     4       DEFINE     S
 23  1010     IMPACT ANALYSIS PROGRAM                              VERSION   1.1  (730108)           22 APR 1974          PAGE   4
*****************************************************************************************************************************

                   TAPE13    LABEL=AIR QUALITY (POLLUTION) VARIABLES


GRID               LANTRAN   1.1  22 APR 1974     RUN    1058                        (UNIT 13)

                     1       DEFINE     CO
                     2       DEFINE     NOX
 23  1010     IMPACT ANALYSIS PROGRAM                              VERSION   1.1  (730108)           22 APR 1974          PAGE   5
*****************************************************************************************************************************

OPERATIONS         STANDARDS OPERATIONS                                              (UNIT  5)

                   SET          CO           CO          *          REGION
                   SET          CO/STD       CO          /          1.25        CO STANDARD
                   LIST         CO/STD

                   GRID LIST FOR CO/STD


                        1           2           3           4           5

                 3         0.05        0.07        0.0         0.0         0.0

                 2         0.05        0.06        0.0         0.06        0.0

                 1         0.04        0.05        0.04        0.06        0.07
                   DISPLAY   CO/STD

                   GRID PLOT FOR CO/STD

               1    2    3    4    5

             ..........
           3 ..........                 3
             ..........
             ..........
             ..........     .....
           2 ..........     .....       2
             ..........     .....
             ..........     .....
             .........................
           1 .........................  1
             .........................
             .........................

               1    2    3    4    5


        LEVEL DESIGNATIONS...

               1         2         3         4         5         6         7         8         9
                       .....     +++++     =====     XXXXX     OOOOO     @@@@@     #####     #####
                       .....     +++++     =====     XXXXX     OOOOO     @@@@@     #####     #####
                       .....     +++++     =====     XXXXX     OOOOO     @@@@@     #####     #####
                       .....     +++++     =====     XXXXX     OOOOO     @@@@@     #####     #####
CELL COUNT:    5        10         0         0         0         0         0         0         0
VALUE:       0.0       0.53      0.0       0.0       0.0       0.0       0.0       0.0       0.0

MAXIMUM:     0.00      0.40      0.45      0.50      0.55      0.60      0.65      0.70
MINIMUM:               0.00      0.40      0.45      0.50      0.55      0.60      0.65      0.70
```

Figure 54 Contd.

```
**************************************************************************************************************
              SET        NOX        NOX       *          REGION
              SET        NOX/STD    NOX       /          100.0      NOX STANDARD
              LIST       NOX/STD

              GRID LIST FOR NOX/STD

                       1          2          3          4          5

           3          0.02       0.03       0.0        0.0        0.0

           2          0.03       0.04       0.0        0.05       0.0

           1          0.02       0.04       0.05       0.05       0.06
              DISPLAY    NOX/STD
              GRID PLOT FOR NOX/STD

          1    2    3    4    5

        ..........
      3 ..........              3
        ..........
        ..........
        ..........     .....
      2 ..........     .....    2
        ..........     .....
        ..........     .....
        .........................
      1 .........................   1
        .........................
        .........................

          1    2    3    4    5


        LEVEL DESIGNATIONS...

          1          2          3          4          5          6          7          8          9
                   .....      +++++      =====      XXXXX      OOOOO      @@@@@      ■■■■■      ■■■■■
                   .....      +++++      =====      XXXXX      OOOOO      @@@@@      ■■■■■      ■■■■■
                   .....      +++++      =====      XXXXX      OOOOO      @@@@@      ■■■■■      ■■■■■
                   .....      +++++      =====      XXXXX      OOOOO      @@@@@      ■■■■■      ■■■■■
CELL COUNT:  5          10          0          0          0          0          0          0          0
VALUE:      0.0        0.39       0.0        0.0        0.0        0.0        0.0        0.0        0.0

MAXIMUM:    0.00       0.40       0.45       0.50       0.55       0.60       0.65       0.70
MINIMUM:               0.00       0.40       0.45       0.50       0.55       0.60       0.65       0.70
```



```
**************************************************************************************************************

     PARAMETERS          SYMBOLISM FOR 'DOSAGE'                              (UNIT 5)

              SCALE UNIT (METERS)=  1000.000

              GRID DIMENSIONS:  5 CELLS(X) BY  3 CELLS(Y)

              CELL DIMENSIONS (UNITS):      1.00(X) BY      1.00(Y)

              GRID ORIGIN, SCALE UNITS: ( 578.00, 4520.00)

              OUTPUT DATA SET= 7
```



```
**************************************************************************************************************

OPERATIONS          DOSAGE OPERATIONS                                        (UNIT 5)

              SET        CO*POP     CO        *          POP
              LIST       CO*POP

              GRID LIST FOR CO*POP


                       1          2          3          4          5

           3          0.0        0.0        0.0        0.0        0.0

           2          0.0        0.0        0.0        619.85     0.0

           1          0.0        0.0        134.45     248.83     0.0
              DISPLAY    CO*POP
              GRID PLOT FOR CO*POP

          1    2    3    4    5

      3                         3


                       ■■■■■
      2                ■■■■■    2
                       ■■■■■
                       ■■■■■
                  ■■■■■■■■■■
      1           ■■■■■■■■■■    1
                  ■■■■■■■■■■
                  ■■■■■■■■■■

          1    2    3    4    5


        LEVEL DESIGNATIONS...

          1          2
                   ■■■■■
                   ■■■■■
                   ■■■■■
                   ■■■■■
CELL COUNT:  12         3
VALUE:      0.0        1003.13

MAXIMUM:    0.00
MINIMUM:               0.00
              SET        NOX*POP    NOX       *          POP
```

Figure 54 cont.

```
 23  1010      IMPACT ANALYSIS PROGRAM                                  VERSION   1.1  (730108)            22 APR 1974            PAGE   9
*************************************************************************************************************************************
                 LIST       NOX*POP

                 GRID LIST FOR NOX*POP


                          1          2          3          4          5

              3          0.0        0.0        0.0        0.0        0.0

              2          0.0        0.0        0.0   39687.38        0.0

              1          0.0        0.0   12840.85   18263.13        0.0
                 DISPLAY    NOX*POP

                 GRID PLOT FOR NOX*POP

        1    2    3    4    5

    3                               3

                  #####
    2             #####             2
                  #####
                  #####
             ##########
    1        ##########             1
             ##########
             ##########

        1    2    3    4    5


            LEVEL DESIGNATIONS...

            1         2
                  #####
                  #####
                  #####
                  #####
CELL COUNT:  12        3
VALUE:       0.0   70791.31

MAXIMUM:     0.00
MINIMUM:               0.00
                 REPLACE    CO*SCH       CO*POP
                 REPLACE    NOX*SCH      NOX*POP
                 SET        CO*SCH       CO            *             SCHOOLS
                 LIST       CO*SCH

 23  1010      IMPACT ANALYSIS PROGRAM                                  VERSION   1.1  (730108)            22 APR 1974            PAGE  10
*************************************************************************************************************************************

                 GRID LIST FOR CO*SCH


                          1          2          3          4          5

              3          0.0        0.0        0.0        0.0        0.0

              2          0.0        0.0        0.0     210.15        0.0

              1          0.0        0.0        0.0        0.0        0.0
                 DISPLAY    CO*SCH

                 GRID PLOT FOR CO*SCH

        1    2    3    4    5

    3                               3

                  #####
    2             #####             2
                  #####
                  #####

    1                               1


        1    2    3    4    5


            LEVEL DESIGNATIONS...

            1         2
                  #####
                  #####
                  #####
                  #####
CELL COUNT:  14        1
VALUE:       0.0     210.15

MAXIMUM:     0.00
MINIMUM:               0.00
                 SET        NOX*SCH      NOX           *             SCHOOLS
                 LIST       NOX*SCH
```

Figure 54 contd.

```
          GRID LIST FOR NOX*SCH


                    1         2         3         4         5
        3          0.0       0.0       0.0       0.0       0.0

        2          0.0       0.0       0.0   13455.42      0.0

        1          0.0       0.0       0.0       0.0       0.0
          DISPLAY    NOX*SCH

          GRID PLOT FOR NOX*SCH

       1    2    3    4    5

   3                             3

   2                  █████      2
                      █████
                      █████
                      █████
   1                             1


       1    2    3    4    5


   LEVEL DESIGNATIONS...

       1       2
            █████
            █████
            █████
            █████
CELL COUNT:  14       1
VALUE:      0.0   13455.42

MAXIMUM:    0.00
MINIMUM:          0.00
          SET        R01        R01       *        240.      CONVERT TO ACRES
          REPLACE    RES        R01
          SET        CO*RES     CO        *        RES
          LIST       CO*RES
```



```
          GRID LIST FOR CO*RES


                    1         2         3         4         5
        3          0.0       0.0       0.0       0.0       0.0

        2          0.0       0.0       0.0       9.36      0.0

        1          0.0       0.0       1.05      6.91      0.0
          DISPLAY    CO*RES

          GRID PLOT FOR CO*RES

       1    2    3    4    5

   3                             3

   2                  █████      2
                      █████
                      █████
                      █████
   1             ██████████      1
                 ██████████
                 ██████████
                 ██████████

       1    2    3    4    5


   LEVEL DESIGNATIONS...

       1       2
            █████
            █████
            █████
            █████
CELL COUNT:  12       3
VALUE:      0.0     17.32

MAXIMUM:    0.00
MINIMUM:          0.00
          SET        NOX*RES    NOX       *        RES
          LIST       NOX*RES
```

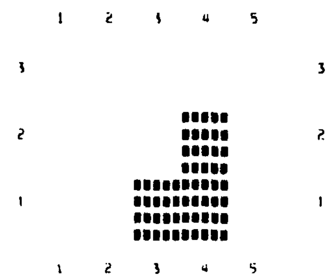
Figure 54 contd.

GRID LIST FOR NOX*RES

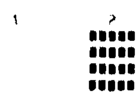
	1	2	3	4	5
3	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	599.33	0.0
1	0.0	0.0	99.88	507.46	0.0

DISPLAY NOX*RES

GRID PLOT FOR NOX*RES



LEVEL DESIGNATIONS...



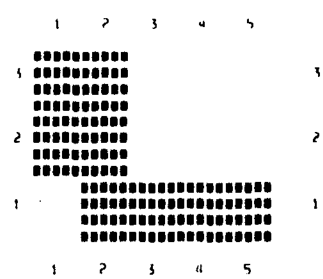
```
CELL COUNT:   12        3
VALUE:        0.0    1206.66

MAXIMUM:      0.00
MINIMUM:                0.00
              REPLACE   CO*COMM    CO*RES
              REPLACE   NOX*COMM   NOX*RES
              SET       S          S          *        240.      CONVERT TO ACRES
              REPLACE   COMM       S
              SET       CO*COMM    CO         *        COMM
              LIST      CO*COMM
```


GRID LIST FOR CO*COMM

	1	2	3	4	5
3	1.57	16.36	0.0	0.0	0.0
2	1.74	4.84	0.0	0.0	0.0
1	0.0	13.97	10.76	4.32	2.66

DISPLAY CO*COMM

GRID PLOT FOR CO*COMM



LEVEL DESIGNATIONS...

```
CELL COUNT:    7        8
VALUE:        0.0     54.82

MAXIMUM:      0.00
MINIMUM:               0.00
            SET        CO*COMM    CO        *        COMM
            LIST       CO*COMM
```

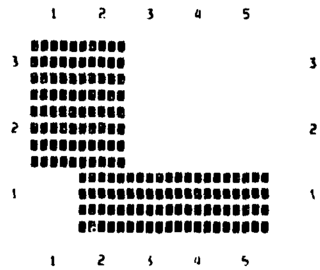
Figure 54 contd.

GRID LIST FOR CO*COMM

	1	2	3	4	5
3	1.57	16.36	0.0	0.0	0.0
2	1.74	4.84	0.0	0.0	0.0
1	0.0	13.07	10.26	4.32	2.66

DISPLAY CO*COMM

GRID PLOT FOR CO*COMM



LEVEL DESIGNATIONS...

	1	2
CELL COUNT:	7	8
VALUE:	0.0	54.82

MAXIMUM: 0.00
MINIMUM: 0.00

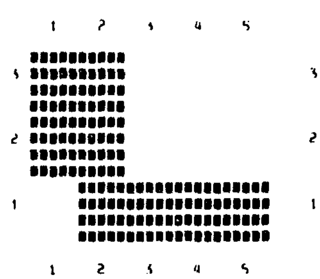
```
SET     NOX*COMM  NOX     *     COMM
LIST    NOX*COMM
```


GRID LIST FOR NOX*COMM

	1	2	3	4	5
3	50.16	641.84	0.0	0.0	0.0
2	81.30	246.50	0.0	0.0	0.0
1	0.0	869.09	979.61	317.16	189.00

DISPLAY NOX*COMM

GRID PLOT FOR NOX*COMM



LEVEL DESIGNATIONS...

	1	2
CELL COUNT:	7	8
VALUE:	0.0	3374.66

MAXIMUM: 0.00
MINIMUM: 0.00

```
DELETE   CO*COMM
DELETE   NOX*COMM
REPLACE  R01      RES
REPLACE  S        COMM
```

Figure 54 contd.

```
 23  1010     IMPACT ANALYSIS PROGRAM                          VERSION   1.1  (730108)          22 APR 1974            PAGE  17
*******************************************************************************************************************************

       PARAMETERS          SYMBOLISH FOR 'SCORE'                                    (UNIT  5)

              SCALE UNIT (METERS)=  1000.000

              GRID DIMENSIONS:  5 CELLS(X) BY  3 CELLS(Y)

              CELL DIMENSIONS (UNITS):      1.00(X) BY      1.00(Y)

              GRID ORIGIN, SCALE UNITS: ( 578.00, 4520.00)

              OUTPUT DATA SET= 7


 23  1010     IMPACT ANALYSIS PROGRAM                          VERSION   1.1  (730108)          22 APR 1974            PAGE  18
*******************************************************************************************************************************

OPERATIONS            LAND USE COMPATIBILITY SCORE                                     (UNIT  5)

              DELETE     POP
              SET        INTERSEC   CO        AND        SCHOOLS    SCHOOLS
              SET        POLL*LU    CO        *          INTERSEC
              SET        POLL*LU    POLL*LU   /          1.25       NORMALIZE BY CO STD.
              SET        PSCORE     POLL*LU   GT         0.25       PERMISSIBLE A.Q.
              SET        INTERSEC   CO        AND        R01        RESIDENTIAL
              SET        POLL*LU    CO        *          INTERSEC
              SET        POLL*LU    POLL*LU   /          1.25       NORMALIZE BY CO STD.
              SET        TEMP       POLL*LU   GT         1.0        PERMISSIBLE A.Q.
              SET        PSCORE     PSCORE    +          TEMP       UPDATE POLL. SCORE
              SET        INTERSEC   CO        AND        S          COMMERCIAL
              SET        POLL*LU    CO        *          INTERSEC
              SET        POLL*LU    POLL*LU   /          1.25       NORMALIZE BY CO STD.
              SET        TEMP       POLL*LU   GT         1.5        PERMISSIBLE A.Q.
              SET        PSCORE     PSCORE    +          TEMP       UPDATE POLL. SCORE
              LIST       PSCORE

              GRID LIST FOR PSCORE


                    1          2          3          4          5

          3        0.0        0.0        0.0        0.0        0.0

          2        0.0        0.0        0.0        0.0        0.0

          1        0.0        0.0        0.0        0.0        0.0
              DISPLAY    PSCORE


 23  1010     IMPACT ANALYSIS PROGRAM                          VERSION   1.1  (730108)          22 APR 1974            PAGE  19
*******************************************************************************************************************************

              GRID PLOT FOR PSCORE

          1    2    3    4    5

       3                         3


       2                         2


       1                         1


          1    2    3    4    5


       LEVEL DESIGNATIONS...

          1          2          3          4
                   .....      00000      █████
                   .....      00000      █████
                   .....      00000      █████
                   .....      00000      █████
CELL COUNT:  15        0          0          0
VALUE:      0.0      0.0        0.0        0.0

MAXIMUM:    0.00      1.00       2.00
MINIMUM:              0.00       1.00       2.00
              SET        SCORE      PSCORE    GT         0.         INITIALIZE 'SCORE'
              SET        INTERSEC   NOX       AND        SCHOOLS    SCHOOLS
              SET        POLL*LU    NOX       *          INTERSEC
              SET        POLL*LU    POLL*LU   /          100.0      NORMALIZE BY NOX STD
              SET        PSCORE     POLL*LU   GT         0.25       PERMISSIBLE A.Q.
              SET        INTERSEC   NOX       AND        R01        RESIDENTIAL
              SET        POLL*LU    NOX       *          INTERSEC
              SET        POLL*LU    POLL*LU   /          100.0      NORMALIZE BY NOX STD
              SET        TEMP       POLL*LU   GT         1.0        PERMISSIBLE A.Q.
              SET        PSCORE     PSCORE    +          TEMP       UPDATE POLL. SCORE
              SET        INTERSEC   NOX       AND        S          COMMERCIAL
              SET        POLL*LU    NOX       *          INTERSEC
              SET        POLL*LU    POLL*LU   /          100.0      NORMALIZE BY NOX STD
              SET        TEMP       POLL*LU   GT         2.0        PERMISSIBLE A.Q.
              SET        PSCORE     PSCORE    +          TEMP       UPDATE POLL. SCORE
              LIST       PSCORE
```

Figure 54 contd.

```
                GRID LIST FOR PSCORE

                     1          2          3          4          5
          3        0.0        0.0        0.0        0.0        0.0
          2        0.0        0.0        0.0        0.0        0.0
          1        0.0        0.0        0.0        0.0        0.0
                DISPLAY   PSCORE

                GRID PLOT FOR PSCORE

        1    2    3    4    5

     3                             3

     2                             2

     1                             1

        1    2    3    4    5

      LEVEL DESIGNATIONS...

        1          2          3          4
                 .....      00000      #####
                 .....      00000      #####
                 .....      00000      #####
                 .....      00000      #####
CELL COUNT:  15            0          0          0
VALUE:      0.0          0.0        0.0        0.0

MAXIMUM:    0.00         1.00       2.00
MINIMUM:                 0.00       1.00       2.00
                SET        TEMP       PSCORE     GT        0.
                SET        SCORE      SCORE      +         TEMP      UPDATE L.U. SCORE
                LIST       SCORE
```



```
****************************************************************************************************

                GRID LIST FOR SCORE

                     1          2          3          4          5
          3        0.0        0.0        0.0        0.0        0.0
          2        0.0        0.0        0.0        0.0        0.0
          1        0.0        0.0        0.0        0.0        0.0
                DISPLAY   SCORE

                GRID PLOT FOR SCORE

        1    2    3    4    5

     3                             3

     2                             2

     1                             1

        1    2    3    4    5

      LEVEL DESIGNATIONS...

        1          2          3          4
                 .....      00000      #####
                 .....      00000      #####
                 .....      00000      #####
                 .....      00000      #####
CELL COUNT:  15            0          0          0
VALUE:      0.0          0.0        0.0        0.0

MAXIMUM:    0.00         1.00       2.00
MINIMUM:                 0.00       1.00       2.00
                DELETE     SCHOOLS
                DELETE     R01
                DELETE     S
                DELETE     POLL+LU

END OF PROGRAM.
```

Figure 54 contd.

5. SYNAGRAPHIC COMPUTER MAPPING PROGRAM (SYMAP)

5.1 Program Description

5.1.1 Introduction

The SYMAP program is a general-purpose computer program for generating graphic displays of spatially distributed information, using the standard line printer. Multiple printing (called "overprinting") at each print-position on the line-printer is used to produce shades from white to black, hence providing a third dimension in addition to the row and column dimensions of the print medium. The applications of the program are general, but it is most suited for the mapping of geographical information, which is its use in the AQUIP system.

Essentially, SYMAP produces three distinct types of maps: (1) conformant-zone maps; (2) contour maps; and (3) proximal maps. In the first case, a set of spatial regions (e.g., geographical "zones") are defined, values assigned to each zone and the results plotted in such a manner that the shading everywhere within each conformant-zone represents the value assignment to that zone. In the second case, a set of data points is used to construct a three-dimensional (continuous) surface passing through the points. Contours of constant value (or "isopleths") defined for this surface are then plotted, with each value range represented by one combination of overprinted characters making up a "symbol". The third type of map, the "proximal" map is similar to the first, except that the conformant zones are constructed on the basis of proximity to data points. It is the second mode of operation, i.e., the contour map mode, which is of interest in the AQUIP system, since this mode is used to plot the isopleths of computed air quality.

The SYMAP program was originated in 1963 by Howard T. Fisher, working at Northwestern Technological Institute. Since that time it has undergone substantial development sponsored by the Laboratory for Computer Graphics and Spatial Analysis, at the Harvard University Graduate School of Design, Cambridge, Massachusetts. The present version of SYMAP, as implemented in the AQUIP system, is essentially version 5.14 as distributed and documented by the Laboratory for Computer Graphics, with only superficial changes required for installation and use with other AQUIP components.

The modes of operation and potential applications of the SYMAP program far exceed the requirements of the AQUIP system, and the task of fully documenting the program would be beyond the scope of this effort. For this reason, only those modes of operation, options and formats which are directly concerned with the functions served in the AQUIP data system are presented in this manual. A summary description of standard SYMAP conventions, formats and keyword package functions is given in the remainder of this section. Keyword package formats required for AQUIP functions are explicitly presented in Section 5.2, and the data flow system, data set description and other AQUIP implementation information in Section 5.3. For additional information on the SYMAP program, the user is referred to standard documentation for the program, available upon request from the Laboratory for Computer Graphics.

5.1.2 Summary Description of SYMAP Conventions

The logical structure of the SYMAP program is organized around keyword packages as in the ERT/AQUIP programs. These packages may be conveniently divided into two groups, those which make up the "base map" and those which insert data values and actually produce a map. The user prepares his base-map by selecting a study region for plotting, and coding spatial information regarding the region itself: the outline of the area to be considered, points at which data values are to be inserted, coordinates of conformant-zones and legends to appear on the output map. For each map to be plotted, he then supplies a set of values for assignment either to the data points or to conformant-zones, together with instructions for generating the map.

Several SYMAP conventions are noteworthy:

1. Any self-consistent set of units may be used for coordinates and measurement of linear displacement, but the program is internally based on row and column coordinates (down and across) rather than the usual horizontal and vertical (across and up) axes. By convention coordinates for standard SYMAP formats are given as displacements down from a reference point (such as the upper left-hand corner of the map) and those across from the same point. Any set of input coordinates defined on a right-hand system (such as UTM coordinates) must therefore be converted to the left-hand system. This may be accomplished by reversing the order of the coordinates, and changing the sign of the vertical (north) coordinate. For example, a UTM coordinate pair (572.0, 4510.0) becomes (-4510.0, 572.0). As long as all coordinates and displacements follow the same convention, (internally to SYMAP) spatial relationships will be preserved. Most AQUIP data sets have been interfaced to the SYMAP program (using sub-routine FLEXIN) to perform the above right-to-left coordinate conversion automatically; so that input data can be expressed in right-hand units.

2. Not all data packages are required to produce a map. The program draws upon a vast reservoir of default options if not supplied in the input. No data package may, however, be supplied more than once within the input for any one map.

3. All linear measurements are based upon the assumption that horizontal spacing occurs at 10 columns per inch, and that vertical spacing at 8 rows per inch. These spacings are required in order to produce a uniform distribution of symbols within a homogeneous area.

4. Input values may have to be scaled in some cases, since values less than .01 are printed as 0.

5. Provision has been made in all SYMAP input packages (except for F-MAP, CLEAR and ENDJOB) for non-standard data input formats, which are accommodated by the application-dependent subroutine FLEXIN. In the present application, this subroutine has been written to interface SYMAP with the other AQUIP programs. In general, each SYMAP keyword package involves a FLEXIN procedure which reads in an AQUIP data package intact (from keyword card through '99999' card).

5.1.3 SYMAP Keyword Format

The first card of each package of a SYMAP input card deck is a "keyword card" with function analogous to those of the other AQUIP programs. The format of the keyword card, however, differs from that of the ERT programs, and is thus presented as follows:

Columns	Variable	Format	Meaning
1-15	KEY	A4,A2,9X	Keyword
16-20	OPT	A5	Non-blank if option card follows.
21-25	PRINT	A5	Non-blank if input data is not to be listed as read in.
31-40	DIV(1)	F10.0	Blank if vertical coordinate is in equal units (see above, Section 5.2.3); 8.0 if expressed in rows.
41-50	DIV(2)	F10.0	Blank if horizontal coordinate is in equal units; 10.0 if expressed in columns.

Columns	Variable	Format	Meaning
51-60		F10.0	Not used.
61-65	TAPE	A5	Blank if A-CONFORMOLINES package is to be read from cards; non-blank if from unit 11.
72		A1	Not used.

By convention, OPT is specified as an 'X' in column 18 for all packages for which FLEXIN is invoked (option card follows keyword card). PRINT is specified as an 'X' in column 23 if print is to be suppressed. The other parameters on the keyword card are not used in AQUIP.

All keyword packages are delimited by '99999' as they are in other AQUIP programs. Similarly, the end of the program is signaled by an 'ENDJOB' card. Use of comments cards is not permitted in SYMAP input packages.

The format of the option card (second card if OPT is specified) is as follows:

Columns	Variable	Format	Meaning
1-5	IFORM	I5	FLEXIN routine to be used for data input if non-zero.
6-10	NPTS	I5	Blank if data set is terminated by a '99999' card; otherwise, the number of cards to be read.
11-15	REW	A5	Non-blank if tape 12 is to be rewound before processing.

In AQUIP, neither the NPTS or REW parameters are used since data sets are terminated by '99999' cards, and rewind options are controlled by FLEXIN itself.

5.1.4 Keyword Package Summary

The following lists all available keyword packages with a brief explanation of their general purpose. Those which may be used for AQUIP functions are noted, and described in detail in Section 5.2.

A-OUTLINE

This package describes the outline of the study area if non-rectangular, by specifying the coordinate locations of the outline vertices. (Used for contour and proximal maps only.)

AQUIP: Used with FLEXIN (IFORM=1) to read in right-hand coordinates.

A-CONFORMOLINES

This package is used to give the positions of the data zones to which data is to be related, by specifying the coordinate locations of vertices on the zonal outlines. This package is required for a conformant map.

AQUIP: Used with FLEXIN (IFORM=2) to read 'FIGURES' data cards with right-hand coordinates.

B-DATA POINTS

This package is used to give the positions of the data points to which values are to be related, by specifying their coordinate locations. Data points may be either the points for which data are available, or the centers of areas, called data zones, for which data are available. (When warranted by the nature of the study, and under exceptional circumstances, other "centers" may be used, such as centers of population.) This package is required for contour and proximal maps.

AQUIP: Used with FLEXIN (IFORM=3) to read in a 'POINTS' package intact.

C-OTOLEGENDS

This package is used to specify the relative position of legends which are to be adjusted automatically if the size and/or scale of the map are altered.

AQUIP: Used with FLEXIN (IFORM=4) to convert coordinates.

D-BARRIERS

This package is used to give the coordinate location and strength of impediments to interpolation at specified vertices.

AQUIP: Not used.

E-VALUES

This package is used to assign numerical data to the data points and/or data zones, by specifying the "values" involved. All such data must, of course, be measured on a consistent uniform basis. (While normally required, this package may be omitted if a preliminary "base map" is desired for checking locations before applying values.)

AQUIP: Used with FLEXIN (IFORM=6) to read one of six data fields of a 'VALUES' package intact.

E1-VALUES INDEX

This package is used to adjust the reference order of data values in the E-VALUES package.

AQUIP: Not used.

F-MAP

This package is used to specify below the map an appropriate title for the identification of each separate map you may wish to run. In addition, it instructs the computer to make each specific map pursuant to certain "electives". These electives provide a variety of options for obtaining maps suited to your particular needs. An F-MAP package is required for each map desired.

AQUIP: Used as in distributed version, except for elective 10, which has been replaced by elective 40.

CLEAR

This single keyword card wipes out all previously read-in data packages, resetting all parameters to initial values. It is useful for multiple unrelated map-runs stacked within a single job submission.

ENDJOB

Terminates program execution with the printed message: "XXX MAPS HAVE BEEN PRODUCED", "END OF JOB", where XXX is the number of maps.

5.1.5 Program Output

The normal output of the SYMAP program consists of:

1. Tabular printout of coordinates of all vertices making up an outline in an 'A-OUTLINE' package.

2. Listing of all vertices of conformant zones, together with centroid coordinates and areas, as read in an 'A-CONFORMOLINES' package.

3. Listing of coordinates of data points as read in a 'B-DATA POINTS' package.

4. Listing of values assigned to data points as read in an 'E-VALUES' package.

5. Descriptive listing of all legend information as read in a 'C-OTOLEGENDS' package.

6. Listing of map title and all electives except elective 40 for an F-MAP package.

7. Listing of points, values and level assignments for use in the mapping process.

8. Output map, with a frequency distribution of points within each level range at the bottom, followed by the text of elective 40, if specified.

5.2 Keyword Packages

5.2.1 A-OUTLINE

This package is optional and is used to specify the outline of the study area for a contour or a proximal map, when the study area does not fill the entire space within the rectangular map border.

FIRST CARD

Keyword card 'A-OUTLINE', with OPT specified ('X' in column 18), and PRINT specified ('X' in column 23) if print is to be suppressed.

SECOND CARD

Option card, with IFORM=1 (column 5).

THIRD AND FOLLOWING CARDS

Coordinate locations of study area outline vertices (i.e., those points at which the outline changes direction).

Columns	Variable	Format	Meaning
11-20	UTMX	F10.5	Horizontal coordinate of vertex, scale units.
21-30	UTMY	F10.5	Vertical coordinate of vertex,scale units.

LAST CARD

Delimiter card '99999'.

Punch each vertex location on a separate card, starting with the uppermost vertex and proceeding clockwise,back to and including,once again, the point of beginning. This repetition tells the program that the outline is complete. If there are two or more vertices equally high, start with the one that is furthest to the left. If the outline is curved, approximate the curve with short straight-line segments.

If the study area is not contained within a single outline, two or more outlines may be employed - presented in any desired sequence. There is no set limitation on the number of outlines, but no single outline may have fewer than 3 or more 100 vertices. If a large complex outline would require more than 100 vertices, subdivide it into two or more outlines which meet along a common edge at any angle except horizontal.

5.2.2 A-CONFORMOLINES

This package is used to specify the outline of each of the data zones of the study area. Only one data value may be associated with any one data zone. In certain instances, however, more than one outline may be needed to define a data zone. In such cases, each of the outlines, which together define the whole data zone, is associated with the same data value.

FIRST CARD

Keyword card 'A-CONFORMOLINES' with OPT specified, and PRINT specified if print is to be suppressed.

SECOND CARD

Option card with IFORM=2.

FOLLOWING CARDS

Outlines of each conformant zone (one or more cards for each zone).

FIRST CARD - first vertex card of conformant zone.

Columns	Variable	Format	Meaning
1-5	IREF	I5	Reference number of associated data value if non-blank. If blank, assume the next value in list.
6-9			Not used.
10	KT	A1	'P','L','A'.
11-20	UTMX	F10.5	Horizontal coordinate of first vertex, scale units.
21-30	UTMY	F10.5	Vertical coordinate of first vertex, scale units.

ADDITIONAL CARDS - one for each additional vertex.

Columns	Variable	Format	Meaning
11-20	UTMX	F10.5	Horizontal coordinate of vertex, scale units.
21-30	UTMY	F10.5	Vertical coordinate of vertex, scale units.

LAST CARD - (of 'A-CONFORMOLINES' package) - Delimiter '99999'.

Each conformant zone is considered to be a point ('P') with a single vertex, a broken line ('L') of two or more vertices, or an irregular polygon area ('A') of four or more vertices.

NOTE that conformant zone subpackages are compatible in format with those of a LANTRAN 'FIGURES' package (Section 2.2.2).

'A-OUTLINE' and 'A-CONFORMOLINES' packages are mutually exclusive. Unless the latter is present, an isopleth map will be produced. Once a 'A-CONFORMOLINES' package has been introduced, the conformant-zone mode is assumed, and retained until a 'CLEAR' card is read, or until elective 27 is specified in an F-Map Package.

5.2.3 B-DATA POINTS

This package is used to specify the coordinate locations of the points at which data is to be provided. Data points may be located outside the study area, and even beyond the rectangular map border. In the latter event, however, their location will not appear. No special sequence of locations is required. If a conformant map is to be produced from this source map, the reference number of each data point should be the same as that of the zonal outline in which it appears.

FIRST CARD - Keyword card 'B-DATA POINTS' with OPT specified, and PRINT specified if print is to be suppressed.

SECOND CARD - Option card with IFORM=3.

THIRD AND FOLLOWING CARDS - A keyword 'POINTS' data set, beginning with the keyword card and ending with a '99999' card. See Sections 2.2.3 and/or 3.2.2 for format.

There is a limit of 1000 data points for any one map. If more data points are needed, divide the work into two or more parts with some overlap.

5.2.4 C-OTOLEGENDS

This package is used to specify the relative position and content of any special wording, numbering or other symbolism desired on the face of the map or within the rectangular map border. Any supplementary information which will apply equally to all maps in any one series may be provided such as: the general title applicable to the study area, compass directions, major landmarks, rivers and railroads, etc. Legends supplied in this package are called "OTOLEGENDS" because they are defined in terms of the source map coordinates rather than by row or column, and hence retain their relationships to physical features of the map even though the output map may be printed at different scales.

The map background - the area between the rectangular map border and the outline of the study area - may be used for legends without affecting the map itself, whereas legends inside the area outline may adversely affect map legibility and comprehension, especially if placed at data point locations.

FIRST CARD -	Keyword card 'C-OTOLEGENDS' with OPT specified, and PRINT specified if print is to be suppressed.
SECOND CARD -	Option card with IFORM=4.
THIRD AND FOLLOWING CARDS -	OTOLEGENDS subpackages, one or more cards per otolegend.
LAST CARD -	Delimiter card '99999'.

Each OTOLEGEND is coded in one of the following formats:

1. POINT LEGEND, SINGLE SYMBOL - overprinted, if desired - 1 card.

Columns	Meaning
6-9	The print and overprint characters (any of which may be blank) for the single symbol desired.
10	The letter 'P'
11-20	The horizontal coordinate of associated source map point, in scale units.
21-30	The vertical coordinate of associated source map point, scale units.
31-40	The vertical displacement desired, namely, the number of rows up (precede by '-'), or the number of rows down for the symbol to be adjusted, relative to its associated source map point.
41-50	The horizontal displacement, namely, the number of columns to the left (preceded by '-'), or the number of columns to the right for the symbol to be adjusted, relative to its associated source map point.

2. POINT LEGEND, MULTIPLE CHARACTER (Vertical or Horizontal) - no overprint - 2 cards

FIRST CARD

Columns	Meaning
1	Leave blank for horizontal legend, punch '-' (minus) for vertical legend.
4-5	The number of characters in legend (not to exceed 50).
10	The letter 'P'.
11-20	The horizontal coordinate of associated source map point, scale units.
21-30	The vertical coordinate of associated source map point, scale units.
31-40	The vertical displacement, namely, the number of rows up (preceded by '-'), or the number of rows down for the "start" of the legend, relative to its associated source map point.
41-50	The horizontal displacement, namely, the number of columns to the left (preceded by '-'), or the number of columns to the right for the "start" of the legend, relative to its associated source map point.

SECOND CARD

Columns	Meaning
1-50	Punch the desired legend starting in Column 1 and ending in the column whose number is punched in Columns 4-5 of the first card.

3. LINE LEGEND, SINGLE SYMBOL - Repeated - 2 or more cards.

Columns	Meaning
6-9	The print and overprint characters (any of which may be blank) for the symbol desired.
10	The letter "L"
11-20	The horizontal coordinate of first point on line,in scale units
21-30	The vertical coordinate of first point on line, in scale units

OTHER CARDS - The coordinate locations of the succeeding vertices on the line, one location to a card, in columns 11-20 and 21-30 as for the first point. Columns 1-10 are left blank on these cards.

4. AREA LEGEND, SINGLE SYMBOL - filled outline - 2 or more cards

FIRST CARD

Columns	Meaning
6-9	The print and overprint characters (any of which my be blank)
10	The letter "A".
11-20	The horizontal coordinate of the first vertex (the uppermost point on the outline, and if more than one, the left most of these).
21-30	The vertical coordinate of the first vertex.

OTHER CARDS - The coordinate locations of succeeding vertices on the outline, one location to a card, in columns 11-20 and 21-30 as for the first vertex. On the last card repeat the coordinate location of the first vertex to "close" the outline. Columns 1-10 are left blank on these cards.

NOTE: That a character is any single keypunch designations EBCDIC, whereas a symbol is composed of four characters, printed one on top of the other in the same location, any or all of which may be blank. This process is called "overprinting". The set of symbols used for value ranges and special purposes is called symbolism.

5.2.5 E-VALUES

This package is used to specify the values of quantitative information applicable to each data point (for a contour or proximal map) or to each data zone (for a conformant map).

FIRST CARD - Keyword card 'E-VALUES' with OPT specified and PRINT specified if print is to be suppressed.

SECOND CARD - OPTION card with IFORM=6.

THIRD CARD

Columns	Variable	Format	Meaning
1-5	JFORM	I5	Field designator, 1-6 (selects which variable in the 'VALUE' package is to be plotted)
6-10	NU	I5	Unit from which 'VALUES' package is to be read; if 5, read from cards and write the package to unit 12.
11-15	REW	1X,A4	If non-blank, unit NU is rewound before 'VALUES' are read.
21-70	TEXT	12A4,A2	Text for printing in output.

FOLLOWING CARDS - (present only if NU=5 has been specified) - A keyword 'VALUES' data set, beginning with the keyword card and ending with a '99999' card. See Sections 2.2.4 and/or 3.2.4 for format.

NOTE: That if the 'VALUES' package is read from cards, it is written to unit 12. The same 'VALUES' package may be reread again with a different JFORM value simply by using NU=12 and specifying rewind as per the following example:

```
  .
  .
  E-VALUES      X
     6
     1     5
     (followed by a complete 'VALUES' package on cards)
                                       (First map)
  .
  .
  E-VALUES      X
     6
     2     12 X
  .                                    (Second map)
  .
  .
```

NOTE: That the 'VALUES' package may be placed on a tape or disk file in card-image format by a previous SYMAP run or a run with another program (such as MARTIK). Note also that the package on the data set must have the keyword as the first card, and the '99999' delimiter on the last card. If taken from a tape or disk file, there is no '99999' card in the 'E-VALUES' package.

5.2.6 F-MAP

This package instructs the computer to make a map - based on the information supplied in the prior packages - and is used to specify the precise form of that map in terms of certain available optional treatments known as electives.

FIRST CARD - Keyword card 'F-MAP' with PRINT specified if print is to be suppressed.

SECOND, THIRD AND FOURTH CARDS - Map title (3 cards, punched columns 1-72 each) to appear below the map.

FOLLOWING CARDS - Elective cards as desired.

LAST CARD - Delimiter card '99999'.

Each elective is specified by one or more cards. The first card is in the following format:

FIRST CARD (of elective subpackage)

Columns	Variable	Format	Meaning
1-5	NUMOP	I5	Elective number
6-10	SAME	A5	Blank for new specification; non-blank for repeat of this option (from the last map)
11-20	VALUE(1)	F10.5	Values as required by elective.
.	.	.	
.	.	.	
.	.	.	
61-70	VALUE(6)	F10.5	

ADDITIONAL CARDS, if required, in format dependent upon elective.

The following is an abbreviated list of electives, their functions and parameters. Details have been given only for those electives which are of interest to AQUIP applications. See the SYMAP user's manual for an expanded discussion of F-MAP electives.

ELECTIVE 1 - (1 card) size of the output map

VALUE (1): Vertical dimension of rectangular map border in inches.

VALUE (2): Horizontal dimension of map border in inches.

STANDARD: 13.0 inches for the larger dimension with the smaller dimension proportioned accordingly. If a horizontal dimension greater than 13.0 inches is specified, the map will be printed in two or more sections for mounting side-by-side.

A maximum of 72.0 inches is allowed unless elective 16 is specified.

ELECTIVE 2 - (1 card) extreme points

VALUE (1): Vertical coordinate of upper left corner of map measured in scale units down from the reference point (for AQUIP, this must be the negative of the vertical scale unit. For example, if the top border of the map is to be at 4520.0, specify VALUE (1)=-4520).

VALUE (2): Horizontal coordinate of upper left corner of map, in scale units across from the reference point. (For AQUIP, this is the horizontal scale unit. For example, if the left border of the map is to be at 572.0, specify VALUE (2)=572.0.)

VALUE (3): Vertical coordinate of lower right corner of map.

VALUE (4): Horizontal coordinate of lower right corner of map.

STANDARD: To select extreme points from a preceding package: A-CONFORMOLINES, A-OUTLINES, B-DATA POINTS, or C-OTOLEGENDS.

ELECTIVE 3 - (1 card) number of levels

VALUE (1): Number of levels or class intervals (from 2 to 10) punched as a decimal number.

STANDARD: Five levels.

ELECTIVE 4 - (1 card) value range minimum

VALUE (1): Minimum value of total value range. Values below this range are mapped with the letter "L" for LOW.

STANDARD: The minimum value of the data.

ELECTIVE 5 - (1 card) value range maximum

VALUE (1): Maximum value of the total value range. Values above this range are mapped with the letter "H" for HIGH.

ELECTIVE 6 - (1 or 2 cards) value range intervals

Equally distributed data points: - All VALUE fields blank. Level ranges are constructed such that each level range contains the same number of data points.

Level value ranges: VALUE fields are punched with decimal numbers proportionate to the size of the corresponding value ranges. If more than 6 levels, continue in the same format on the second card up to a maximum of 10 levels.

STANDARD: Assign an equal range to each interval.

ELECTIVE 7 - (5 cards) Symbolism

On the second - fifth cards: Punch in the appropriate columns the characters desired. The designations for the card columns are given in Table 4 as are the standard sumbol assignments. The second card contains the "basic" characters making up each symbol, and the third through fifth the "overprint" characters.

STANDARD: Symbolism as shown in Table 4. Standard level symbolism is shown as a function of the number of levels (Elective 3) in Table 5.

ELECTIVE 8 - (1 card) Contour Lines

Suppresses contour lines between adjacent levels of symbolism.

STANDARD: Show contour lines.

ELECTIVE 9 - (1 card) Histogram Bars

Suppresses the histogram bars showing graphically the frequency distribution of data point levels.

STANDARD: Show histogram bars.

ELECTIVE 10 - Not used (replaced by option 40 for AQUIP)

ELECTIVE 11 - (1 card) Printing actual value at data point

Prints the data value at its data point location to 2 decimal places with decimal point located at the data point location.

STANDARD: Show data point symbol (Table 4).

TABLE 4

SYMBOLISM FOR LEVELS AND SPECIAL PURPOSES

Column	Description		Standard Symbolism Card no: 2	3	4	5
1		1	.			
2		2	'			
3		3	-			
4		4	=			
5	General symbolism for level:	5	+			
6		6	X			
7		7	O			
8		8	O	-		
9		9	O	X		
10		10	O	X	A	V
11		1	1			
12		2	2			
13		3	3			
14		4	4			
15	Respective data point symbols for level:	5	5			
16		6	6			
17		7	7			
18		8	8			
19		9	9			
20		10	*			
21	Low--general symbolism		L			
22	Low--data point symbolism		L	.		
23	High--general symbolism		H			
24	High--data point symbolism		H	H	H	/
25	Background symbolism					
26	Symbolism for contour lines					
27	No data (used only with barriers)		N			
28	Superimposed data points		S			
29	Data points with invalid values		M			

TABLE 5

STANDARD SYMBOLISM FOR VARIOUS LEVELS

	general symbolism										data point symbolism									
column:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
number of levels desired:																				
1	.										1									
2	.	■									1	2								
3	.	O	■								1	2	3							
4	.	+	O	■							1	2	3	4						
5	.	+	O	Θ	■						1	2	3	4	5					
6	.	+	X	Θ	⊠	■					1	2	3	4	5	6				
7	.	'	+	X	Θ	⊠	■				1	2	3	4	5	6	7			
8	.	'	+	X	O	Θ	⊠	■			1	2	3	4	5	6	7	8		
9	.	'	=	+	X	O	Θ	⊠	■		1	2	3	4	5	6	7	8	9	
10	.	'	-	=	+	X	O	Θ	⊠	■	1	2	3	4	5	6	7	8	9	*

ELECTIVE 12 - (1 card) Multiple Elective Repeat

All non-standard electives used in the preceding map of a single job submission are to be repeated. Additional non-standard electives may be added, but elective 12 may not be used if any electives are to revert to standard.

STANDARD: Provide the required elective cards for each non-standard elective to be used in each map.

ELECTIVE 13 - (1 card) Scale

VALUE (1): Number of inches on the output map desired to represent one source map unit.

STANDARD: Establish the scale from the size and extreme point electives (specified or standard).

ELECTIVE 14 - (1 card) Shift

VALUE (1): Distance between top border and top extreme edge of study area, inches (positive, zero or negative).

VALUE (2): Left border

VALUE (3): Bottom border

VALUE (4): Right border

STANDARD: Extreme edges of study area (Elective 2) touch their corresponding map borders (all VALUE fields = 0).

ELECTIVE 15 - (1 card) Characters per inch

VALUE (1): Number of rows per inch at which map will be printed

VALUE (2): Number of columns per inch

STANDARD: 8 rows per inch and 10 columns per inch.

ELECTIVE 16 - (1 card) large size

Required if the vertical or horizontal dimensions of the map (elective 1) are to exceed 72.0 inches. WARNING: Size (elective 1) and large size (elective 16) are to be used with caution; execution time goes as the area of the map (in square inches)!

STANDARD: A map not exceeding 72.0 inches, or a map with larger dimension equal to 13.0 inches if either dimension is in excess of 72.0 inches, is specified.

ELECTIVE 17 - (1 card) Suppress tabular printout of map data

Suppresses printout of output data for conformolines of data points, immediately preceding map.

STANDARD: Tabular printout immediately preceding map.

ELECTIVES 18-20 - Invalid data range electives (see SYMAP documentation).

ELECTIVE 21 - Store output map on tape (see SYMAP documentation)

ELECTIVE 22 - (1 card) Continuous Contours

Display contour lines instead of descriptive symbolism if the space between contour lines is too small to print both.

STANDARD: Suppress contour lines in case of conflict.

ELECTIVE 23 - Suppress Invalid data-point symbol (see SYMAP documentation)

ELECTIVE 24 - (1 card) Suppression of Numeric Interpretation

Suppresses printing of the numeric interpretation ("ABSOLUTE VALUE RANGE APPLYING ---", etc.) at the bottom of the map.

STANDARD: Print numeric interpretation.

ELECTIVE 25 - (1 card) Suppress Data Point Symbols

Suppresses appearance of data point symbols within zonal outlines of a conformant zone map.

STANDARD: Print data point symbols.

ELECTIVE 26 - (1 card) Overprint Alignment

To correct the alignment of overprint lines to coincide with the lines to be overprinted. REQUIRED FOR AQUIP on the Spectra 70/45.

STANDARD: Automatic coincidence for the IBM 7094 (reversed for the IBM 360 and Spectra 70/45).

ELECTIVE 27 - (1 card) Contour Map

Produce a contour map when both contour and conformant maps are included in the same job submission.

STANDARD: Produce a conformant map if an A-CONFORMOLINES package has been included in the submission.

ELECTIVES 28-30 - Not used.

ELECTIVES 31-33 - Extrapolation Range Electives (see SYMAP documentation)

ELECTIVES 34-37 - Search Radius and Interpolation Electives (see documentation)

ELECTIVES 38-39 - Not used.

ELECTIVE 40 - (2 or more cards) Map Text

Replaces elective 10 in the standard version (to save core storage on the RCA Spectra 70/45). Elective card is followed by cards containing text punched in columns 1-72, for printing at the bottom of the map. Any number of lines of text may be used.

The last card of text is followed by the '99999' F-MAP delimiter card.

NOTE: This elective must be the last one in the F-MAP package, and the text must be included with every map for which elective 40 is specified, even though the text is the same.

PROXIMAL-MAP ELECTIVES (3 cards)

The combination of electives 31, 36 and 37 is used to specify the proximal type of map. Include one card for each of the three electives. No other specification is required on these cards.

5.3 AQUIP System Implementation

5.3.1 Subroutine FLEXIN

The interface between SYMAP and the other AQUIP programs has been constructed using subroutine FLEXIN. Each of the data input packages of Section 5.2, except 'F-MAP', invokes FLEXIN to read in data in the formats given. It should be noted again that these formats differ from the "standard" SYMAP input formats, principally in the manner in which coordinates are input (right handed horizontal-vertical as opposed to left handed down-across). The functions of each FLEXIN routine are evident from the format specifications of Section 5.2, together with the listing in the APPENDIX. Additional discussion of the potential uses of FLEXIN may be found in the documentation with the distributed version of the SYMAP program.

5.3.2 Data Flow, Isopleth Plotting

The purpose of this section is to relate the SYMAP functions to the overall AQUIP system as shown schematically in Figure 2 of Section 1.1. The analogous schematic data flow system is shown for isopleth plotting in Figure 22. The same conventions have been used in naming of input data sets (I), model data sets (M), computed data sets (C), and programs (P). Each box of Figure 2 has been detailed to represent the card decks (keyword packages) which make it up.

5.3.3 Data Set Descriptions

I6. <u>Map Option Package</u>

I6.1 E-VALUES -- A keyword package (3 cards, optionally followed by data set C2 on cards) which selects the data field to be plotted.

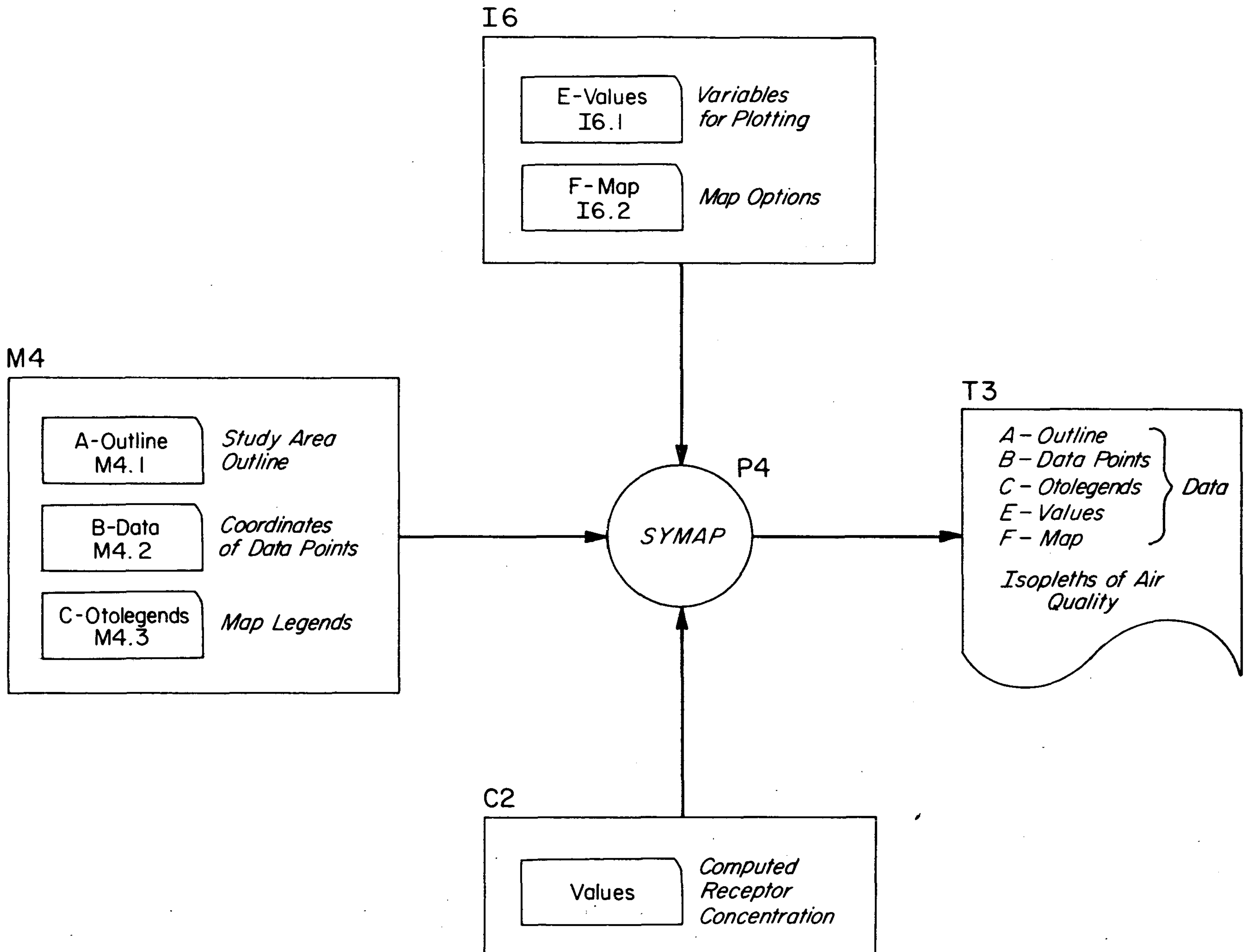


Figure 55 Data Flow Diagram for SYMAP Analysis

In AQUIP, this is the pollutant with 1 for particulates, 2 for SO_2, 3 for CO, 4 for hydrocarbons, and 5 for NO_X.

I6.2 F-MAP -- A key word package containing the title of the map to be plotted, together with any non-standard electives to be specified. For the first map, the size and extreme points (electives 1 and 2) should be specified, and the overprint alignment (elective 26) must be specified for running on the RCA Spectra 70/45. Optional electives such as those involving level ranges and symbolism are usually, but not necessarily specified. For the second and following maps, elective 12 may be specified to repeat all electives specified in previous maps (except elective 40, if used).

M4 Base Map of the Study Region

This model dataset is referred to as the "base map" since it contains all map information specific to the study area:

M4.1 A-OUTLINE -- A keyword package defining the outline of the region to be mapped. For AQUIP, this region is the "Hackensack Meadowlands District" with coordinates for vertices specified in UTM coordinates for the boundary as depicted in Figure I-14 of the Task 1 report.

M4.2 B-DATA POINTS -- A keyword package defining the coordinates of the receptor sites used in the diffusion analysis. This package reads in a 'POINTS' data set, which is in fact the receptor data set M3.2 used as an input to MARTIK.

M4.3 C-OTOLEGENDS -- An optional keyword package in which descriptive information is input for printing on the map (titles, physical features, scales, etc). For AQUIP this package was not used, since a transparent overlay was considered more suitable for a large number of maps printed at smaller scale (page size).

C2 Computed Receptor Concentrations

A keyword 'VALUES' package created as output from MARTIK, in which concentrations are punched (or put to a card-image data set). If on cards, this package is physically a part of the E-VALUES package; otherwise the data set on which it resides is manipulated by the E-VALUES package.

T3 Printed Output

This output consists of a listing of all input data packages as read in, a list of map options, and the map or maps as directed by the data set I6.

5.3.4 SYMAP and the Planning Process

The above discussions have been concerned with the mechanics of setting up the data sets and specifications for use of SYMAP for isopleth plotting. This section provides some examples of the roles of SYMAP in the planning process. Only one of these -- that of isopleth plotting of computed air quality -- has actually been used in AQUIP, but the others may be readily incorporated. In each case, the data flow pattern is similar to that of Figure 55.

1. Isopleth Plotting of Computed Total Air-Quality

This is the role of SYMAP as used in AQUIP, as exemplified by the maps shown for the four plans 1, 1A, 1B, and 1C for the Hackensack Meadowlands Region in the year 1990 (Task 3 report, Appendix). In each case, 'VALUES' representing the calibrated total receptor concentrations have been used as inputs to the program. For convenience, twelve separate SYMAP runs (four plans, three seasons) were used to generate 5 maps each (for the five pollutants).

2. Isopleth Plotting of Air-Quality Subsets

This role is a special case of (1), in which the results of particular types of MARTIK analysis discussed in Section 3.3.5 are displayed graphically. For example, if a diffusion analysis is carried out on the proposed relocation of a highway, and the differential concentration is computed, isopleth plots run with SYMAP will show those areas in which the concentration is increased by the proposed plan and those where it is decreased. Symbolism may, in fact, be selected for two levels (positive and negative values) to delineate these regions directly in the output. Isopleth plotting of "worst case conditions" as generated by MARTIK is not recommended, due to the fact that these cases assume a single wind direction, and the interpolation procedures in SYMAP do not preserve the required source-receptor relationships. (Such maps will show, for example, non-zero concentrations upwind of a source.)

3. Conformal Maps of Land-Use

This role of SYMAP, not incorporated directly into AQUIP, is readily accomplished by constructing A-CONFORMOLINES and E-VALUES packages from the LANTRAN input data set I1. Formats for this data set have been made compatible with this application in mind. If one of the original planning variables is to be displayed, such as density of dwelling units, the output map for this variable will show each zone or "figure" with shading determined by the density of dwelling units assigned to that figure.

Additional variables may be added to those of the input plan data set (I1) by coding them in the LANTRAN format.

4. Isopleth, Conformant or Proximal Maps of Gridded Quantities

This role of SYMAP is of potential use in the planning process, if presentation maps are to be provided using data defined on a grid system as input. In AQUIP, plots of gridded data have been successfully achieved using the 'PLOT' functons in LANTRAN and IMPACT, and therefore this capability has not been incorporated into SYMAP. To do so would require straightforward modification of FLEXIN to accommodate a 'GRID' format data set, with one routine (IFORM=7) written to generate the A-CONFORMOLINES package for the grid system, and another (IFORM=8) to input the values at each grid cell for an E-VALUES package. Before making this modification, programmers should refer to SYMAP documentation, and in particular, the requirements of subroutines INFLAT and INVALS.

5.4 SYMAP Test Case

The SYMAP test case demonstrates how maps of the pollutant concentrations were obtained. The land forms figures, legends for identification, and certain map scale and size parameters determine the basic map form. Figure 56 shows the base map with the overlay of the outline and legends used for the test case. Data from MARTIK is used to obtain the concentrations at the receptors. SYMAP uses this information to calculate the concentrations throughout the map area; and prints the map of concentrations, together with the specified legends.

This test case maps the concentrations of CO and NO_X, but SYMAP is capable of mapping any variables which the user desires maps of. This output is very useful for a visual display of the air quality that results from the land use plan.

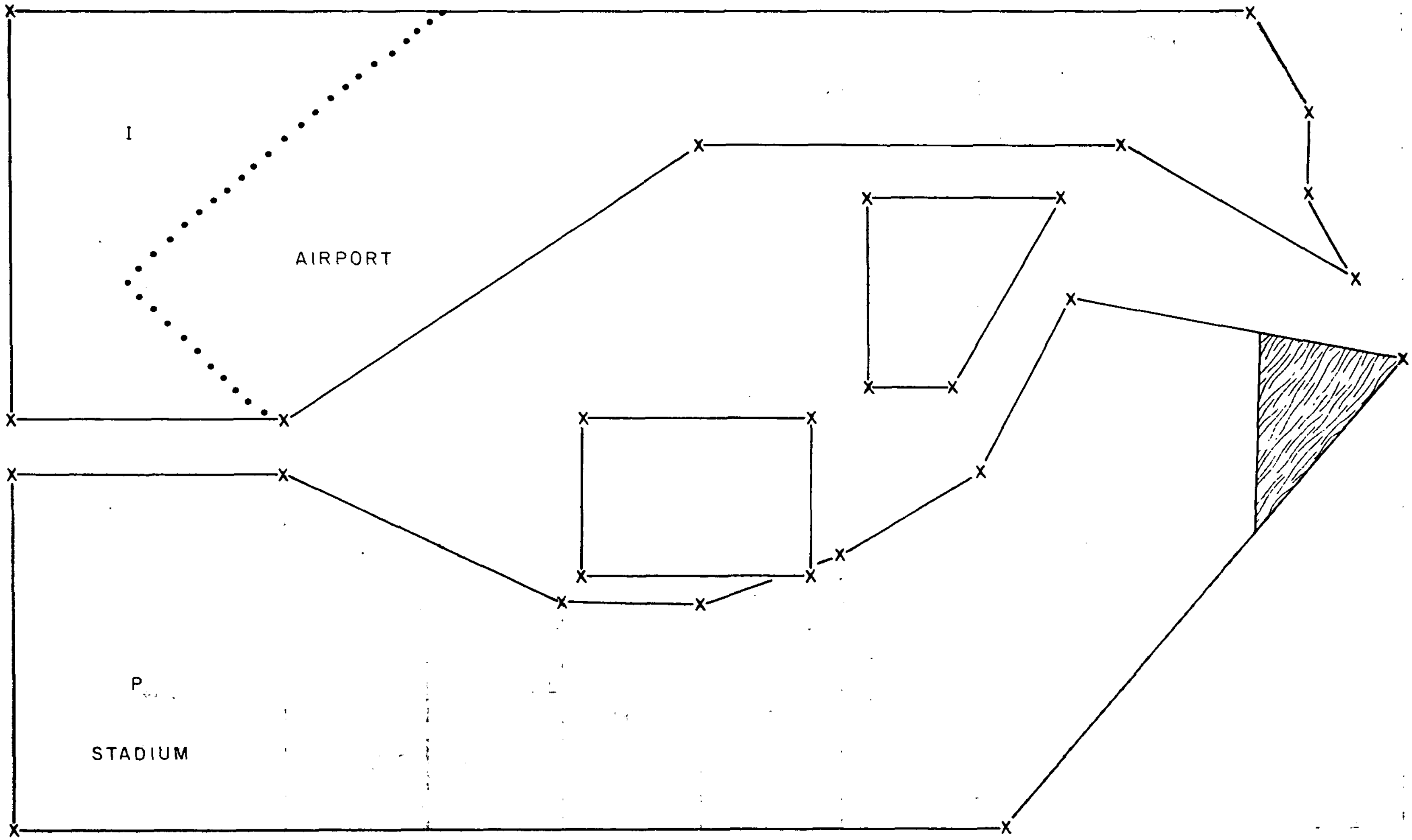


Figure 56 Base Map with SYMAP Legends

Job Control Language

SYMAP resides on a link-library at ERT; the beginning JCL links SYMAP and initiates execution. The dataset- required for the SYMAP run are:

FT01, FT02, and FT03 are work datasets. These must be provided for every SYMAP run.

FT09 is the run-log dataset. It must be provided for any run of a program in the AQUIP system.

FT13 is a VALUES package that was created in the MARTIK test case #2. This values package was the annual air quality due to the background sources, and the land use emissions.

Keyword Package Input

The first package used is an A-OUTLINE package, see Section 5.2.1. The vertices given specify the four "islands," shown in Figure 56. The print on page 1 tallies the vertices for each "island", and also gives the area and the centroid of the "island". These "islands" are the areas where values are going to be mapped into them. Note that there is no card distinguishing the end of one outline "island" and the beginning of the next. The program determines this from the repetion of the vertices.

The next package used is a B-DATA POINTS, see Section 5.2.3. This is used to specify the location of the points where values are going to be specified. The data for this package is a POINTS package that could be used in another program. The POINTS package used should be the POINTS package that was used to specify the receptors when values were calculated. In this case it means that the POINTS package used here should be identical to the POINTS package used in the MARTIK test case #2 where the values were calculated.

The print on page 2 lists the points input. Note: SYMAP print uses down and across, rather than the more common up and across coordinates. This means that the Y coordinate that was input as a positive number is listed as a negative number.

The legends that are to be printed are then input using a C-OTOLEGENDS package, see Section 5.2.4. This package in this test case specifies some point priented legends: AIRPORT, RIVER, and STADIUM. These are specified by their location relative to a point. A line of blanks is then specified.

This line has three vertices, two end points and one middle point where the line bends. An area with overprinted (and) is specified. Finally, two more point legends are specified.

Page 4 print echoes the legends to be printed. The locations and description of each of the legends is listed.

The values associated with each of the points specified in the E-VALUES package, see Section 5.2.5. This package is selecting the first value for plotting. This was the CO in PPM during the MARTIK OUTPUT so it will be CO in PPM here. The NU unit is 13, which is the dataset named AQUAL that contains a VALUES package created by MARTIK test case #2. The effect is to input the VALUES package created by MARTIK into the SYMAP program. The user must take care to remember or label the VALUES package to be certain.

The user must retain the creating run, which is specified in the VALUES label as MARTIK RUN 3019, to be certain he knows what the VALUES are and how they were created. MARTIK run 3019 is the test case #2.

At the end of the page 4 listing the value for CO in PPM at each of the points is given. These values were obtained from the VALUES package created by MARTIK.

The F-MAP package created the map of concentrations. Section 5.2.6 describes all the possible electives for maps. Only some of these electives were used in this test case. The electives not used remained their default values.

The first three cards specify the title that is printed underneath the map:

TEST CASE CONCENTRATIONS
CO
ANNUAL

Elective 1 specifies the horizontal dimension of the map to be 12 inches. the vertical dimension, left blank, will be scaled to fit.

Elective 2 specifies the coordinates of the two corners of the map. These coordinates are in the down-across coordinate system. The values used specify the area to be mapped as the area which is being studied. The Y coordinate is negative, unlike the Y coordinates in the other packages, because of the coordinate system difference. Without this elective the default values would have resulted in the mapping of a portion of space far removed from the area of interest.

Elective 4 specifies the minimum value to be .025. Values below this value will be flagged as L, unless this symbol is changed in another elective.

Elective 5 specifies the maximum as .10. Values above this will be flagged with H unless the symbol is changed.

The maximum and minimum are also used for the calculation of default value range intervals.

Elective 7 was used to change the symbols printed from the default symbols to the symbol input on the following cards.

Elective 8 was used to suppress the blanks between contour levels.

Elective 26 was used for overprint adjustment. This is needed on the printer used at ERT.

The printout first tallies the Electives that were specified. Overprint symbols are overprinted. The next page gives information derived from the data. The map scale is calculated using the specified physical size of the map, and the coordinates of the two corners of the map. Then using printer row and column coordinates, the data point locations, their values, and the value range interval the value falls in, are printed. The search radius indicates the mean distance that had to be searched for finding sufficient points to calculate a value.

The next page contains the map that results. Each point has a value calculated by using the several adjacent points which were input values. Locations outside of the outline "islands" are left blank. This permits leaving the river blank to help reader orientation. The legends AIRPORT, RIVER, etc., override the value symbols and provide another means of identifying sections of the map.

With this map created the next step is to obtain the values for annual NOX. The E-VALUES is used again, and again the VALUES package created by MARTIK is referenced. This time the field specified is 2, the NOX values. Because the values package had already been read, REW had to be specified non-blank to rewind the file back to the beginning of the VALUES package. The result is tallied on page 7. The values listed are the annual average NOX values created by MARTIK test case #2.

The map is then made from NOX. Electives 4 and 5 are changed to reflect the NOX ranges. Elective 12 is used to keep all the other electives at their non-standard values. The map that results is a map of the Annual NOX concentrations calculated by the MARTIK test case #2.

An ENDJOB terminates the run after the two maps have been created.

```
//ERTSYMAP JOB (58202440000,ERT==,101,===,MKEEFE,219==========,4610),XX,X
// MSGLEVEL=1
/*PARMS  COPIES=03,LINECT=00
//SYMAP EXEC FORTHLG,REGION.GO=192K,TIME.GO=2
//LKED.SYSLIN DD *
 INCLUDE LIB(FLEXALL)
 INCLUDE LIB(MAIN,BLOCK,VALID,LEVEL,INPUT,INVALS,INPTS,ININD,INLINS)
 INCLUDE LIB(INFLAT,INCOVS,INMAP,INIT,NUMCHR,INBARS,SMFPIN)
 INCLUDE LIB(INDXER,SORT,DIMSET,LEVSET,LIMIT,STAND,PROFIG,PROPTS,MAP)
 INCLUDE LIB(BORDER,LINE,OUT,LEGD,SECTIN,INSFCT,GON,ALINE,COVER)
 INCLUDE LIB(DATSYM,FLAT,BANDR,ICLOSE,BARIN,SLOPER,CONTOR,INFLSM)
 INCLUDE LIB(ININTP,BLANK,FINAL,HGRAM)
 INCLUDE ERT(HEADR,ERRX)
/*
//LKED.LIB DD DSN=SYMAP,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP),
// DCB=(RECFM=FB,LRECL=80,BLKSIZE=3200)
//LKED.ERT DD DSN=ERT4610.P9990000.ERTLIB,DISP=SHR
//GO.FT01F001 DD DSN=WORK1,UNIT=SYSDA,SPACE=(TRK,(20,10)),
// DISP=(,DELETE),DCB=(RECFM=VSB,LRECL=84,BLKSIZE=1680)
//GO.FT02F001 DD DSN=WORK2,UNIT=SYSDA,SPACE=(TRK,(20,10)),
// DISP=(,DELETE),DCB=(RECFM=VSB,LRECL=84,BLKSIZE=1684)
//GO.FT03F001 DD DSN=WORK3,UNIT=SYSDA,SPACE=(TRK,(20,10)),
// DISP=(,DELETE),DCB=(RECFM=VSB,LRECL=84,BLKSIZE=1684)
//GO.FT09F001 DD DSN=C461002.ER701.LOGDATA,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AVCO16)
//GO.FT13F001 DD DSN=AQUAL,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO.FT05F001 DD *
A=OUTLINE          X
    1
                578.0     4523.0
                582.5     4523.0
                582.7     4522.6
                582.7     4522.3
                582.8     4522.0
                582.0     4522.5
                580.5     4522.5
                579.0     4521.5
                578.0     4521.5
                578.0     4523.0
                578.0     4521.3
                579.0     4521.3
                580.0     4520.8
                580.5     4520.8
                581.0     4521.0
                581.5     4521.3
                581.8     4522.0
                581.0     4522.0
                581.6     4520.0
                578.0     4520.0
                578.0     4521.3
                580.1     4521.5
                580.9     4521.5
                580.9     4520.9
                580.1     4520.9
                580.1     4521.5
                581.1     4522.3
                581.8     4522.3
                581.4     4521.6
                581.1     4521.6
                581.1     4522.3
99999
B=DATA POINTS      X
    3
POINTS                  TEST RECEPTOR GRID
          1 578.5     4520.5
          2 578.5     4522.5
          3 580.5     4520.5
          4 580.5     4522.5
          5 582.5     4520.5
          6 582.5     4522.5
99999
C=OTOLEGENDS       X
    4
    7    P      579.0     4522.1
AIRPORT
    5    P      580.1     4521.8
RIVER
    7    P      578.0     4520.0          -1.          1.
STADIUM
         L      579.0     4521.5
                578.5     4522.0
                579.6     4523.0
     ()  A      582.5     4521.8
                583.0     4521.7
                582.5     4521.0
                582.5     4521.8
     P   P      578.5     4520.5
     1   P      578.5     4522.5
99999
F=VALUES           X
    6
    1    13            CO
99999
F=MAP
TEST CASE CONCENTRATIONS
CO
ANNUAL
    1               12.
    2      -4523.0   578.0      -4520.0   583.0
    4      .025
    5      .10
    7
.*XOO.*XOO..OO
,  -X,  -X  XX
   -    -   AA
            VV
    8
   26
99999
F=VALUES           X
    6
    2    13 X          NOX
99999
F=MAP
TEST CASE CONCENTRATIONS
NOX
ANNUAL
    4      1.5
    5      6.5
   12
99999
ENDJOB
/*EOF
**
```

Figure 57 SYMAP Test Case Deck Setup

```
//ERTSYMAP JOB (88202440000,ERT**,101,***,MKEEFE,219*********,4610),XX,X JOB 237
// MSGLEVEL=1
***PARMS COPIES=03,LINECT=00                                                        ACCEPTED
//SYMAP EXEC FORTHLG,REGION.GO=192K,TIME.GO=2
XX           PROC PR=A                                                              00000010
XXLKED EXEC       PGM=IEWL,PARM='MAP,LET,LIST',                                     X00000020
XX                REGION=100K                                                       00000030
XXSYSPRINT DD     SYSOUT=&PR,DCB=(LRECL=121,BLKSIZE=1573),                          X00000040
IEF653I SUBSTITUTION JCL - SYSOUT=A,DCB=(LRECL=121,BLKSIZE=1573),
XX                SPACE=(1573,(24,48))                                              00000050
XXSYSLIB    DD    DSNAME=SYS1.FORTLIB,DISP=SHR                                      00000060
XX          DD    DSNAME=SYS1.DOUBLEP,DISP=SHR                                      00000070
XXSYSUT1 DD UNIT=SYSDA,SPACE=(CYL,(2,1))                                            00000080
XXSYSLMOD   DD    DSN=&GOSET(FMXXMAIN),UNIT=SYSDA,DISP=(,PASS),                     00000090
XX                SPACE=(CYL,(15,,1))                                               00000100
//LKED.SYSLIN DD *
//LKED.LIB DD DSN=SYMAP,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP),
// DCB=(RECFM=FB,LRECL=80,BLKSIZE=3200)
//LKED.ERT DD DSN=ERT4610.P9990000.ERTLIB,DISP=SHR
IEF236I ALLOC. FOR ERTSYMAP LKED    SYMAP
IEF237I 081    ALLOCATED TO SYSPRINT
IEF237I 359    ALLOCATED TO SYSLIB
IEF237I 357    ALLOCATED TO
IEF237I 251    ALLOCATED TO SYSUT1
IEF237I 251    ALLOCATED TO SYSLMOD
IEF237I 062    ALLOCATED TO SYSLIN
IEF237I 101    ALLOCATED TO LIB
IEF237I 255    ALLOCATED TO ERT
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS1.FORTLIB                                            KEPT
IEF285I   VOL SER NOS= ACS101.
IEF285I   SYS1.DOUBLEP                                            KEPT
IEF285I   VOL SER NOS= ACS102.
IEF285I   SYS74049.T125405.RV000.ERTSYMAP.R0000699                DELETED
IEF285I   VOL SER NOS= ACS001.
IEF285I   SYS74049.T125405.RV000.ERTSYMAP.GOSET                   PASSED
IEF285I   VOL SER NOS= ACS001.
IEF285I   SYMAP                                                   KEPT
IEF285I   VOL SER NOS= AIRMAP.
IEF285I   ERT4610.P9990000.ERTLIB                                 KEPT
IEF285I   VOL SER NOS= USE000.
IEF373I STEP /LKED    / START 74049.1409
IEF374I STEP /LKED    / STOP  74049.1410 CPU    0MIN 19.66SEC MAIN  98K LCS    0K
XXGO     EXEC   PGM=*.LKED.SYSLMOD,COND=(5,LT,LKED)                                 00000110
XXFT06F001 DD   SYSOUT=&PR,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1596)                   00000120
IEF653I SUBSTITUTION JCL - SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1596)
//GO.FT01F001 DD DSN=&&WORK1,UNIT=SYSDA,SPACE=(TRK,(20,10)),
// DISP=(,DELETE),DCB=(RECFM=VSB,LRECL=84,BLKSIZE=1684)
//GO.FT02F001 DD DSN=&&WORK2,UNIT=SYSDA,SPACE=(TRK,(20,10)),
// DISP=(,DELETE),DCB=(RECFM=VSB,LRECL=84,BLKSIZE=1684)
//GO.FT03F001 DD DSN=&&WORK3,UNIT=SYSDA,SPACE=(TRK,(20,10)),
// DISP=(,DELETE),DCB=(RECFM=VSB,LRECL=84,BLKSIZE=1684)
//GO.FT09F001 DD DSN=C461302.ERT01.LOGDATA,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AVCO16)
//GO.FT13F001 DD DSN=AQUAL,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO.FT05F001 DD *
IEF236I ALLOC. FOR ERTSYMAP GO      SYMAP
IEF237I 251    ALLOCATED TO PGM=*.DD
IEF237I 080    ALLOCATED TO FT06F001
IEF237I 251    ALLOCATED TO FT01F001
IEF237I 250    ALLOCATED TO FT02F001
IEF237I 251    ALLOCATED TO FT03F001
IEF237I 131    ALLOCATED TO FT09F001
IEF237I 101    ALLOCATED TO FT13F001
IEF237I 064    ALLOCATED TO FT05F001
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS74049.T125405.RV000.ERTSYMAP.GOSET                   PASSED
IEF285I   VOL SER NOS= ACS001.
IEF285I   &&WORK1                                                 DELETED
IEF285I   VOL SER NOS= ACS001.
IEF285I   &&WORK2                                                 DELETED
IEF285I   VOL SER NOS= ACS000.
IEF285I   &&WORK3                                                 DELETED
IEF285I   VOL SER NOS= ACS001.
IEF285I   C461002.ERT01.LOGDATA                                   KEPT
IEF285I   VOL SER NOS= AVCO16.
IEF285I   AQUAL                                                   KEPT
IEF285I   VOL SER NOS= AIRMAP.
IEF373I STEP /GO      / START 74049.1410
IEF374I STEP /GO      / STOP  74049.1414 CPU    0MIN 19.49SEC MAIN 182K LCS    0K
IEF285I   SYS74049.T125405.RV000.ERTSYMAP.GOSET                   DELETED
IEF285I   VOL SER NOS= ACS001.
IEF375I  JOB /ERTSYMAP/ START 74049.1409
IEF376I  JOB /ERTSYMAP/ STOP  74049.1414 CPU    0MIN 39.15SEC
F88-LEVEL LINKAGE EDITOR OPTIONS SPECIFIED MAP,LET,LIST
         DEFAULT OPTION(S) USED -  SIZE=(98304,8192)
IEW0000       INCLUDE LIB(FLEXALL)
IEW0000       INCLUDE LIB(MAIN,BLOCK,VALID,LEVEL,INPUT,INVALS,INPTS,ININD,INLINS)
IEW0000       INCLUDE LIB(INFLAT,INCOVS,INMAP,INIT,NUMCHR,INBARS,SHEPIN)
IEW0000       INCLUDE LIB(INDXER,SORT,DIMSET,LEVSET,LIMIT,STAND,PROPIC,PROPTS,MAP)
IEW0000       INCLUDE LIB(BORDER,LINE,OUT,LEGD,SECTIN,INSECT,GON,ALINE,COVER)
IEW0000       INCLUDE LIB(DATSYM,FLAT,BANDR,ICLOSE,BARIN,SLOPER,CONTOR,INFLSM)
IEW0000       INCLUDE LIB(ININTP,BLANK,FINAL,MGRAM)
IEW0000       INCLUDE FRT(HEADR,ERRX)
```

MODULE MAP

CONTROL SECTION			ENTRY							
NAME	ORIGIN	LENGTH	NAME	LOCATION	NAME	LOCATION	NAME	LOCATION	NAME	LOCATION
FLEXIN	00	584								
MAIN	588	1B2								
HEAD	[illegible]	54								
KEEP	798	10								
NUMBER	7A8	28								
LOCATN	7D0	18								
VALID	7E8	1FC								
LEVEL	9E8	138								
INPUT	B20	4F0								
INVALS	1010	5FC								
INPTS	1610	700								
ININD	2310	4E2								
INLINS	27F8	D64								
INFLAT	3560	1160								
INCOVS	46C0	198C								
INMAP	5C50	18C8								
INIT	7518	364								
NUMCHR	7880	200								
INBARS	7A80	6FC								
SHEPIN	8180	82A								
INDXER	8480	346								
SORT	8CF8	1B0								
DIMSET	8EA8	70E								
LEVSET	95B8	50E								
LIMIT	9AC8	6A0								
STAND	A168	528								
PROPIC	A690	738								
PROPTS	ADC8	634								
MAP	B400	6CC								
BORDER	BAD0	34E								
LINE	BE20	3C8								
OUT	C1E8	168								
LEGD	C350	CE								
INLEGS	C420	CE								
SECTIN	C4F0	146								
INSECT	C648	480								

Figure 58   SYMAP Test Case Printed Output

```
  1  5027     SYNAGRAPHIC COMPUTER MAPPING PROGRAM               VERSION   5.8  (720720)             18 FEB 1974              PAGE   2
**********************************************************************************************************************************

B-DATA

                    TEST RECEPTOR GRID

B-DATA POINTS
-------------

COORDINATES MANIPULATED BY ROUTINE      3

POINT           DOWN      ACROSS

(    1)        -4520.50    578.50
(    2)        -4522.50    578.50
(    3)        -4520.50    580.50
(    4)        -4522.50    580.50
(    5)        -4520.50    582.50
(    6)        -4522.50    582.50

  1  5027     SYNAGRAPHIC COMPUTER MAPPING PROGRAM               VERSION   5.8  (720720)             18 FEB 1974              PAGE   3
**********************************************************************************************************************************

C-OTOL
C-OTOLEGENDS
------------

COORDINATES MANIPULATED BY ROUTINE      4
VERTEX          DOWN      ACROSS      +ROWS       +COLS
(    1) 'AIRPORT' ACROSS FROM
               -4522.10    579.00        0.          0.
(    2) 'RIVER' ACROSS FROM
               -4521.80    580.10        0.          0.
(    3) 'STADIUM' ACROSS FROM
               -4520.00    578.00       -1.          1.
(    4) ' ' ON LINE

(    1)        -4521.50    579.00
(    2)        -4522.00    578.50
(    3)        -4521.00    579.60
LENGTH=          2.19
(    5) 'I' IN AREA

(    1)        -4521.80    582.50
(    2)        -4521.70    583.00
(    3)        -4521.00    582.50
(    4)        -4521.80    582.50
LENGTH=          2.17
AREA=           0.50
CENTER=(  -4521.34,    582.59)
(    6) 'P' AT POINT

               -4520.50    578.50        0.          0.
(    7) 'I' AT POINT

               -4522.50    578.50        0.          0.

  1  5027     SYNAGRAPHIC COMPUTER MAPPING PROGRAM               VERSION   5.8  (720720)             18 FEB 1974              PAGE   4
**********************************************************************************************************************************

E-VALU

                   MARTIK RUN   3019    DATE 13 FEB 1974
                   CO          NOX            C O    HYDROC.        N OX        S O2
F-VALUES
--------

COORDINATES MANIPULATED BY ROUTINE      6

DATUM          VALUE

(    1)        0.04                                                   30190030
(    2)        0.04                                                   30190040
(    3)        0.05                                                   30190050
(    4)        0.07                                                   30190060
(    5)        0.09                                                   30190070
(    6)        0.04                                                   30190080

  1  5027     SYNAGRAPHIC COMPUTER MAPPING PROGRAM               VERSION   5.8  (720720)             18 FEB 1974              PAGE   5
**********************************************************************************************************************************

99999
  1  5027     SYNAGRAPHIC COMPUTER MAPPING PROGRAM               VERSION   5.8  (720720)             18 FEB 1974              PAGE   6
**********************************************************************************************************************************

F-MAP

F-MAP
-----
TEST CASE CONCENTRATIONS
CO
ANNUAL
ELECTIVE

    1 MAP SIZE IS           0.0  INCHES LONG BY          12.00 INCHES WIDE
    2 EXTREME POINTS ARE (  -4523.00,     578.00) AND (  -4520.00,     583.00)
    4 LOWER DATA LIMIT IS        0.02
    5 UPPER DATA LIMIT IS        0.10
    7 NEW SYMBOLS ARE ,+X88,+X88..88

    8 NO CONTOUR LINES BETWEEN LEVELS
   26 CORRECTING OVERPRINTING
```

Figure 58 Contd.

MAP 1

TEST CASE CONCENTRATIONS
CO
ANNUAL

MAP SCALE = 2.4000 INCHES ON OUTPUT MAP/UNITS ON SOURCE MAP

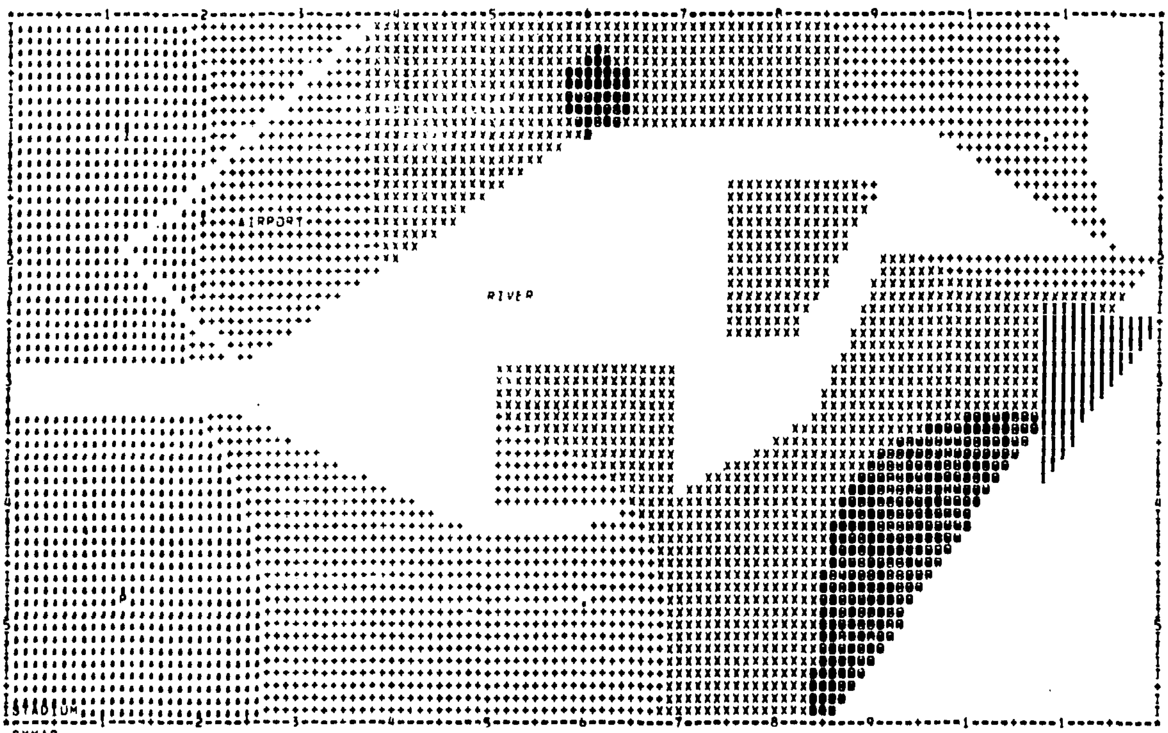
MAP SHOULD BE PRINTED AT 8.0 ROWS PER INCH AND 10.0 COLUMNS PER INCH

ROW = (DOWN COORDINATE - -4523.00) * 19.2000
COLUMN = (ACROSS COORDINATE - 578.00) * 24.0000

DATA POINTS FOR MAP

POINT	ROW	COLUMN	DATUM	VALUE	LEVEL
1)	48	12	1	0.04	1
2)	10	12	2	0.04	1
3)	48	60	3	0.05	2
4)	10	60	4	0.07	4
5)	48	108	5	0.09	5
6)	10	108	6	0.04	2

STANDARD SEARCH RADIUS IS 3.1915



SYMAP

TEST CASE CONCENTRATIONS
CO
ANNUAL

DATA VALUE EXTREMES ARE 0.04 0.09

ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL
('MAXIMUM' INCLUDED IN HIGHEST LEVEL ONLY)

MINIMUM	0.02	0.04	0.05	0.07	0.08
MAXIMUM	0.04	0.05	0.07	0.08	0.10

PERCENTAGE OF TOTAL ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL

20.00 20.00 20.00 20.00 20.00

FREQUENCY DISTRIBUTION OF DATA POINT VALUES IN EACH LEVEL

LEVEL	1	2	3	4	5
SYMBOLS					
FREQ.	2	2	0	1	1

Figure 58 Contd.

1 5027 SYNAGRAPHIC COMPUTER MAPPING PROGRAM VERSION 5.8 (720720) 18 FEB 1974 PAGE 7

E=VALU

MARTIK RUN 3019 DATE 13 FEB 1974
CO NOX C O HYDROC. N OX S O2

F=VALUES

COORDINATES MANIPULATED BY ROUTINE 6

DATUM	VALUE	
(1)	2.23	30190030
(2)	1.53	30190040
(3)	4.42	30190050
(4)	3.04	30190060
(5)	6.08	30190070
(6)	3.89	30190080

1 5027 SYNAGRAPHIC COMPUTER MAPPING PROGRAM VERSION 5.8 (720720) 18 FEB 1974 PAGE 8

99999

1 5027 SYNAGRAPHIC COMPUTER MAPPING PROGRAM VERSION 5.8 (720720) 18 FEB 1974 PAGE 9

F=MAP

F=MAP

TEST CASE CONCENTRATIONS

NOX

ANNUAL

ELECTIVE

4 LOWER DATA LIMIT IS 1.50
5 UPPER DATA LIMIT IS 6.50
12 PREVIOUS MAP OPTIONS USED

MAP 2

TEST CASE CONCENTRATIONS
NOX
ANNUAL

MAP SCALE = 2.4000 INCHES ON OUTPUT MAP/UNITS ON SOURCE MAP

MAP SHOULD BE PRINTED AT 8.0 ROWS PER INCH AND 10.0 COLUMNS PER INCH

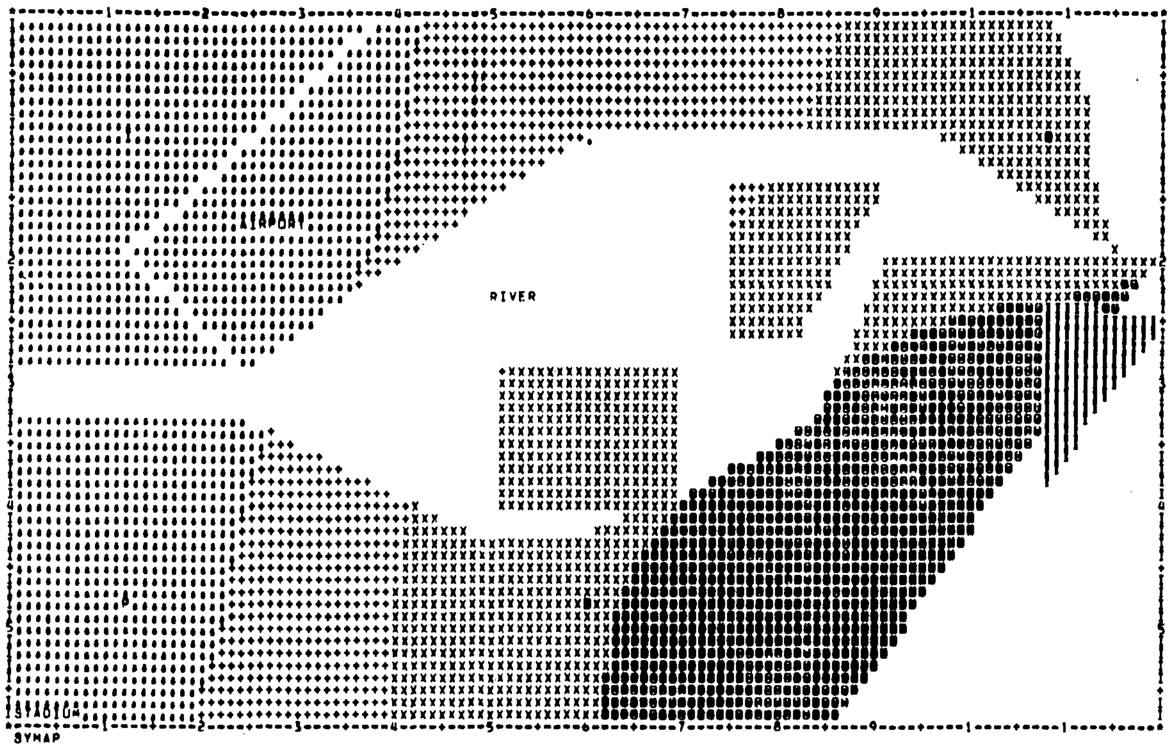
ROW = (DOWN COORDINATE - -4523.00) * 19.2000
COLUMN = (ACROSS COORDINATE - 578.00) * 24.0000

DATA POINTS FOR MAP

POINT	ROW	COLUMN	DATUM	VALUE	LEVEL
1)	48	12	1	2.23	1
2)	10	12	2	1.53	1
3)	48	60	3	4.42	3
4)	10	60	4	3.04	2
5)	48	108	5	6.08	5
6)	10	108	6	3.89	3

STANDARD SEARCH RADIUS IS 3.1915

Figure 58 Contd.



TEST CASE CONCENTRATIONS

NOX

ANNUAL

DATA VALUE EXTREMES ARE 1.53 6.08

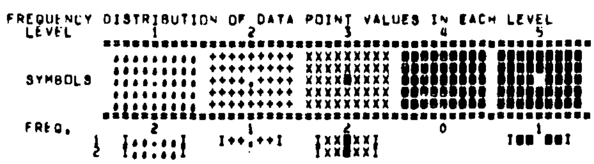
ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL
('MAXIMUM' INCLUDED IN HIGHEST LEVEL ONLY)

MINIMUM	1.50	2.50	3.50	4.50	5.50
MAXIMUM	2.50	3.50	4.50	5.50	6.50

PERCENTAGE OF TOTAL ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL

20.00	20.00	20.00	20.00	20.00

FREQUENCY DISTRIBUTION OF DATA POINT VALUES IN EACH LEVEL



1 5027 SYNAGRAPHIC COMPUTER MAPPING PROGRAM VERSION 5.8 (720720) 18 FEB 1974 PAGE 10

FNDJOB

2 MAPS HAVE BEEN PRODUCED
END OF JOB

PRINT REPEATED BY OPERATOR

Figure 58 Contd.

6. UTILITY PROGRAMS

The following three utility programs have been provided in addition to the set of four programs which make up the AQUIP software system. The first (METCON) provides the means for developing the climatological data for the study region and period of interest. The second (UPDATE) is of use in generating and updating card-image files which may--optionally--be used as input to AQUIP programs. The third (LOG-GEN) is provided in the event that the AQUIP system disk files require regeneration.

6.1 Meteorological Data Conversion Program (METCON)

METCON is a data-handling program which reads one or more wind roses in non-standard format and converts it to type 1 (MARTIK 'METD' package) wind-rose format. The present version of METCON has been designed to transform "Wind Distribution by Pasquill Stability Classes (5)" data sets as generated by the STAR Program of the National Climatic Center, Federal Building, Asheville, N. C. For the Hackensack Meadowlands Study, data from Station No. 14734 (Newark, N.J.) was obtained for the period January to December 1970 (8 observations daily) to generate the wind-rose used in the model-validation studies, and for the period January 1955 to December 1964 (24 observations daily) for the 1990 air-quality projections.

The METCON program, like the regular AQUIP programs, is directed by a Keyword package structure. Keywords implemented in the present version are: PARAMETERS, STAR, and ENDJOB.

6.1.1 PARAMETERS

The format of the PARAMETERS package is given in Section 1.3.3. The name, type, dimension, default value and a brief description of meaning is given for each parameter currently accepted by namelist &INPUT:

Variable	Type	Dimension	Default	Description
NORM	L*4	1	.TRUE.	Normalizes wind rose to 1.0 if .TRUE.
DEPTH	R*4	1	400.	Mixing depth in meters (see description of METD package, Section 3.2.5)
DMX	R*4	5	0.	Mixing depth for each stability (for METD, see Section 3.2.5)
PAMB	R*4	1	1000.	Ambient pressure in millibars (see METD, see Section 3.2.5)
TAMB	R*4	1	288.	Ambient temperature in degrees Kelvin (see METD, Section 3.2.5)
UNIT	I*4	1	7	Output unit for METD data set.
OUTP	L*4	1	.TRUE.	If .FALSE., wind rose not written on UNIT, but merely listed.

6.1.2 STAR

This package consists of the keyword card, followed by the "STAR" format wind rose data, terminated by a '99999' delimiter, and performs the following functions:

1. Reads STAR wind rose from unit IC, checking to make sure all data within package relates to the same station and the same month.

2. Normalizes, if requested.

3. Tabulates the wind-rose in MARTIK format.

4. Writes the wind rose on a data set with reference number UNIT. If UNIT=7, the wind rose is punched.

6.1.3 ENDJOB

This card terminates program execution.

6.1.4 Numbered Error Messages

The following table constitutes the set of conditions checked in the METCON program, listed by routine, number, and error cause.

INPUT

10 Unexpected '99999' card encountered.

80 Undefined keyword

100 No keyword specified

800 Unexpected end of file.

INPARM

800 Unexpected end of file during namelist &INPUT.

900 Error in namelist &INPUT.

INSTAR

120 Month (columns 64-65) out of range (Month <1 or Month ≥17).

121 Non-identical station number within package (columns 56-60).

122 Non-identical month within package (columns 64-65).

INE

20 Undefined line spacing parameter in column 15 (must be ' ', '0', or '1').

6.1.5 METCON Test Case

The following METCON test case shows how the STAR windrose was converted into a MARTIK windrose. The STAR windrose was input on cards and the MARTIK WINDROSE WAS OUTPUT TO UNIT 11.

The PARAMETERS package set the output unit to 11, and specified the mixing depth, ambient temperature, and the ambient pressure. See Section 6.1.1 for the default values.

The STAR data was input. This data is the winter windrose for Newark, New Jersey, generated by the National Weather Service's STAR program. The STAR package lists the MARTIK windrose calculated from the STAR windrose, and places the card image MARTIK METD package on Unit 11. Pages 3 through 7 list the MARTIK METD information in the same format as MARTIK will after the windrose is input.

```
//ERTUPDTE JOB (88202440000,ERT==,101,===,MKEEPE,219=========,4610),XX,X
// MSGLEVEL=1,CLASS=B
/*PARMS  COPIES=03
// EXEC FORTGCLG,REGION,GO=150K,TIME,GO=1
//FORT,SYSIN DD *
/*
//GO,FT09F001 DD DSN=C461002,ER701,LOGDATA,DISP=SHR,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AVC016)
//GO,FT11F001 DD DSN=METO,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO,FT05F001 DD *
PARAMETERS            10 YEAR STAR WINTER WIND ROSE
 &INPUT
 UNIT=11,
 NORM=.TRUE.,DEPTH=423.0,TAMB=276.0,PAMB=1013.25,
 &END
STAR DATA             1990 STAR-GENERATED WINTER WIND ROSE
   N A 0.000000,000000,000000,000000,000000,00000       14734 1A1355 16412
 NNE A 0.000000,000000,000000,000000,000000,00000       14734 2A1355 16412
  NE A 0.000000,000000,000000,000000,000000,00000       14734 3A1355 16412
 ENE A 0.000000,000000,000000,000000,000000,00000       14734 4A1355 16412
   E A 0.000000,000000,000000,000000,000000,00000       14734 5A1355 16412
 ESE A 0.000000,000000,000000,000000,000000,00000       14734 6A1355 16412
  SE A 0.000000,000000,000000,000000,000000,00000       14734 7A1355 16412
 SSE A 0.000000,000000,000000,000000,000000,00000       14734 8A1355 16412
   S A 0.000000,000000,000000,000000,000000,00000       14734 9A1355 16412
 SSW A 0.000000,000000,000000,000000,000000,00000       1473410A1355 16412
  SW A 0.000000,000000,000000,000000,000000,00000       1473411A1355 16412
 WSW A 0.000000,000000,000000,000000,000000,00000       1473412A1355 16412
   W A 0.000000,000000,000000,000000,000000,00000       1473413A1355 16412
 WNW A 0.000000,000000,000000,000000,000000,00000       1473414A1355 16412
  NW A 0.000000,000000,000000,000000,000000,00000       1473415A1355 16412
 NNW A 0.000000,000000,000000,000000,000000,00000       1473416A1355 16412
   N B 0.000140,000050,000000,000000,000000,00000       14734 1B1355 16412
 NNE B 0.000140,000050,000000,000000,000000,00000       14734 2B1355 16412
  NE B 0.000190,000090,000050,000000,000000,00000       14734 3B1355 16412
 ENE B 0.000140,000090,000000,000000,000000,00000       14734 4B1355 16412
   E B 0.000520,000190,000000,000000,000000,00000       14734 5B1355 16412
 ESE B 0.000330,000090,000050,000000,000000,00000       14734 6B1355 16412
  SE B 0.000140,000000,000000,000000,000000,00000       14734 7B1355 16412
 SSE B 0.000330,000090,000050,000000,000000,00000       14734 8B1355 16412
   S B 0.000190,000050,000050,000000,000000,00000       14734 9B1355 16412
 SSW B 0.000190,000050,000090,000000,000000,00000       1473410B1355 16412
  SW B 0.000240,000140,000000,000000,000000,00000       1473411B1355 16412
 WSW B 0.000280,000050,000050,000000,000000,00000       1473412B1355 16412
   W B 0.000090,000050,000000,000000,000000,00000       1473413B1355 16412
 WNW B 0.000190,000090,000050,000000,000000,00000       1473414B1355 16412
  NW B 0.000050,000050,000000,000000,000000,00000       1473415B1355 16412
 NNW B 0.000140,000050,000000,000000,000000,00000       1473416B1355 16412
   N C 0.000100,000600,001110,000050,000000,00000       14734 1C1355 16412
 NNE C 0.000380,001390,002550,000000,000000,00000       14734 2C1355 16412
  NE C 0.000290,001390,001340,000000,000000,00000       14734 3C1355 16412
 ENE C 0.000230,000510,000830,000000,000000,00000       14734 4C1355 16412
   E C 0.000560,000880,000370,000000,000000,00000       14734 5C1355 16412
 ESE C 0.000280,000460,000650,000000,000000,00000       14734 6C1355 16412
  SE C 0.000140,000280,000460,000000,000000,00000       14734 7C1355 16412
 SSE C 0.000470,000970,000880,000050,000000,00000       14734 8C1355 16412
   S C 0.000470,000930,000740,000000,000000,00000       14734 9C1355 16412
 SSW C 0.000420,001060,002040,000000,000000,00000       1473410C1355 16412
  SW C 0.000750,001810,003560,000000,000000,00000       1473411C1355 16412
 WSW C 0.000330,001940,003430,000140,000000,00000       1473412C1355 16412
   W C 0.000100,000740,003470,000090,000000,00000       1473413C1355 16412
 WNW C 0.000240,001200,003560,000090,000000,00000       1473414C1355 16412
  NW C 0.000000,000560,002220,000090,000000,00000       1473415C1355 16412
 NNW C 0.000000,000600,002500,000050,000000,00000       1473416C1355 16412
   N D 0.000680,002920,009680,014260,001850,00051       14734 1D1355 16412
 NNE D 0.001400,010000,030600,027270,004680,00097       14734 2D1355 16412
  NE D 0.002170,010600,022040,017130,002690,00093       14734 3D1355 16412
 ENE D 0.002100,005190,006990,005560,000930,00046       14734 4D1355 16412
   E D 0.003660,007500,005190,002360,000320,00000       14734 5D1355 16412
 ESE D 0.001710,004860,004400,001480,000420,00019       14734 6D1355 16412
  SE D 0.000930,001620,001710,000230,000000,00000       14734 7D1355 16412
 SSE D 0.000880,003610,003940,001760,000370,00014       14734 8D1355 16412
   S D 0.001470,004400,007780,002180,000460,00009       14734 9D1355 16412
 SSW D 0.002330,009440,017550,010510,002080,00148       1473410D1355 16412
  SW D 0.003970,013190,019030,009440,000690,00023       1473411D1355 16412
 WSW D 0.001850,009210,017500,017590,001670,00028       1473412D1355 16412
   W D 0.001420,004350,014030,029810,004030,00093       1473413D1355 16412
 WNW D 0.000790,003940,015930,061570,016060,00380       1473414D1355 16412
  NW D 0.000560,001900,009400,049540,015320,00616       1473415D1355 16412
 NNW D 0.000620,002500,009860,033520,009350,00255       1473416D1355 16412
   N E 0.001380,003700,006200,000000,000000,00000       14734 1E1355 16412
 NNE E 0.001490,007590,007640,000000,000000,00000       14734 2E1355 16412
  NE E 0.002290,007640,001990,000000,000000,00000       14734 3E1355 16412
 ENE E 0.001420,003150,000320,000000,000000,00000       14734 4E1355 16412
   E E 0.002300,002410,000140,000000,000000,00000       14734 5E1355 16412
 ESE E 0.000780,001760,000190,000000,000000,00000       14734 6E1355 16412
  SE E 0.000950,000560,000230,000000,000000,00000       14734 7E1355 16412
 SSE E 0.001040,002960,000560,000000,000000,00000       14734 8E1355 16412
   S E 0.001820,004490,000790,000000,000000,00000       14734 9E1355 16412
 SSW E 0.004630,015050,004490,000000,000000,00000       1473410E1355 16412
  SW E 0.009050,026110,008290,000000,000000,00000       1473411E1355 16412
 WSW E 0.004720,020460,012960,000000,000000,00000       1473412E1355 16412
   W E 0.002340,013150,014770,000000,000000,00000       1473413E1355 16412
 WNW E 0.001480,009580,016570,000000,000000,00000       1473414E1355 16412
  NW E 0.001170,005370,013980,000000,000000,00000       1473415E1355 16412
 NNW E 0.000860,003520,009260,000000,000000,00000       1473416E1355 16412
99999
ENDJOB
/*EOF
**
```

Figure 59 METCON Test Case Deck Setup

```
//ERTC1108 JOB (88202440000,ERT--,101,---,MKEEFE,219---------,4610),XX,X JOB 650
// MSGLEVEL=1,CLASS=B
***PARMS COPIES=03                                                        ACCEPTED
// EXEC FORTGCLG,REGION.GO=150K,TIME.GO=1
XX        PROC PR=A,PU=B                                                  00000010
XXFORT EXEC     PGM=IEYFORT,                                              X00000020
XX              PARM='ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP',           X00000030
XX              REGION=150K                                               00000040
XXSYSPRINT DD  SYSOUT=&PR,DCB=(RECFM=FBA,LRECL=120,BLKSIZE=1680)          00000050
IEF653I SUBSTITUTION JCL - SYSOUT=A,DCB=(RECFM=FBA,LRECL=120,BLKSIZE=1680)
XXSYSPUNCH DD  SYSOUT=&PU,DCB=(RECFM=FB,LRECL=80,BLKSIZE=1680),          X00000060
IEF653I SUBSTITUTION JCL - SYSOUT=B,DCB=(RECFM=FB,LRECL=80,BLKSIZE=1680),
XX              SPACE=(1680,(48,120))                                     00000070
XXSYSLIN   DD  UNIT=SYSDA,DISP=(,PASS),SPACE=(3200,(100,50)),             X00000080
XX              DCB=(,RECFM=FB,LRECL=80,BLKSIZE=3200)                     00000090
//FORT.SYSIN DD *
IEF236I ALLOC. FOR ERTC1108 FORT
IEF237I 085   ALLOCATED TO SYSPRINT
IEF237I 090   ALLOCATED TO SYSPUNCH
IEF237I 253   ALLOCATED TO SYSLIN
IEF237I 06A   ALLOCATED TO SYSIN
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS74058.T074640.RV000.ERTC1108.R0006002      PASSED
IEF285I   VOL SER NOS= AC8002.
IEF373I STEP /FORT    / START 74058.1827
IEF374I STEP /FORT    / STOP  74058.1827 CPU   0MIN 11.61SEC MAIN 102K LCS   0K
XXLKED EXEC     PGM=IEWL,PARM='MAP,LET,LIST',COND=(5,LT,FORT),           X00000100
XX              REGION=100K                                               00000110
XXSYSPRINT DD  SYSOUT=&PR,DCB=(LRECL=121,BLKSIZE=1573),                  X00000120
IEF653I SUBSTITUTION JCL - SYSOUT=A,DCB=(LRECL=121,BLKSIZE=1573),
XX              SPACE=(1573,(24,48))                                      00000130
XXSYSLIB   DD  DSNAME=SYS1.FORTLIB,DISP=SHR                               00000140
XX         DD  DSNAME=SYS1.DOUBLEP,DISP=SHR                               00000150
XXSYSUT1    DD  UNIT=SYSDA,SPACE=(CYL,(5,1))                              00000160
XXSYSLMOD  DD  DSN=&GOSET(FGXXMAIN),UNIT=SYSDA,DISP=(,PASS),              00000170
XX              SPACE=(CYL,(15,,1))                                       00000180
XXSYSLIN   DD  DSNAME=*.FORT.SYSLIN,VOLUME=REF=*.FORT.SYSLIN,             X00000190
XX              DCB=(,RECFM=FB,LRECL=80,BLKSIZE=3200),DISP=(OLD,DELETE)   00000200
IEF236I ALLOC. FOR ERTC1108 LKED
IEF237I 085   ALLOCATED TO SYSPRINT
IEF237I 256   ALLOCATED TO SYSLIB
IEF237I 257   ALLOCATED TO
IEF237I 253   ALLOCATED TO SYSUT1
IEF237I 251   ALLOCATED TO SYSLMOD
IEF237I 253   ALLOCATED TO SYSLIN
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS1.FORTLIB                                  KEPT
IEF285I   VOL SER NOS= ACS101.
IEF285I   SYS1.DOUBLEP                                  KEPT
IEF285I   VOL SER NOS= ACS102.
IEF285I   SYS74058.T074640.RV000.ERTC1108.R0006005      DELETED
IEF285I   VOL SER NOS= AC8002.
IEF285I   SYS74058.T074640.RV000.ERTC1108.GOSET         PASSED
IEF285I   VOL SER NOS= AC8001.
IEF285I   SYS74058.T074640.RV000.ERTC1108.R0006002      DELETED
IEF285I   VOL SER NOS= AC8002.
IEF373I STEP /LKED    / START 74058.1827
IEF374I STEP /LKED    / STOP  74058.1828 CPU   0MIN 09.14SEC MAIN  98K LCS   0K
XXGO   EXEC    PGM=*.LKED.SYSLMOD,COND=((5,LT,FORT),(5,LT,LKED))          00000210
XXFT06F001 DD  SYSOUT=&PR,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1596)          00000220
IEF653I SUBSTITUTION JCL - SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1596)
//GO.FT09F001 DD DSN=C461002.ER701.LOGDATA,DISP=SHR,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AVC016)
//GO.FT11F001 DD DSN=METD,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
//GO.FT05F001 DD *
//
IEF236I ALLOC. FOR ERTC1108 GO
IEF237I 251   ALLOCATED TO PGM=*.DD
IEF237I 085   ALLOCATED TO FT06F001
IEF237I 121   ALLOCATED TO FT09F001
IEF237I 101   ALLOCATED TO FT11F001
IEF237I 06B   ALLOCATED TO FT05F001
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS74058.T074640.RV000.ERTC1108.GOSET         PASSED
IEF285I   VOL SER NOS= AC8001.
IEF285I   C461002.ER701.LOGDATA                         KEPT
IEF285I   VOL SER NOS= AVC016.
IEF285I   METD                                          KEPT
IEF285I   VOL SER NOS= AIRMAP.
IEF373I STEP /GO      / START 74058.1828
IEF374I STEP /GO      / STOP  74058.1828 CPU   0MIN 04.71SEC MAIN  92K LCS   0K
IEF283I   SYS74058.T074640.RV000.ERTC1108.R0006002      NOT DELETED 8
IEF283I   VOL SER NOS= AC8002 1.
IEF285I   SYS74058.T074640.RV000.ERTC1108.GOSET         DELETED
IEF285I   VOL SER NOS= AC8001.
IEF375I  JOB /ERTC1108/ START 74058.1827
IEF376I  JOB /ERTC1108/ STOP  74058.1828 CPU   0MIN 25.46SEC
```

Figure 60 METCON Test Case Printed Output

BEGIN METEOROLOGICAL DATA CONVERSION PROGRAM   VERSION   2,0 LEVEL 720131 RUN   2061
TABLE COUNT= 39

10 YEAR STAR WINTER WIND ROSE   (UNIT 5)

OUTPUT DATA SET FOR THE FOLLOWING ROUTINE(S) IS UNIT 11

1990 STAR-GENERATED WINTER WIND ROSE   (UNIT 5)

STAR DATA. FOR STATION NO

METEOROLOGICAL INPUT DATA

TYPE 1 WINDROSE   1990 STAR-GENERATED WINTER WIN
AMBIENT TEMP = 276,00 DEG K   AMBIENT PRES = 1013,25 MB

TOTAL FREQUENCY OF OCCURENCE,CLASS 1 =   0,0

STABILITY CLASS 2   DMX=   423,0

WINDSPEED CLASS

WIND DIR.	1	2	3	4	5	6	SUM
N	0,000140	0,000050	0,0	0,0	0,0	0,0	0,000190
NNE	0,000140	0,000050	0,0	0,0	0,0	0,0	0,000190
NE	0,000190	0,000090	0,000050	0,0	0,0	0,0	0,000330
ENE	0,000140	0,000090	0,0	0,0	0,0	0,0	0,000230
E	0,000520	0,000190	0,0	0,0	0,0	0,0	0,000710
ESE	0,000330	0,000090	0,000050	0,0	0,0	0,0	0,000470
SE	0,000140	0,0	0,0	0,0	0,0	0,0	0,000140
SSE	0,000330	0,000090	0,000050	0,0	0,0	0,0	0,000470
S	0,000190	0,000050	0,000050	0,0	0,0	0,0	0,000290
SSW	0,000190	0,000050	0,000090	0,0	0,0	0,0	0,000330
SW	0,000240	0,000140	0,0	0,0	0,0	0,0	0,000380
WSW	0,000280	0,000050	0,000050	0,0	0,0	0,0	0,000380
W	0,000050	0,000050	0,0	0,0	0,0	0,0	0,000100
WNW	0,000190	0,000090	0,000050	0,0	0,0	0,0	0,000330
NW	0,000050	0,000050	0,0	0,0	0,0	0,0	0,000100
NNW	0,000140	0,000050	0,0	0,0	0,0	0,0	0,000190
SUM	0,003260	0,001180	0,000390	0,0	0,0	0,0	0,004830

TOTAL FREQUENCY OF OCCURENCE,CLASS 2 =   0,00483

STABILITY CLASS 3   DMX=   423,0

WINDSPEED CLASS

WIND DIR.	1	2	3	4	5	6	SUM
N	0,000100	0,000600	0,001110	0,000050	0,0	0,0	0,001860
NNE	0,000380	0,001390	0,002550	0,0	0,0	0,0	0,004320
NE	0,000290	0,001390	0,001340	0,0	0,0	0,0	0,003020
ENE	0,000230	0,000510	0,000830	0,0	0,0	0,0	0,001570
E	0,000560	0,000880	0,000370	0,0	0,0	0,0	0,001810
ESE	0,000280	0,000460	0,000650	0,0	0,0	0,0	0,001390
SE	0,000140	0,000280	0,000460	0,0	0,0	0,0	0,000880
SSE	0,000470	0,000970	0,000880	0,000050	0,0	0,0	0,002370
S	0,000470	0,000930	0,000740	0,0	0,0	0,0	0,002140
SSW	0,000420	0,001060	0,002040	0,0	0,0	0,0	0,003520
SW	0,000750	0,001810	0,003560	0,0	0,0	0,0	0,006120
WSW	0,000330	0,001940	0,003430	0,000140	0,0	0,0	0,005840
W	0,000100	0,000740	0,003470	0,000090	0,0	0,0	0,004400
WNW	0,000240	0,001200	0,003560	0,000090	0,0	0,0	0,005090
NW	0,0	0,000560	0,002220	0,000090	0,0	0,0	0,002870
NNW	0,0	0,000600	0,002500	0,000050	0,0	0,0	0,003150
SUM	0,004760	0,015320	0,029709	0,000560	0,0	0,0	0,050349

TOTAL FREQUENCY OF OCCURENCE,CLASS 3 =   0,05035

Figure 60   Contd.

STABILITY CLASS 4 DMX= 358,4

WINDSPEED CLASS

WIND DIR,	1	2	3	4	5	6	SUM
N	0,000680	0,002920	0,009680	0,014260	0,001850	0,000510	0,029899
NNE	0,001400	0,010000	0,030599	0,027269	0,004680	0,000970	0,074918
NE	0,002170	0,010600	0,022039	0,017130	0,002690	0,000930	0,055559
ENE	0,002100	0,005190	0,006990	0,005560	0,000930	0,000460	0,021229
E	0,003660	0,007500	0,005190	0,002360	0,000320	0,0	0,019030
ESE	0,001710	0,004860	0,004400	0,001480	0,000420	0,000190	0,013060
SE	0,000930	0,001620	0,001710	0,000230	0,0	0,0	0,004490
SSE	0,000880	0,003610	0,003940	0,001760	0,000370	0,000140	0,010700
S	0,001470	0,004400	0,007780	0,002180	0,000460	0,000090	0,016380
SSW	0,002330	0,009440	0,017550	0,010510	0,002080	0,001480	0,043389
SW	0,003970	0,013190	0,019030	0,009440	0,000690	0,000230	0,046549
WSW	0,001850	0,009210	0,017500	0,017590	0,001670	0,000280	0,048099
W	0,001420	0,004350	0,014030	0,029809	0,004030	0,000930	0,054569
WNW	0,000790	0,003940	0,015930	0,061568	0,016060	0,003800	0,102087
NW	0,000560	0,001900	0,009400	0,049539	0,015320	0,006160	0,082878
NNW	0,000620	0,002500	0,009860	0,033519	0,009350	0,002550	0,058399
SUM	0,026539	0,095227	0,195625	0,284203	0,060918	0,018720	0,681232

TOTAL FREQUENCY OF OCCURENCE,CLASS 4 = 0,68123

STABILITY CLASS 5 DMX= 100,0

WINDSPEED CLASS

WIND DIR,	1	2	3	4	5	6	SUM
N	0,001380	0,003700	0,006200	0,0	0,0	0,0	0,011280
NNE	0,001490	0,007590	0,007640	0,0	0,0	0,0	0,016720
NE	0,002290	0,007640	0,001990	0,0	0,0	0,0	0,011920
ENE	0,001420	0,003150	0,000320	0,0	0,0	0,0	0,004890
E	0,002300	0,002410	0,000140	0,0	0,0	0,0	0,004850
ESE	0,000780	0,001760	0,000190	0,0	0,0	0,0	0,002730
SE	0,000950	0,000560	0,000230	0,0	0,0	0,0	0,001740
SSE	0,001040	0,002960	0,000560	0,0	0,0	0,0	0,004560
S	0,001820	0,004490	0,000790	0,0	0,0	0,0	0,007100
SSW	0,004630	0,015050	0,004490	0,0	0,0	0,0	0,024169
SW	0,009050	0,026109	0,008290	0,0	0,0	0,0	0,043449
WSW	0,004720	0,020459	0,012960	0,0	0,0	0,0	0,038139
W	0,002340	0,013150	0,014770	0,0	0,0	0,0	0,030259
WNW	0,001480	0,009580	0,016570	0,0	0,0	0,0	0,027629
NW	0,001170	0,005370	0,013980	0,0	0,0	0,0	0,020519
NNW	0,000860	0,003520	0,009260	0,0	0,0	0,0	0,013640
SUM	0,037719	0,127497	0,098377	0,0	0,0	0,0	0,263593

TOTAL FREQUENCY OF OCCURENCE,CLASS 5 = 0,26359

TOTAL FREQUENCY OF OCCURRENCE,CLASSES 1 TO 5 = 1,00000

END OF PROGRAM,

Figure 60 Contd.

6.2 Data Set Generation and Update Program (UPDATE)

UPDATE is a program designed to facilitate handling of sequenced card or card image data sets. UPDATE functions allow the user to:

1. Generate a new sequenced card image data set from unsequenced cards.
2. Update an existing data set by inserting, deleting, or replacing desired elements.
3. Move a data set from one unit to another.
4. Transmit information to the console teletype (for mounting and dismounting tapes, etc.).

UPDATE is designed around the keyword concept. However, the keywords and delimiters are of a special form, in order that source cards and keyword data sets of other programs may be manipulated without confusion. Keywords implemented in the present version are: '$GEN', '$MOD', '$MOV', '$MSG', '$END'. The end of package delimiter is '$$$$'. The format for the UPDATE keyword card is as follows:

Columns	Format	Variable	Meaning
1-4	A4	Keyword	
13-15	I3	IC	Input unit for data set
16-18	I3	JC	Output unit for data set
21-70	12A4,A2	TITLE	For identification
71-72	A2	JF	Non-blank if followed by comments card (only for $MSG)
73-76	A4	KODE	First four characters of sequence
77-80	I4	N	Remainder of sequence

6.2.1 $GEN

'$GEN' generates a new sequenced data set from card inputs. Sequencing consists of KODE on the keyword card followed by an integer which is incremented by N for each new record. The end of data set is assumed when '$$$$' is encountered.

6.2.2 $MOD

'$MOD' allows modification of an existing data set. For certain manipulations, the keyword card is followed by a directive card of the format:

Columns	Format	Variable
1-8	A8	Directive
65-72	A8	Beginning sequence number
73-80	A8	Ending sequence number

The following manipulations may be performed:

1. List all card images on the input data set - by supplying 'LIST=YES' on the directive card. Note that a LIST= $\left\{ \begin{matrix} \text{YES} \\ \text{NO} \end{matrix} \right\}$ card must precede all other directives.

2. Replace card images by inputting a card (on unit 5) with an identical sequence number as the card to be replaced in the data set.

3. Insert one or more input cards into the data set by specifying sequence numbers (on the input cards) which are between those of the nearest card images of the data set.

4. Delete cards in a data set - by specifying 'D' in column 1 of the directive card with the beginning and ending sequence numbers in columns 65-80. (If only one card is to be deleted, the beginning sequence number must be blank.)

NOTE: In all cases, except for the 'LIST=YES' option, two data sets are required: one for the input data set and one updated (output) data set.

6.2.3 $MOV

'$MOV' moves a data set from an input unit (IC) to an output data set (JC). Cards will be listed if JC=IC, JC=6 or JC=0. NOTE: The package delimiter ('$$$$') must follow the data set on unit IC.

6.2.4 $MSG

'$MSG' sends a message to the operator by way of the console. On the keyword card, JF must be non-blank. Columns 1 to 70 of the following card will be printed. If another card of the message follows, JF should again be non-blank. If execution is to continue, JC on keyword card should be zero. If program is to PAUSE, JC should equal 1. An operator response of 'C' will allow continuation of processing after a PAUSE.

6.2.5 $END

'$END' signifies the end of execution. (Analogous to 'ENDJOB').

6.2.6 Numbered Error Messages

The following table constitutes the set of exceptions that may occur in UPDATE, listed by routine, number and error cause.

MAIN

20 Undefined keyword

GENER

20 No unit specified on $GEN keyword card (IC).

300 Unexpected end of file on input file (unit 5)

MOVE

4 No input unit specified (IC) or input unit greater than 5 and less than 10.

20 Output unit (JC) is 5, 8 or 9.

UPDATE

1 Error on input unit IC.

2 Either all of the input data set records have been deleted or the first input data set record is an end of file.

6.2.7 UPDATE Test Case

The test case for UPDATE illustrates one example of each of the basic UPDATE capabilities. The MARTIK METD package created by the METCON program is converted into a sequenced deck, and then into a uni-directional windrose.

This run used temporary datasets because they were meant only for test purposes. In actual use these datasets would be either cards or permanent datasets whereever the values are desired to be saved.

FT09 is the run-log dataset.

FT11, FT12, and FT13 are three card-image datasets which are created by UPDATE. The datasets required are entirely dependent upon the operations and unit numbers specified by the user.

The initial input is a $GEN, followed by the METD package. The $GEN keywork is peculiar in that the <u>IC</u> is the unit where the cards are to be saved after sequencing. In this case IC was 11. For the sequencing rules see Section 6.2.1.

After the METD cards have been sequenced and saved on Unit 11, a $MOV is performed, see Section 6.2.2. This keywork simply moves the entire file from Unit IC to Unit JC. Now the card images on Unit JC. $MOV also generates a list of the cards, pages 3 and 4.

Finally, a $MOD is performed, Section 6.2.2. The LIST=YES specifies that the dataset will be listed after the changes have been made. The next card is a replacement card, then the remaining cards are deleted, and finally a 99999 card is added. The result of this is the creation of a unit-directional windrose from the previous windrose. This new windrose is on Unit 13.

The run is terminated with a $END.

```
//ERTUPDTE JOB (88202440000,ERT--,101,***,MKEEFE,219----------,4610),XX,X
// MSGLEVEL=1,CLASS=B
/*PARMS  COPIES=03
//READ1 EXEC PGM=IEBUPDTE,PARM=NEW
//SYSPRINT DD SYSOUT=A
//SYSUT2 DD UNIT=SYSDA,DISP=(,PASS),SPACE=(TRK,1),
// DCB=(RECFM=FB,LRECL=80,BLKSIZE=3200)
//SYSIN DD *
./ ADD LIST=ALL
$GEN          11       MOVE CARD IMAGES & SEQUENCE                              METD0010
./ ENDUP
/*
//READ2 EXEC PGM=IEBUPDTE,PARM=NEW
//SYSPRINT DD SYSOUT=A
//SYSUT2 DD UNIT=SYSDA,DISP=(,PASS),SPACE=(TRK,1),
// DCB=(RECFM=FB,LRECL=80,BLKSIZE=3200)
//SYSIN DD *
./ ADD LIST=ALL
$$$$
$MOV          11  12  MOVE & LIST CARD IMAGES
$MOD          12  13 1CHANGE TO UNIDIRECTIONAL WINDROSE
LIST=YES
      4 11 1,0                                                                  MET   30
D                                                                  MET    40MET  830
99999                                                                           MET   40
$$$$
$END
./ ENDUP
/*
//UPDATE EXEC FORTGCLG,REGION.GO=98K,TIME.GO=1
//FORT.SYSIN DD *
/*
//LKED.SYSLIN DD
// DD *
 INCLUDE ERT(HEADR,ERRX,ICHARX,INTX)
/*
//LKED.ERT DD DSN=ERT4610.P9990000.ERTLIB,DISP=SHR
//GO.FT09F001 DD DSN=*.READ1.SYSUT2,VOL=REF=*.READ1.SYSUT2,
// DISP=(OLD,DELETE)
// DD DSN=METD,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
// DD DSN=*.READ2.SYSUT2,VOL=REF=*.READ2.SYSUT2,DISP=(OLD,DELETE)
//OO.FT09F001 DD DSN=C461002.ER701.LOGDATA,DISP=SHR,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AVC016)
//GO.FT11F001 DD UNIT=SYSDA,SPACE=(TRK,1),
// DCB=(RECFM=FB,LRECL=80,BLKSIZE=3200)
//GO.FT12F001 DD UNIT=SYSDA,SPACE=(TRK,1),
// DCB=(RECFM=FB,LRECL=80,BLKSIZE=3200)
//GO.FT13F001 DD UNIT=SYSDA,SPACE=(TRK,1),
// DCB=(RECFM=FB,LRECL=80,BLKSIZE=3200)
/*EOF
**
```

Figure 61 UPDATE Test Case Deck Setup

```
//ERTUPDTE JOB (88202440000,ERT--,101,---,MKEEFE,219----------,4610),XX,X JOB 172
// MSGLEVEL=1,CLASS=B
***PARMS COPIES=03                                                              ACCEPTED
//READ1 EXEC PGM=IEBUPDTE,PARM=NEW
//SYSPRINT DD SYSOUT=A
//SYSUT2 DD UNIT=SYSDA,DISP=(,PASS),SPACE=(TRK,1),
// DCB=(RECFM=FB,LRECL=80,BLKSIZE=3200)
//SYSIN DD *
IEF236I ALLOC. FOR ERTUPDTE READ1
IEF237I 080    ALLOCATED TO SYSPRINT
IEF237I 253    ALLOCATED TO SYSUT2
IEF237I 061    ALLOCATED TO SYSIN
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I    SYS74060,T074500,RV000,ERTUPDTE,R0001133       PASSED
IEF285I    VOL SER NOS= AC8002.
IEF373I STEP /READ1    / START 74060.1030
IEF374I STEP /READ1    / STOP  74060.1031 CPU    0MIN 01.40SEC MAIN  34K LCS    0K
//READ2 EXEC PGM=IEBUPDTE,PARM=NEW
//SYSPRINT DD SYSOUT=A
//SYSUT2 DD UNIT=SYSDA,DISP=(,PASS),SPACE=(TRK,1),
// DCB=(RECFM=FB,LRECL=80,BLKSIZE=3200)
//SYSIN DD *
IEF236I ALLOC. FOR ERTUPDTE READ2
IEF237I 080    ALLOCATED TO SYSPRINT
IEF237I 253    ALLOCATED TO SYSUT2
IEF237I 062    ALLOCATED TO SYSIN
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I    SYS74060,T074500,RV000,ERTUPDTE,R0001136       PASSED
IEF285I    VOL SER NOS= AC8002.
IEF373I STEP /READ2    / START 74060.1031
IEF374I STEP /READ2    / STOP  74060.1031 CPU    0MIN 01.27SEC MAIN  34K LCS    0K
//UPDATE EXEC FORTGCLG,REGION.GO=96K,TIME.GO=1
XX          PROC PR=A,PU=B                                                      00000010
XXFORT EXEC     PGM=IEYFORT,                                                   X00000020
XX              PARM='ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP',                X00000030
XX              REGION=150K                                                     00000040
XXSYSPRINT DD  SYSOUT=&PR,DCB=(RECFM=FBA,LRECL=120,BLKSIZE=1680)               00000050
IEF653I SUBSTITUTION JCL - SYSOUT=A,DCB=(RECFM=FBA,LRECL=120,BLKSIZE=1680)
XXSYSPUNCH DD  SYSOUT=&PU,DCB=(RECFM=FB,LRECL=80,BLKSIZE=1680),                X00000060
IEF653I SUBSTITUTION JCL - SYSOUT=B,DCB=(RECFM=FB,LRECL=80,BLKSIZE=1680),
XX              SPACE=(1680,(48,120))                                           00000070
XXSYSLIN    DD  UNIT=SYSDA,DISP=(,PASS),SPACE=(3200,(100,50)),                 X00000080
XX              DCB=(,RECFM=FB,LRECL=80,BLKSIZE=3200)                           00000090
//FORT.SYSIN DD *
IEF236I ALLOC. FOR ERTUPDTE FORT      UPDATE
IEF237I 084    ALLOCATED TO SYSPRINT
IEF237I 090    ALLOCATED TO SYSPUNCH
IEF237I 253    ALLOCATED TO SYSLIN
IEF237I 063    ALLOCATED TO SYSIN
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I    SYS74060,T074500,RV000,ERTUPDTE,R0001140       PASSED
IEF285I    VOL SER NOS= AC8002.
IEF373I STEP /FORT     / START 74060.1031
IEF374I STEP /FORT     / STOP  74060.1032 CPU    0MIN 06.75SEC MAIN  98K LCS    0K
XXLKED EXEC     PGM=IEWL,PARM='MAP,LET,LIST',COND=(5,LT,FORT),                 X00000100
XX              REGION=100K                                                     00000110
XXSYSPRINT DD  SYSOUT=&PR,DCB=(LRECL=121,BLKSIZE=1573),                        X00000120
IEF653I SUBSTITUTION JCL - SYSOUT=A,DCB=(LRECL=121,BLKSIZE=1573),
XX              SPACE=(1573,(24,48))                                            00000130
XXSYSLIB    DD  DSNAME=SYS1.FORTLIB,DISP=SHR                                    00000140
XX          DD  DSNAME=SYS1.DOUBLEP,DISP=SHR                                    00000150
XXSYSUT1     DD  UNIT=SYSDA,SPACE=(CYL,(5,1))                                   00000160
XXSYSLMOD   DD  DSN=&GOSET(PGXXMAIN),UNIT=SYSDA,DISP=(,PASS),                   00000170
XX              SPACE=(CYL,(15,,1))                                             00000180
//LKED.SYSLIN DD
X/SYSLIN    DD  DSNAME=*.FORT.SYSLIN,VOLUME=REF=*.FORT.SYSLIN,                 X00000190
XX              DCB=(,RECFM=FB,LRECL=80,BLKSIZE=3200),DISP=(OLD,DELETE)  00000200
// DD *
//LKED.ERT DD DSN=ERT4610.P9990000.ERTLIB,DISP=SHR
IEF236I ALLOC. FOR ERTUPDTE LKED      UPDATE
IEF237I 080    ALLOCATED TO SYSPRINT
IEF237I 256    ALLOCATED TO SYSLIB
IEF237I 257    ALLOCATED TO
IEF237I 253    ALLOCATED TO SYSUT1
IEF237I 253    ALLOCATED TO SYSLMOD
IEF237I 253    ALLOCATED TO SYSLIN
IEF237I 065    ALLOCATED TO
IEF237I 255    ALLOCATED TO ERT
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I    SYS1.FORTLIB                                   KEPT
IEF285I    VOL SER NOS= ACS101.
IEF285I    SYS1.DOUBLEP                                   KEPT
IEF285I    VOL SER NOS= ACS102.
IEF285I    SYS74060.T074500.RV000.ERTUPDTE.R0001143       DELETED
IEF285I    VOL SER NOS= AC8002.
IEF285I    SYS74060.T074500.RV000.ERTUPDTE.GOSET          PASSED
IEF285I    VOL SER NOS= AC8002.
IEF285I    SYS74060.T074500.RV000.ERTUPDTE.R0001140       DELETED
IEF285I    VOL SER NOS= AC8002.
IEF285I    ERT4610.P9990000.ERTLIB                        KEPT
IEF285I    VOL SER NOS= USER00.
IEF373I STEP /LKED     / START 74060.1032
IEF374I STEP /LKED     / STOP  74060.1032 CPU    0MIN 08.46SEC MAIN  98K LCS    0K
XXGO    EXEC     PGM=*.LKED.SYSLMOD,COND=((5,LT,FORT),(5,LT,LKED))              00000210
XXFT06F001 DD  SYSOUT=&PR,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1596)               00000220
IEF653I SUBSTITUTION JCL - SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1596)
//GO.FT05F001 DD DSN=*.READ1.SYSUT2,VOL=REF=*.READ1.SYSUT2,
// DISP=(OLD,DELETE)
// DD DSN=METD,DISP=OLD,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AIRMAP)
// DD DSN=*.READ2.SYSUT2,VOL=REF=*.READ2.SYSUT2,DISP=(OLD,DELETE)
//GO.FT09F001 DD DSN=C461002.ER701.LOGDATA,DISP=SHR,
// UNIT=SYSPV,VOL=(PRIVATE,RETAIN,SER=AVC016)
//GO.FT11F001 DD UNIT=SYSDA,SPACE=(TRK,1),
// DCB=(RECFM=FB,LRECL=80,BLKSIZE=3200)
//GO.FT12F001 DD UNIT=SYSDA,SPACE=(TRK,1),
// DCB=(RECFM=FB,LRECL=80,BLKSIZE=3200)
//GO.FT13F001 DD UNIT=SYSDA,SPACE=(TRK,1),
// DCB=(RECFM=FB,LRECL=80,BLKSIZE=3200)
//
IEF236I ALLOC. FOR ERTUPDTE GO        UPDATE
IEF237I 253    ALLOCATED TO PGM=*.DD
IEF237I 080    ALLOCATED TO FT06F001
IEF237I 253    ALLOCATED TO FT05F001
IEF237I 101    ALLOCATED TO
IEF237I 253    ALLOCATED TO
IEF237I 121    ALLOCATED TO FT09F001
IEF237I 253    ALLOCATED TO FT11F001
IEF237I 253    ALLOCATED TO FT12F001
IEF237I 251    ALLOCATED TO FT13F001
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I    SYS74060.T074500.RV000.ERTUPDTE.GOSET          PASSED
IEF285I    VOL SER NOS= AC8002.
IEF285I    SYS74060.T074500.RV000.ERTUPDTE.R0001133       DELETED
IEF285I    VOL SER NOS= AC8002.
IEF285I    METD                                           KEPT
```

Figure 62 UPDATE Test Case Printed Output

```
BEGIN DATASET GENERATION AND UPDATE PROGRAM.            VERSION   2.0 LEVEL 730514 RUN   2013
TABLE COUNT= 39

 18  2013      DATASET GENERATION AND UPDATE PROGRAM.            VERSION   2.0  (730514)              1 MAR 1974              PAGE   1
************************************************************************************************************************************

               MOVE CARD IMAGES & SEQUENCE

               UNIT=11   CODE=METD   SEQNO=  10

               METD                 1990 STAR-GENERATED WINTER WIND ROSE                              MET   10
                       1 423.00000 276.000001013.250001990 STAR-GENERATED WINTER WIN                  MET   20
                    1  1  0.0        0.0        0.0        0.0        0.0        0.0                   MET   30
                    1  2  0.0        0.0        0.0        0.0        0.0        0.0                   MET   40
                    1  3  0.0        0.0        0.0        0.0        0.0        0.0                   MET   50
                    1  4  0.0        0.0        0.0        0.0        0.0        0.0                   MET   60
                    1  5  0.0        0.0        0.0        0.0        0.0        0.0                   MET   70
                    1  6  0.0        0.0        0.0        0.0        0.0        0.0                   MET   80
                    1  7  0.0        0.0        0.0        0.0        0.0        0.0                   MET   90
                    1  8  0.0        0.0        0.0        0.0        0.0        0.0                   MET  100
                    1  9  0.0        0.0        0.0        0.0        0.0        0.0                   MET  110
                    1 10  0.0        0.0        0.0        0.0        0.0        0.0                   MET  120
                    1 11  0.0        0.0        0.0        0.0        0.0        0.0                   MET  130
                    1 12  0.0        0.0        0.0        0.0        0.0        0.0                   MET  140
                    1 13  0.0        0.0        0.0        0.0        0.0        0.0                   MET  150
                    1 14  0.0        0.0        0.0        0.0        0.0        0.0                   MET  160
                    1 15  0.0        0.0        0.0        0.0        0.0        0.0                   MET  170
                    1 16  0.0        0.0        0.0        0.0        0.0        0.0                   MET  180
                    2  1  0.00014    0.00005    0.0        0.0        0.0        0.0                   MET  190
                    2  2  0.00014    0.00005    0.0        0.0        0.0        0.0                   MET  200
                    2  3  0.00019    0.00009    0.00005    0.0        0.0        0.0                   MET  210
                    2  4  0.00014    0.00009    0.0        0.0        0.0        0.0                   MET  220
                    2  5  0.00052    0.00019    0.0        0.0        0.0        0.0                   MET  230
                    2  6  0.00033    0.00009    0.00005    0.0        0.0        0.0                   MET  240
                    2  7  0.00014    0.0        0.0        0.0        0.0        0.0                   MET  250
                    2  8  0.00033    0.00009    0.00005    0.0        0.0        0.0                   MET  260
                    2  9  0.00019    0.00005    0.00005    0.0        0.0        0.0                   MET  270
                    2 10  0.00019    0.00005    0.00009    0.0        0.0        0.0                   MET  280
                    2 11  0.00024    0.00014    0.0        0.0        0.0        0.0                   MET  290
                    2 12  0.00028    0.00005    0.00005    0.0        0.0        0.0                   MET  300
                    2 13  0.00005    0.00005    0.0        0.0        0.0        0.0                   MET  310
                    2 14  0.00019    0.00009    0.00005    0.0        0.0        0.0                   MET  320
                    2 15  0.00005    0.00005    0.0        0.0        0.0        0.0                   MET  330
                    2 16  0.00014    0.00005    0.0        0.0        0.0        0.0                   MET  340
                    3  1  0.00010    0.00060    0.00111    0.00005    0.0        0.0                   MET  350
                    3  2  0.00038    0.00139    0.00255    0.0        0.0        0.0                   MET  360
                    3  3  0.00029    0.00139    0.00134    0.0        0.0        0.0                   MET  370
                    3  4  0.00023    0.00051    0.00083    0.0        0.0        0.0                   MET  380
                    3  5  0.00056    0.00088    0.00037    0.0        0.0        0.0                   MET  390
                    3  6  0.00028    0.00046    0.00065    0.0        0.0        0.0                   MET  400
                    3  7  0.00014    0.00028    0.00046    0.0        0.0        0.0                   MET  410
                    3  8  0.00047    0.00097    0.00088    0.00005    0.0        0.0                   MET  420
                    3  9  0.00047    0.00093    0.00074    0.0        0.0        0.0                   MET  430
                    3 10  0.00042    0.00106    0.00204    0.0        0.0        0.0                   MET  440
                    3 11  0.00075    0.00181    0.00356    0.0        0.0        0.0                   MET  450
                    3 12  0.00033    0.00194    0.00343    0.00014    0.0        0.0                   MET  460
                    3 13  0.00010    0.00074    0.00347    0.00009    0.0        0.0                   MET  470
                    3 14  0.00024    0.00120    0.00356    0.00009    0.0        0.0                   MET  480
                    3 15  0.0        0.00056    0.00222    0.00009    0.0        0.0                   MET  490
                    3 16  0.0        0.00060    0.00250    0.00009    0.0        0.0                   MET  500
                    4  1  0.00068    0.00292    0.00968    0.01426    0.00185    0.00051               MET  510

 18  2013      DATASET GENERATION AND UPDATE PROGRAM.            VERSION   2.0  (730514)              1 MAR 1974              PAGE   2
************************************************************************************************************************************
                    4  2  0.00140    0.01000    0.03060    0.02727    0.00468    0.00097               MET  520
                    4  3  0.00217    0.01060    0.02204    0.01713    0.00269    0.00093               MET  530
                    4  4  0.00210    0.00519    0.00699    0.00556    0.00093    0.00046               MET  540
                    4  5  0.00366    0.00750    0.00519    0.00236    0.00032    0.0                   MET  550
                    4  6  0.00171    0.00486    0.00440    0.00148    0.00042    0.00019               MET  560
                    4  7  0.00093    0.00162    0.00171    0.00023    0.0        0.0                   MET  570
                    4  8  0.00088    0.00361    0.00394    0.00176    0.00037    0.00014               MET  580
                    4  9  0.00147    0.00440    0.00778    0.00218    0.00046    0.00009               MET  590
                    4 10  0.00233    0.00944    0.01755    0.01051    0.00208    0.00148               MET  600
                    4 11  0.00397    0.01319    0.01903    0.00944    0.00069    0.00023               MET  610
                    4 12  0.00185    0.00921    0.01750    0.01759    0.00167    0.00028               MET  620
                    4 13  0.00142    0.00435    0.01403    0.02981    0.00403    0.00093               MET  630
                    4 14  0.00079    0.00394    0.01593    0.06157    0.01606    0.00380               MET  640
                    4 15  0.00056    0.00190    0.00940    0.04954    0.01532    0.00616               MET  650
                    4 16  0.00062    0.00250    0.00986    0.03352    0.00935    0.00255               MET  660
                    5  1  0.00138    0.00370    0.00620    0.0        0.0        0.0                   MET  670
                    5  2  0.00149    0.00759    0.00764    0.0        0.0        0.0                   MET  680
                    5  3  0.00229    0.00764    0.00199    0.0        0.0        0.0                   MET  690
                    5  4  0.00142    0.00315    0.00032    0.0        0.0        0.0                   MET  700
                    5  5  0.00230    0.00241    0.00014    0.0        0.0        0.0                   MET  710
                    5  6  0.00078    0.00176    0.00019    0.0        0.0        0.0                   MET  720
                    5  7  0.00095    0.00056    0.00023    0.0        0.0        0.0                   MET  730
                    5  8  0.00104    0.00296    0.00056    0.0        0.0        0.0                   MET  740
                    5  9  0.00182    0.00449    0.00079    0.0        0.0        0.0                   MET  750
                    5 10  0.00463    0.01505    0.00449    0.0        0.0        0.0                   MET  760
                    5 11  0.00905    0.02611    0.00829    0.0        0.0        0.0                   MET  770
                    5 12  0.00472    0.02046    0.01296    0.0        0.0        0.0                   MET  780
                    5 13  0.00234    0.01315    0.01477    0.0        0.0        0.0                   MET  790
                    5 14  0.00148    0.00958    0.01657    0.0        0.0        0.0                   MET  800
                    5 15  0.00117    0.00537    0.01398    0.0        0.0        0.0                   MET  810
                    5 16  0.00086    0.00352    0.00926    0.0        0.0        0.0                   MET  820
               99999                                                                                  MET  830
```

Figure 62 Contd.

```
18  2013     DATASET GENERATION AND UPDATE PROGRAM,          VERSION   2.0  (730514)              1 MAR 1974              PAGE   3
*******************************************************************************************************************************

              MOVE & LIST CARD IMAGES

              DATA SET TRANSFERRED FROM UNIT 11 TO UNIT 12

              METO                 1990 STAR-GENERATED WINTER WIND ROSE                                      MET    10
                        1 423.00000 276.000001013.250001990 STAR-GENERATED WINTER WIN                        MET    20
                     1  1   0.0        0.0        0.0        0.0        0.0        0.0                        MET    30
                     1  2   0.0        0.0        0.0        0.0        0.0        0.0                        MET    40
                     1  3   0.0        0.0        0.0        0.0        0.0        0.0                        MET    50
                     1  4   0.0        0.0        0.0        0.0        0.0        0.0                        MET    60
                     1  5   0.0        0.0        0.0        0.0        0.0        0.0                        MET    70
                     1  6   0.0        0.0        0.0        0.0        0.0        0.0                        MET    80
                     1  7   0.0        0.0        0.0        0.0        0.0        0.0                        MET    90
                     1  8   0.0        0.0        0.0        0.0        0.0        0.0                        MET   100
                     1  9   0.0        0.0        0.0        0.0        0.0        0.0                        MET   110
                     1 10   0.0        0.0        0.0        0.0        0.0        0.0                        MET   120
                     1 11   0.0        0.0        0.0        0.0        0.0        0.0                        MET   130
                     1 12   0.0        0.0        0.0        0.0        0.0        0.0                        MET   140
                     1 13   0.0        0.0        0.0        0.0        0.0        0.0                        MET   150
                     1 14   0.0        0.0        0.0        0.0        0.0        0.0                        MET   160
                     1 15   0.0        0.0        0.0        0.0        0.0        0.0                        MET   170
                     1 16   0.0        0.0        0.0        0.0        0.0        0.0                        MET   180
                     2  1   0.00014    0.00005    0.0        0.0        0.0        0.0                        MET   190
                     2  2   0.00014    0.00005    0.0        0.0        0.0        0.0                        MET   200
                     2  3   0.00019    0.00009    0.00005    0.0        0.0        0.0                        MET   210
                     2  4   0.00014    0.00009    0.0        0.0        0.0        0.0                        MET   220
                     2  5   0.00052    0.00019    0.0        0.0        0.0        0.0                        MET   230
                     2  6   0.00033    0.00009    0.00005    0.0        0.0        0.0                        MET   240
                     2  7   0.00014    0.0        0.0        0.0        0.0        0.0                        MET   250
                     2  8   0.00033    0.00009    0.00005    0.0        0.0        0.0                        MET   260
                     2  9   0.00019    0.00005    0.00005    0.0        0.0        0.0                        MET   270
                     2 10   0.00019    0.00005    0.00009    0.0        0.0        0.0                        MET   280
                     2 11   0.00024    0.00014    0.0        0.0        0.0        0.0                        MET   290
                     2 12   0.00028    0.00005    0.00005    0.0        0.0        0.0                        MET   300
                     2 13   0.00005    0.00005    0.0        0.0        0.0        0.0                        MET   310
                     2 14   0.00019    0.00009    0.00005    0.0        0.0        0.0                        MET   320
                     2 15   0.00005    0.00005    0.0        0.0        0.0        0.0                        MET   330
                     2 16   0.00014    0.00005    0.0        0.0        0.0        0.0                        MET   340
                     3  1   0.00010    0.00060    0.00111    0.00005    0.0        0.0                        MET   350
                     3  2   0.00038    0.00139    0.00255    0.0        0.0        0.0                        MET   360
                     3  3   0.00029    0.00139    0.00134    0.0        0.0        0.0                        MET   370
                     3  4   0.00023    0.00051    0.00083    0.0        0.0        0.0                        MET   380
                     3  5   0.00056    0.00088    0.00037    0.0        0.0        0.0                        MET   390
                     3  6   0.00028    0.00046    0.00065    0.0        0.0        0.0                        MET   400
                     3  7   0.00014    0.00028    0.00046    0.0        0.0        0.0                        MET   410
                     3  8   0.00047    0.00097    0.00088    0.00005    0.0        0.0                        MET   420
                     3  9   0.00047    0.00093    0.00074    0.0        0.0        0.0                        MET   430
                     3 10   0.00042    0.00106    0.00204    0.0        0.0        0.0                        MET   440
                     3 11   0.00075    0.00181    0.00356    0.0        0.0        0.0                        MET   450
                     3 12   0.00033    0.00194    0.00343    0.00014    0.0        0.0                        MET   460
                     3 13   0.00010    0.00074    0.00347    0.00009    0.0        0.0                        MET   470
                     3 14   0.00024    0.00120    0.00356    0.00009    0.0        0.0                        MET   480
                     3 15   0.0        0.00056    0.00222    0.00009    0.0        0.0                        MET   490
                     3 16   0.0        0.00060    0.00250    0.00005    0.0        0.0                        MET   500
                     4  1   0.00068    0.00292    0.00968    0.01426    0.00185    0.00051                    MET   510
18  2013     DATASET GENERATION AND UPDATE PROGRAM,          VERSION   2.0  (730514)              1 MAR 1974              PAGE   4
*******************************************************************************************************************************
                     4  2   0.00140    0.01000    0.03060    0.02727    0.00468    0.00097                    MET   520
                     4  3   0.00217    0.01060    0.02204    0.01713    0.00269    0.00093                    MET   530
                     4  4   0.00210    0.00519    0.00699    0.00556    0.00093    0.00046                    MET   540
                     4  5   0.00366    0.00750    0.00519    0.00236    0.00032    0.0                        MET   550
                     4  6   0.00171    0.00486    0.00440    0.00148    0.00042    0.00019                    MET   560
                     4  7   0.00093    0.00162    0.00171    0.00023    0.0        0.0                        MET   570
                     4  8   0.00088    0.00361    0.00394    0.00176    0.00037    0.00014                    MET   580
                     4  9   0.00147    0.00440    0.00778    0.00218    0.00046    0.00009                    MET   590
                     4 10   0.00233    0.00944    0.01755    0.01051    0.00208    0.00148                    MET   600
                     4 11   0.00397    0.01319    0.01903    0.00944    0.00069    0.00023                    MET   610
                     4 12   0.00185    0.00921    0.01750    0.01759    0.00167    0.00028                    MET   620
                     4 13   0.00142    0.00435    0.01403    0.02981    0.00403    0.00093                    MET   630
                     4 14   0.00079    0.00394    0.01593    0.06157    0.01606    0.00380                    MET   640
                     4 15   0.00056    0.00190    0.00940    0.04954    0.01532    0.00616                    MET   650
                     4 16   0.00062    0.00250    0.00986    0.03352    0.00935    0.00255                    MET   660
                     5  1   0.00138    0.00370    0.00620    0.0        0.0        0.0                        MET   670
                     5  2   0.00149    0.00759    0.00764    0.0        0.0        0.0                        MET   680
                     5  3   0.00229    0.00764    0.00199    0.0        0.0        0.0                        MET   690
                     5  4   0.00142    0.00315    0.00032    0.0        0.0        0.0                        MET   700
                     5  5   0.00230    0.00241    0.00014    0.0        0.0        0.0                        MET   710
                     5  6   0.00078    0.00176    0.00019    0.0        0.0        0.0                        MET   720
                     5  7   0.00095    0.00056    0.00023    0.0        0.0        0.0                        MET   730
                     5  8   0.00104    0.00296    0.00056    0.0        0.0        0.0                        MET   740
                     5  9   0.00182    0.00449    0.00079    0.0        0.0        0.0                        MET   750
                     5 10   0.00463    0.01505    0.00449    0.0        0.0        0.0                        MET   760
                     5 11   0.00905    0.02611    0.00829    0.0        0.0        0.0                        MET   770
                     5 12   0.00472    0.02046    0.01296    0.0        0.0        0.0                        MET   780
                     5 13   0.00234    0.01315    0.01477    0.0        0.0        0.0                        MET   790
                     5 14   0.00148    0.00958    0.01657    0.0        0.0        0.0                        MET   800
                     5 15   0.00117    0.00537    0.01398    0.0        0.0        0.0                        MET   810
                     5 16   0.00086    0.00352    0.00926    0.0        0.0        0.0                        MET   820
              99999                                                                                          MET   830

END OF DATASET ON UNIT 11
18  2013     DATASET GENERATION AND UPDATE PROGRAM,          VERSION   2.0  (730514)              1 MAR 1974              PAGE   5
*******************************************************************************************************************************

              CHANGE TO UNIDIRECTIONAL WINDROSE

              INPUT UNIT=12   OUTPUT UNIT=13   CODE=        SEGNO=   0
18  2013     DATASET GENERATION AND UPDATE PROGRAM,          VERSION   2.0  (730514)              1 MAR 1974              PAGE   6
*******************************************************************************************************************************
         1          METO                 1990 STAR-GENERATED WINTER WIND ROSE                  MET    10
         2                    1 423.00000 276.000001013.250001990 STAR-GENERATED WINTER WIN    MET    20
         3                 4 11 1.0                                                            MET    30
         4          99999                                                                      MET    40
```

Figure 62   Contd.

6.3 LOGDATA Generation Program (LOG-GEN)

This utility program is used to initialize the AQUIP run log file at system implementation or regeneration. All AQUIP programs access the LOGDATA file at the onset of execution, to update the run-number for the program. This file is permanently located on the AQUIP system disk at the New Jersey Health Department's RCA Spectra 70/45 computer, and on an equivalent 2314 disk at the IBM 360/50 of the Department of Transportion. If these disk files must, for some reason, be replaced, the LOG-GEN program must be run before any of the AQUIP system programs may be executed. Once initialized, the LOGDATA file is maintained by the AQUIP programs without attention. The listing of LOG-GEN is given with those of the other programs in the Appendix, and the file specifications have been given in Section 1.5 (see Table 2). No data cards are required by the program.

7. CURRENT DATASET CATALOG

The identity and location of the card datasets at the New Jersey facility are given in Figure 63. The first column gives the card drawer number that each dataset is in. The item number gives an order within each drawer. The program which is associated with each dataset is given. Datasets are described relative to the program they are input for when they may be either input or output. The dataset code number, from the code numbers assigned in the dataflow sections, is given for input and output datasets. The keyword used to input the dataset is given when appropriate. The description is a brief description to identify the data within each dataset. Finally the section is the section number of the Task 5 Report which describes the keyword and dataset format for the dataset.

NEW JERSEY DATASET CATALOG

27 FEBRUARY 1974

Card Drawer	Item	Program	Dataset Code	Keyword	Description	Section
1	1.	SYMAP	--	--	SYMAP source deck - SYDK1-SYDK4	
2	2.1	SYMAP	--	--	SYMAP source deck - SYDK5-SYDK9	
	2.2	MARTIK	--	--	MARTIK source deck (update 9/25/73)	
3	3.1.1	SYMAP	M4.1	A-OUTLINES	Annual	5.2.1
	3.1.2	SYMAP	M4.2	B-DATAPOINTS	Annual	5.2.3
	3.1.3	SYMAP	I6.2	F-MAP	Annual for pollutants: PARTICULATES, SO_X, CO, HC, NO_X	5.2.6
	3.2.1	SYMAP	I6.1	E-VALUES	Annual air quality, Plan 1A	5.2.5
	3.2.2	SYMAP	I6.1	E-VALUES	Annual air quality, Plan 1B	5.2.5
	3.2.3	SYMAP	I6.1	E-VALUES	Annual air quality, Plan 1C	5.2.5
	3.2.4	SYMAP	I6.1	E-VALUES	Winter air quality, Plan 1A	5.2.5
	3.2.5	SYMAP	I6.1	E-VALUES	Winter air quality, Plan 1B	5.2.5
	3.2.6	SYMAP	I6.1	E-VALUES	Winter air quality, Plan 1C	5.2.5
	3.2.7	SYMAP	I6.1	E-VALUES	Summer air quality, Plan 1A	5.2.5
	3.2.8	SYMAP	I6.1	E-VALUES	Summer air quality, Plan 1B	5.2.5
	3.2.9	SYMAP	I6.1	E-VALUES	Summer air quality, Plan 1C	5.2.5
	3.3.1	SYMAP	M4.1	A-OUTLINES	Summer outlines	5.2.1
	3.3.2	SYMAP	M4.2	B-DATAPOINTS	Summer points	5.2.3
	3.3.3	SYMAP	I6.1	E-VALUES	Summer air quality, Plan 1	5.2.5
	3.3.4	SYMAP	I6.2	F-MAP	Summer for pollutants: PARTICULATES, SO_X, CO, HC, NO_X	5.2.6
	3.4.1	MARTIK	M3.1	PARAMETERS	1990 ANNUAL run (background)	3.2.1
	3.4.2	MARTIK	M3.2	POINTS	1990 receptor locations	3.2.2
	3.4.3	MARTIK	M3.2	METD	1990 ANNUAL wind rose	3.2.5
	3.4.4	MARTIK	M2	SRCE	1990 annual background sources	3.2.7
	3.5	IMPACT	--	--	Test case	4.
	3.6	LANTRAN	--	--	Test case	2.
4	4.1	IMPACT	--	--	Source deck (no JCL)	4.
	4.2	UPDATE	--	--	Source deck (no JCL)	6.2
	4.3	METCON	--	--	Source deck (no JCL)	6.1
	4.4.1	MARTIK	C1	SRCE	Output emission densities from LANTRAN, 1	3.2.7
	4.4.2	MARTIK	C1	SRCE	Output emissions densities from LANTRAN, Plan 1A	3.2.7
	4.4.3	MARTIK	C1	SRCE	Output emissions densities from LANTRAN, Plan 1B	3.2.7
	4.4.4	MARTIK	C1	SRCE	Output emissions densities from LANTRAN, Plan 1C (part #1)	3.2.7
	4.4.5	MARTIK	C1	SRCE	Output emissions densities from LANTRAN, Plan 1C (part #2)	3.2.7
5	5.1	MARTIK	M3.1	PARAMETERS	1990, Plan 1C run	3.2.1
	5.2	LANTRAN	--	--	Source deck (update 9/25/73)	

Figure 63 Catalogue of New Jersey Datasets

Card Drawer	Item	Program	Dataset Code	Keyword	Description	Section
6	6.1.1	MARTIK	M3.1	PARAMETERS	1990 Summer, setup to use LANTRAN output	3.2.1
	6.1.2	MARTIK	M3.5	COMPUTE 1	Vertical wind profile	3.3.1
	6.1.3	MARTIK	M3.2	POINTS	1990 Receptors	3.2.2
	6.1.4	MARTIK	M3.4	RCAL	1990 Receptor calibration	3.2.3
	6.2.1	LANTRAN	I1.1	FIGURES	1990: Plan 1A, land use figures	2.2.2
	6.2.2	LANTRAN	I1.2	VALUES	1990: Plan 1A, emissions variables	2.2.4
	6.2.3	LANTRAN	I1.1	FIGURES	1990: Plan 1B, land use figures	2.2.2
	6.2.4	LANTRAN	I1.2	VALUES	1990: Plan 1B, emissions variables	2.2.4
	6.2.5	LANTRAN	I1.1	FIGURES	1990: Plan 1C, part 1, land use	2.2.2
	6.2.6	LANTRAN	I1.2	VALUES	1990: Plan 1C, part 1, emission variables	2.2.4
	6.2.7	LANTRAN	I1.1	FIGURES	1990: Plan 1C, part 2, land use	2.2.2
	6.2.8	LANTRAN	I1.2	VALUES	1990: Plan 1C, part 2, emissions variables	2.2.4
	6.2.9	LANTRAN	I1.1	FIGURES	1990: Plan 1, land use figures	2.2.2
7	7.1.1	LANTRAN	I1.2	VALUES	1990: Plan 1, emissions variables	2.2.4
	7.1.2	LANTRAN	M1.1	ACTIVITIES	1990, Activities for are with Compute 1	2.2.6
	7.1.3	LANTRAN	M1.2	COMPUTE 1	1990, heat demand Compute	2.3.1
	7.1.4	LANTRAN	M1.3	ACTIVITIES	1990, for COMPUTE 2	2.2.6
	7.1.5	LANTRAN	M1.4	COMPUTE 2	1990, emissions compute	2.3.1
	7.1.6	LANTRAN	M1.5	ACTIVITIES	1990, for COMPUTE 3	2.2.6
	7.1.7	LANTRAN	M1.6	COMPUTES	1990, select point sources	2.3.1
	7.1.8	LANTRAN	--	PARAMETERS	1990	2.2.1
	7.1.9	LANTRAN	M1.7	ALLOCATION	Mode 1 emissions allocation	2.2.7
	7.1.10	LANTRAN	M1.9	OUTPUT	1990, output emissions	
	7.2	IMPACT	--	--	Source deck, 360 DOS	
	7.3	LOGGEN	--	--	Source deck	
	7.4.1	IMPACT	I5.2	OPERATIONS	'STANDARDS' operations	4.2.3
	7.4.2	IMPACT	I5.2	OPERATIONS	'DOSAGE' operations	4.2.3
	7.4.3	IMPACT	I5.2	OPERATIONS	'LAND USE COMPATÁBILITY SCORE' operations	4.2.2
	7.4.4	IMPACT	--	GRID	Define Hackensack 'REGION'	4.2.2
	7.4.5	IMPACT	--	GRID	Plan 1, 'OPEN SPACES'	4.2.2
	7.4.6	IMPACT	--	GRID	Plan 1A, 'OPEN SPACES'	4.2.2
	7.4.7	IMPACT	--	GRID	Plan 1B, 'OPEN SPACES'	4.2.2
	7.4.8	IMPACT	--	GRID	Plan 1C, 'OPEN SPACES'	4.2.2
	7.5	LANTRAN	--	--	Mode 3 Air Quality - test case	
	7.6	IMPACT	--	--	'DOSAGE' test case	
	7.7	LANTRAN	--	--	Mode 1 Emissions - test case	
	7.8	LANTRAN	--	--	Mode 1 Land Use - test case	
	7.9	MARTIK	--	--	Test base based on 7.7 deck	
	7.10	SYMAP	--	--	Test case based on 7.10 deck	

Figure 63 Catalogue of New Jersey Datasets, Contd.

Card Drawer	Item	Program	Dataset Code	Keyword	Description	Section
8	8.1	SYMAP	--	--	RCA SPECTRAA 70/45 source deck	
9	9.1	SYMAP	--	--	RCA source dect ( )	
10	10.1	LANTRAN	--	--	Source deck (obsolete)	
11	11.1	LANTRAN	--	--	Source deck DOS (obsolete)	
12	12.1.1	MARTIK	M3.1	PARAMETERS	1990 WINTER background	3.2.1
	12.1.2	MARTIK	M3.2	RECP('POINTS')	1990 WINTER background	3.2.2
	12.1.3	MARTIK	M3.3	METD	1990 WINTER background	3.2.5
	12.1.4	MARTIK	M2	SRCE	1990 AREA sources	3.2.7
	12.1.5	MARTIK	M2	--	1990 POINT sources	3.2.7
	12.2.1	MARTIK	M3.1	PARAMETERS	1990 SUMMER background	3.2.1
	12.2.2	MARTIK	M3.2	RECP('POINTS')	1990 SUMMER receptors	3.2.2
	12.2.3	MARTIK	M3.2	METD	1990 SUMMER receptors	3.2.5
	12.2.4	MARTIK	M2	SRCE	1990 SUMMER Area sources	3.2.7
	12.2.5	MARTIK	M2	SRCE	1990 SUMMER Point sources	3.2.7
	12.3.1	MARTIK	M2	SRCE	1990 ANNUAL background point sources	3.2.7
13	13.1.1	MARTIK	C1	SRCE	Plan 1, land use, POINT & GRID from LANTRAN, 1990 Annual	3.2.7
	13.1.2	MARTIK	C1	SRCE	Plan 1A, 1990 Annual	3.2.7
	13.1.3	MARTIK	C1	SRCE	Plan 1B, 1990 Annual	3.2.7
	13.1.4	MARTIK	C1	SRCE	Plan 1C, #1, 1990 Annual	3.2.7
	13.1.5	MARTIK	C1	SRCE	Plan 1C, #2, 1990 Annual	3.2.7
	13.2.1	MARTIK	C1	SRCE	Plan 1, WINTER 1990	3.2.7
	13.2.2	MARTIK	C1	SRCE	Plan 1A, WINTER 1990	3.2.7
	13.2.3	MARTIK	C1	SRCE	Plan 1B, WINTER 1990	3.2.7
	13.2.4	MARTIK	C1	SRCE	Plan 1C, #1, WINTER 1990	3.2.7
	13.2.5	MARTIK	C1	SRCE	Plan 1C, #2, WINTER 1990	3.2.7

Figure 63 Catalogue of New Jersey Datasets, Contd.

REFERENCES

Martin, D. O., and Tikvart, J., "A General Atmospheric Diffusion Model for Estimating the Effects of One or More Sources on Air Quality," APCA paper No. 63-148, presented at the Annual Meeting of the Air Pollution Control Association, St. Paul, Minnesota, June 1968.

Gifford, F. A., "Use of Routine Meteorological Observations for Estimating Atmospheric Dispersion," Nuclear Safety, 2(4), pp. 47-51, 1961.

Pasquill, F., "The Estimation of the Dispersion of Windborne Material," Meteorology Mag., 90(1063), pp. 33-49, 1961.

SYMAP User's Reference Manual, Laboratory for Computer Graphics, Harvard Graduate School of Design, Cambridge, Massachusetts (undated).

NAPCA, Air Quality Display Model, National Air Pollution Control Administration, Washington, D.C., 1969.

GLOSSARY

Activity, Activity Level - basic land use and transportation planning units of intensity of use - vehicles per day on a highway, acres of residential land use, square feet of industrial plant space.

Activity Index - a numerical conversion factor to transform the level of activity specified for a land use category into demand for fuel for heating purposes.

Air Quality Contour - a contour line in a plane (usually the horizontal or vertical) representing points of equal concentrations for a specified air pollutant.

Air Quality Criteria - factors used in this study that represent a basis for decision-making, for example ambient air quality standards.

Air Quality Prediction - the calculation of current or future air pollutant concentrations at specified receptor points resulting from the action of meteorological conditions on source emissions.

Albedo - the fraction of solar radiation reflected from the ground surface.

Ambient Air - that portion of the atmosphere, external to buildings, to which the general public has access.

Ambient Air Quality - concentration levels in ambient air for a specified pollutant and a specified averaging time period within a given geographic region.

Ambient Air Quality Standard - a level of air quality established by federal or state agencies which is to be achieved and maintained; primary standards are those judged necessary, with an adequate margin of safety, to protect the public health; secondary standards are those judged necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

AQUIP - an acronym for Air Quality for Urban and Industrial Planning, a computer-based tool for incorporating air pollution considerations into the land use and transportation planning process.

Atmospheric Boundary Layer - the lower region of the atmosphere (to altitudes of 1 to 2 km) where meteorological conditions are strongly influenced by the ground surface features.

Atmospheric Dispersion Model - a mathematical procedure for calculating air pollution concentrations that result from a specified array of emission sources and a specified set of meteorological conditions.

Average Receptor Exposure - a measure of the average impact of air quality levels on specific receptors; the measure is based on the integrated receptor exposure divided by the total number of receptors in the study region.

Background Air Quality - levels of pollutant concentrations within a study region which are the result of emissions from all other sources not incorporated in the model for the study region.

Background Emissions - the emissions inventory applicable to the background region; that is, all emission sources not explicitly included in the inventory for the study region.

Climatology - the study of long term weather as represented by statistical records of parameters such as winds, temperature, cloud cover, rainfall, and humidity which determine the characteristic climate of a region; climatology is distinguished from meteorology in that it is primarily concerned with average, not actual, weather conditions.

Concentrations - a measure of the average density of pollutants usually specified in terms of pollutant weight per unit (typically in units of micrograms per cubic meter), or in terms of relative volume of pollutant per unit volume of air (typically in units of parts per million).

Default Parameters - values associated with a parameter for a category of activities (such as heavy manufacturing) assigned to the activity parameter for a subcategory of activities (such as electrical machinery production) when the actual value for the subcategory is not known.

Degree Days (Heating Degree Days) - the sum of negative departures of average temperature from 65°F; used to determine demand for fuel for heating purposes.

Effective Stack Height - the height of the plume center-line when it becomes horizontal.

Emission Factor - a numerical conversion factor applied to fuel use and process rates to determine emissions and emission rates.

Emissions - effluents into the atmosphere, usually specified in terms of weight per unit time for a given pollutant from a given source.

Emissions Inventory - a data set describing the location and source strength of air pollution emissions within a geographical region.

Emissions Projection - the quantitative estimate of emissions for a specified source and a specified future time.

Equivalent Ambient Air Quality Standards - air quality levels adopted in this study to permit analysis of all air pollutants in terms of annual averages; in cases where state and federal annual standards do not exist, the adopted levels are based on the extrapolation of short period standards.

Fuel Related Sources, Fuel Emissions - fuel related sources use fuel to heat area, or to raise a product to a certain temperature during an industrial process, or for cooking in the house; they produce fuel emissions. (See also Non-Fuel Related Sources.)

Fuel Use Propensity, Fuel Demand - the total heat requirement (space heating plus process heating) determines the fuel demand; the propensity to use a particular fuel or fuels determines the actual amounts of various fuels used to satisfy the heat requirement.

Heating Requirements - the demand for fuel is specified in terms of the heating requirements:

<u>space heating</u> - the fuel used to heat area, such as the floor space of a school in the winter, is that required for space heating; the heat content or value of that fuel defines the space heating requirement (BTUs, British Thermal Units of heating content).

<u>non-space heating, process heating</u> - the fuel used to raise a product to a certain temperature during an industrial process or for cooking (with gas) in the home is that required for process heating or non-space heating. It is generally not related to outside temperature whereas space heating requirements are.

<u>percent space heating, percent process heating</u> - the relative proportion of a fuel or its heat content that is used for space heating or process heating defines, respectively, the percent space heating or percent process heating.

Impact Measure (or Parameter) - a quantitative representation of the degree of impact on air quality or specific receptors resulting from concentrations of specified pollutants.

Influence Region - the influence region for a study area is the geographical region containing the emission sources responsible for at least 90% of the ground level concentrations (averaged throughout the study area) of all pollutants considered.

Integrated Receptor Exposure - a measure of the total impact of air quality levels on specific receptors; the measure is based on the summation within the study region of the number of receptors times the concentration levels to which they are exposed.

Inventories - the aggregation of all fuel and process emissions sources is called the emissions inventory; the components for use with the model:

current inventory - all sources for 1969

background inventory - all sources for 1990 not directly related to the meadowlands plans.

plan inventories - all sources for 1990 related to the Meadowlands plans; this excludes any source outside the Meadowlands boundary and also excludes existing major single sources and the highway network.

Isopleth - the locus of points of equal value in a multidimensional space.

Land Use Intensity - the level of activity associated with a given land use category, for example the population density of residential areas.

Land Use Mix - the percent of total study region area allocated to specific land use categories.

Meteorology - the study of atmospheric motions and phenomena.

Microscale Air Quality - the representation of air quality in a geographical scale characterized by distances between source and receptor ranging from a few meters to a few tens of meters.

Mixing Depth - the vertical distance from the ground to the base of a stable atmospheric layer (also called inversion height).

Model Calibration - the process of correlating model predictions with observed (measurements) data, usually to determine calibration factors relating predicted to observed values for each pollutant.

Model Validation - the detailed investigation of model results by comparison with measured values to identify systematic discrepencies that may be corrected by alterations of model parameters or model mechanics.

Non-Fuel Related Sources, Process Emissions, Separate Process Emissions - non-fuel related sources do not burn fuel primarily for heating purposes or do not burn fuel at all; these include transportation sources, incineration, and certain industrial processes; they produce process or separate process emissions. (See also Fuel Related Sources.)

Ranking Index - a quantitative representation of the net impact on air quality or specific receptors resulting from all pollutants being considered.

Receptor - a physical object which is exposed to air pollution concentrations; objects may be animate or inanimate, and may be arbitrarily defined in terms of size, numbers, and degree of specificity of the object.

Receptor Point - a geographical point at which air pollution concentrations are measured or predicted.

Regional Air Quality - the representation of air quality in a geographical scale characterized by large areas, for example, on the order of 50 square kilometers or greater.

Schedule - number of hours per year a fuel burning activity will consume fuel; used to determine heating requirements.

Source - any stationary or mobile activity which produces air pollutant emissions.

Source Geometry - all sources for modeling purposes are considered to exist as a point, line, or area, defined as follows:

point source - a single major emitter located at a point.

line source - a major highway link, denoted by its end points.

area source - a rectangular area referenced to a grid system; includes not only area-wide sources, such as residential emitters, but single emitters and highway links deemed too small to be considered individual point or line sources by the model.

Stability Category - a classification of atmospheric stability conditions based on surface wind speed, cloud cover and ceiling, supplemented by solar elevation data (latitude, time of day, and time of year).

Stability Wind Rose - a tabulation of the joint frequency of occurrences of wind speed and wind direction by atmospheric stability class at a specific location.

Total Air Quality - the air quality at a receptor point resulting from background emission sources and from emission sources specifically within the study region.

Trapping Distance - the distance downwind of a source at which vertical mixing of a plume begins to be significantly inhibited by the base of the stability layer, and gaussian vertical distribution can no longer be assumed.

Wind Sector - a 22-1/2 degree wind direction range whose center-line is one of the sixteen points of the compass.

SPECIAL TERMS FOR TASK 5 REPORT

Allocation - a procedure in the LANTRAN program whereby data assigned to a set of geographical zones is reassigned to the cells of a grid system.

Card Image - one record of a tape or disc resident data set, containing the equivalent of a single 80 column card.

Correlation Data Set - a gridded data set which specifies variables for correlation with air pollution concentrations at each cell of the chosen grid system.

Data Bank - a collection of data sets which has been organized for a specific application.

Data Set - a collection of data organized in digital format suitable for use or input to a computer program.

Delimiter Card - a single card used to denote the end of a Keyword Package.

Extent - the extent of a geographical point is unity, the extent of a straight line segment is its length, and the extent of a polygon zone is its area.

Figure - a geographical zone within which one or more sets of values related to the zone's activity is uniformly applied.

Grid System - a two dimensional array of rectangular cells set up in such a way that the cell with indices (1, 1) is located in the southeast corner of the array.

Gridded Air Quality Data Set - a data set which specifies predicted air pollution concentration in each cell of a grid system.

Gridded Data Set - a data set which specifies the value of a particular variable in every cell of a grid system.

Keyword Package - a set of program input cards, the first of which is used by the program for control purposes and called a Keyword Card and the following cards, if present, are used for data initialization.

Over-printing - the process whereby multiple characters are printed at the same print position to achieve shading effects.

Parameter - a value assigned to a variable and held constant within one or more computation steps.

Proximal Map - a map for which each character location on the printed output is assigned the value of the data point nearest to it.

Symbol Table - a list of symbols which refer to variables defined on grid systems.

Symbolic Name - an artifical name, consisting of up to 8 characters, which is assigned to a particular gridded data set.

Symbolism - in SYMAP, symbolism refers to the set of single and over-print characters used to represent data values.

Vertex - a geographical point at which the outline of a geographical zone changes direction.

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA-450/3-74-056-f	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE HACKENSACK MEADOWLANDS AIR POLLUTION STUDY - AQUIP Softward System User's Manual		5. REPORT DATE June 1974
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Edward C. Reifenstein, III, Robert J. Horn, III, and Michael Keefe		8. PERFORMING ORGANIZATION REPORT NO. ERT Document No. P-244-5
9. PERFORMING ORGANIZATION NAME AND ADDRESS Environmental Research and Technology, Inc. 429 Marrett Road Lexington, Massachusetts 02173		10. PROGRAM ELEMENT NO.
		11. CONTRACT/GRANT NO. EHSD 71-39
12. SPONSORING AGENCY NAME AND ADDRESS Environemntal Protection Agency Office of Air Quality Planning and Standards Research Triangle Park, North Carolina 27711		13. TYPE OF REPORT AND PERIOD COVERED Final
		14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES
Prepared in cooperation with the New Jersey Department of Environmental Protection, Office of the Commissioner, Labor and Industry Building, Trenton, N. J. 08625

16. ABSTRACT
The Hackensack Meadowlands Air Pollution Study consists of a summary report and five task reports. The summary report discusses the procedures developed for considering air pollution in the planning process and the use of these procedures to evaluate four alternative land use plans for the New Jersey Hackensack Meadowlands for 1990. The task reports describe (1) the emission projection methodology and its application to the Hackensack Meadowlands; (2) the model for predicting air quality levels and its validation and calibration: (3) the evaluation and ranking of the land use plans; (4) the planning guidelines derived from the analysis of the plans; and, (5) the software system.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Land Use Planning and Zoning Local Governments County Governments State Governments Regional Governments Air Pollution Control		

18. DISTRIBUTION STATEMENT Unlimited	19. SECURITY CLASS *(This Report)* Unclassified	21. NO. OF PAGES 412
	20. SECURITY CLASS *(This page)* Unclassified	22. PRICE

EPA Form 2220-1 (9-73)