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A S E A M - 2.1

A Simplified Energy Analysis Method

DOCUMENTATION

FOR THE

ASEAM-2.1

TEACHING TUTORIAL

Prepared by:

The Deringer Group

for

ACEC Research & Management Foundation

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ACKNOWLEDGMENTS

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The U.S. Department of Energy (DOE), Office of Building and Community Systems, sponsored the original development of the ASEAM-2.1 building energy analysis computer program and teaching-tutorial DOE's Office of Federal Energy Management Program and Office of State and Local Assistance Programs sponsored final development of these products.

LEGAL NOTICE

NOTICE

This program has been developed for public distribution. Copies of this demonstration program may be obtained by sending $10.00 to :

ACEC Research & Management Foundation
1015 15th Street, NW
Washington, DC 20005

This fee includes the cost of reproduction, disks, and postage. You are encouraged to copy this program and share it with anyone interested in the ASEAM-2.1 building energy analysis program.

CONTENTS

INTRODUCTION

The following subjects are introduced in this support documentation for the ASEAM-2.1 tutorial:

- Purpose of the Tutorial

  Intended Audience

- Overview of the Tutorial Lessons

- How To . . . Step by Step Procedures
  - How to Begin a Tutorial Session
  - How to Use the Main Menu
  - How to View a Lesson
  - How to End a Tutorial Session

- Recommended References

The primary purpose of this tutorial is to introduce the basic features of the building energy and economics program called: "A Simplified Energy Analysis Method - Version 2.1" (ASEAM-2.1).

The tutorial lessons will introduce you to:

- ASEAM-2.1 calculation procedures
- ASEAM-2.1 input menus
- ASEAM-2.1 output reports

The tutorial will also teach you the step-by-step procedures to perform:

- loads calculations
- system and plant energy calculations
- economics analyses
- retrofit analyses

This tutorial is not the actual ASEAM-2.1 program. It is a series of instructional lessons prepared using the desk-top presentation software package SHOW PARTNER F/X.

INTENDED AUDIENCE

This tutorial has been developed for two principal audiences:

- government energy managers
- university students of architecture and engineering

Thus, the focus of this tutorial is to provide general guidance to these first-time users of ASEAM-2.1.

The tutorial assumes the audience to have a minimal background in both using microcomputers, and in conducting building energy analyses. For this reason, the lessons in the early part of the tutorial provide general introductory information in these areas. Specific details of ASEAM-2.1 procedures are presented in the later lessons.

IT IS RECOMMENDED THAT the novice ASEAM-2.1 user studies the introductory lessons before proceeding to the more detailed lessons. Without the benefit of the information in the early lessons, the user will be less capable of effectively using the ASEAM-2.1 program.

It is also recommended that you obtain a copy of the ASEAM-2.1 User's Manual. This manual contains detailed information about every aspect of the ASEAM-2.1 program.

OVERVIEW OF THE TUTORIAL LESSONS

The tutorial is subdivided into three sections:

BACKGROUND	-	an overview of the tutorial and energy analysis methods
STARTING UP ASEAM-2.1	-	instructions on the installation and organization of ASEAM-2.1.
BASIC ASEAM-2.1 PROCEDURES		step-by-step details of how to use ASEAM-2.1.

Each of the three sections of the tutorial includes 4 or 5 lessons. There are a total of 14 lessons. The lesson are all about 10 minutes in length. Thus, it takes just over two hours to view the complete tutorial.

The tutorial is structured so that you can view any lesson at any time. The user is allowed complete freedom to move backward and forward through each of the lessons in the tutorial.

The following list indicates the sequencing of the lessons in the tutorial.

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LESSON C:	Potential Uses of ASEAM-2.1
LESSON D:	Energy Analysis Methods
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PART III: BASIC ASEAM-2.1 PROCEDURES

LESSON N: Retrofit ECO's

HOW TO . . . STEP-BY-STEP PROCEDURES

There are two methods that can be used to view the lessons in the tutorial:

1. You may choose to view complete lessons in the order presented in the main menu.

2. You may also choose to view only portions of a lesson, or a few select lessons during any tutorial session.

The following keys can be used to control the lessons:

PgDn	-	This key allows you to jump forward to the next page of information in a lesson.
PgUp	-	This key allows you to jump backwards to review the previous page of information in a lesson.
Space Bar	-	This key allows you to stop a lesson at any time. To resume the lesson, you simply press any key on the keyboard.
ESC	-	This key allows you to quit a lesson at any time and return to the main menu.

HOW TO BEGIN A TUTORIAL SESSION

After the computer has been booted (i.e. the MS-DOS operating system has been loaded), insert one of the tutorial disks into drive A. With the default drive A:, simply type DEMO.

The tutorial has been developed using the SHOW PARTNER F/X desk-top presentation program. Thus, the first screen in the tutorial is a SHOW PARTNER F/X credit screen. You will be prompted to press the SPACE BAR to begin the tutorial. An ASEAM-2.1 TUTORIAL title page will then be displayed. After a few seconds, this screen is automatically replaced with the notice shown at the beginning of this document.

The notice is automatically replaced with the ASEAM-2.1 TUTORIAL main menu.

All three tutorial disks can be started with the same procedure, so be sure to read the label on the disk carefully before loading the disk into the drive. The introduction to the tutorial is located on disk number one.

HOW TO USE THE MAIN MENU

The main menu is automatically displayed when you begin a tutorial session. Select the desired lesson from the main menu by typing the single alphabetic character indicated in the menu. The first page of selected lesson will be displayed immediately. Note that you can only access the four or five lessons that are listed in the main menu of the tutorial disk that you are using. If you would like to view any of the other lessons not listed in the main menu of the disk that you are currently using, you must EXIT TO DOS and change disks. Then you must load the tutorial from DOS again by typing "DEMO".

HOW TO VIEW A LESSON

When the first page of a lesson is displayed, the prompt "press ENTER to continue" will be displayed in the lower right hand corner of the screen. In order to proceed through each of the lessons, you press the "ENTER" key (also called the carriage return key) to view each successive page.

If you would like to review a previous page in a lesson, press the "Pg-Up" key once for each page that you would like review.

HOW TO END A TUTORIAL SESSION

When you are ready to leave the tutorial and exit to DOS, you must first return to the main menu. The following method should be used to return to the main menu from a lesson:

Press the "ESC" key.

The "ESC" key will return you to the main menu whenever it is pressed.
When the main menu is on the screen, the following method should be used to quit the tutorial:

Select the last item listed in the menu, "EXIT TO DOS", by typing the letter "Q".

The tutorial will then prompt you to confirm your choice:

Do you want to quit the tutorial?
(Enter Y or N)

RECOMMENDED REFERENCES

The following references are recommended if you would like to know more about the information presented in the tutorial.

Advanced BASIC Programming, Carl Shipman, HP Books, 1983.

A User's Guide to the Federal Building Life-Cycle Cost (FBLCC) Computer Program, Stephen Peterson, NBS Technical Note 1222.

Algorithms for Building Heat Transfer Subroutines, ASHRAE, 1975.

Architects and Engineers Guide to Energy Conservation in Existing Buildings, U.S. Department of Energy, 1980.

ASHRAE 1983 Equipment Handbook

ASHRAE 1984 Systems Handbook

ASHRAE 1985 Handbook of Fundamentals

Bindata User's Guide for Microcomputers, ASHRAE, 1979.

Blast - The Building Loads Analysis and System Thermodynamics Program, US-CERL Technical Report E-153, 1979.

Cooling and Heating Load Calculation Manual, ASHRAE, 1979.

Design Guide for Insulated Buildings, Owens Corning Fiberglass Corp., 1981.

DOE-2 User's Guide, University of California Technical Report LA-8689, 1980.

Energy Conservation Standards for Building Design, Construction and Operation, F.S. Dubin, C.G. Long Jr., McGraw-Hill, 1978.

Engineering Weather Data, Dept. of the Air Force, AFM 88-29, 1978.

Handbook of BASIC for the IBM PC, D.I. Schneider, Prentice-Hall Inc., 1985.

IES Lighting Handbook Reference Volume, Illuminating Engineering Society, 1984.

Introduction to BASIC Programming, Shelly and Cashman, Anaheim Publishing, 1982.

Introduction to Computers and Microprocessing, Shelly and Cashman, Anaheim Publishing, 1980.

Managing Your Hard Disk, Don Berliner, QUE Corp., 1986.

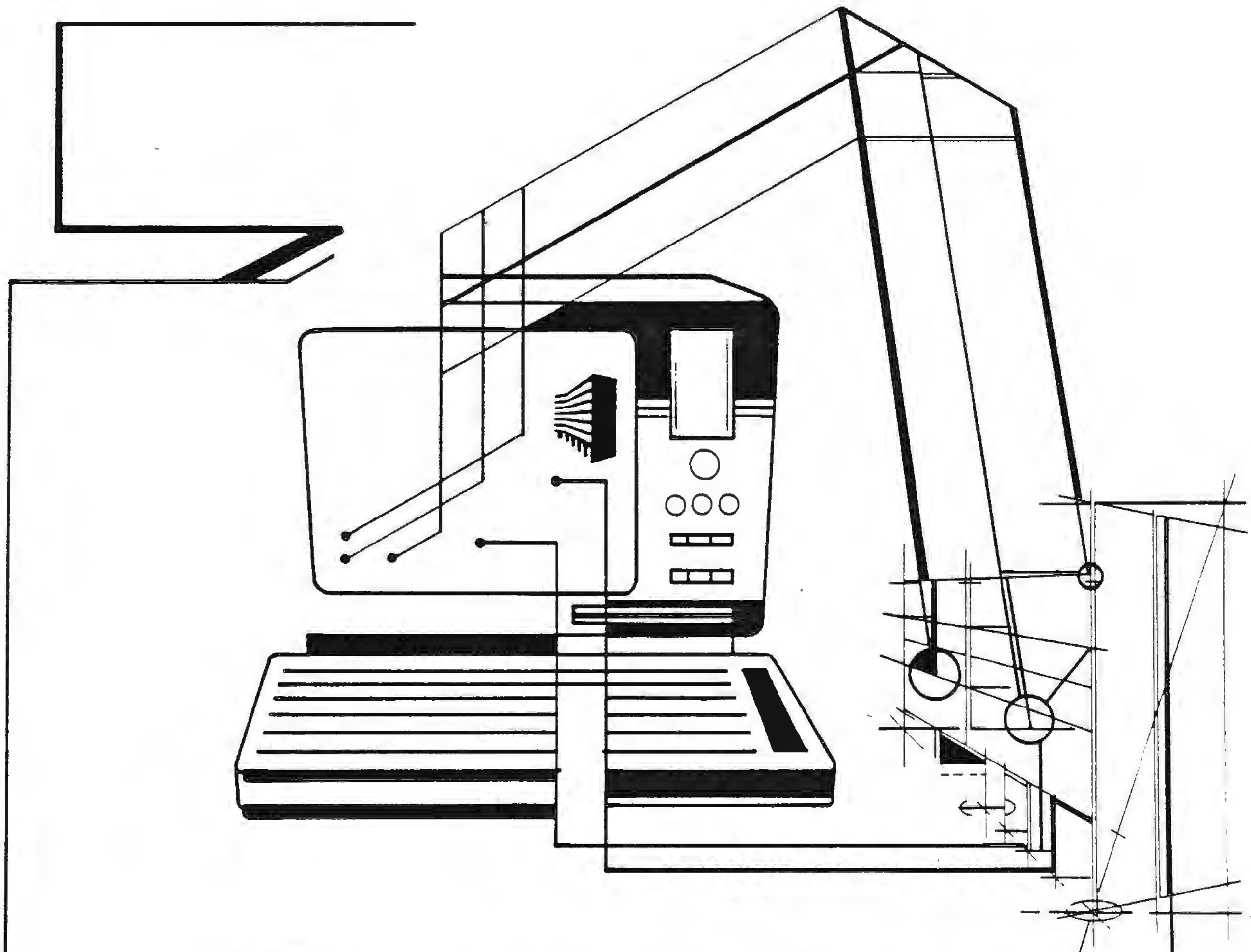
Simplified Energy Analysis Using the Modified Bin Method, D.E. Knebel, ASHRAE, 1983.

Using 123, LeBland and Cobb, QUE Corp., 1985.

Weather Data for Simplified Energy Calculation Methods, Olsen, Moreno, Derringer, and Watson, Battelle PNL Technical Report PNL-5143, 1984. (4 Vols.)

ASEAM 2-1

A Simplified Energy Analysis Method



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NOTICE

This user's manual has been developed with the assistance of many individuals who have devoted considerable time and expense to ensure that it is fully operational. Because of the public-domain nature of ASEAM2.1, it is being released without the customer support system that many software vendors provide. Should you have any problems, suggestions, or questions when using this manual or the ASEAM2.1 program, please *write* to

ASEAM2.1 Coordinator
ACEC Research & Management Foundation
1015 15th Street, N.W., Suite 802
Washington, DC 20005

For questions that can be answered quickly, the ASEAM2.1 coordinator will call or write with a response.

The ASEAM2.1 Coordinator will contact the developer of the ASEAM2.1 software, James A. Fireovid, P.E, for answers to questions that cannot be answered by in-house staff.

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Trademark and Reproduction Acknowledgments

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Note on Earlier Versions of ASEAM2.1

If you have an earlier beta-test version of ASEAM2.1, you should replace it with the current version. Input files created with earlier versions can still be used, with a few modifications.

The Loads Input file (extension .LID) should be edited. There is a question on the second Building/Project data screen about daylight savings time that was not included previously. Edit this screen, entering correct values for all input questions. Save the file with this change and proceed as usual.

The Systems and Plant Input files (extensions .SID and .PID, respectively) do not require modification.

The Specify Analyses screens and run files have been changed. Delete all run files (extensions .SRC for single run calculations, .BRC for batch run calculations, and .PRC for parametric run calculations) created with the earlier version from the Data disk. The next time you use the Specify Analyses segment of ASEAM2.1, you will create new run files. These files will be saved and available for later use.

Note that earlier versions of ASEAM2.1 will not be supported. This release replaces all earlier versions.

Contents

1 Introduction

1 INTRODUCTION

1.1 What is ASEAM2.1?

A Simplified Energy Analysis Method, Version 2.1 (ASEAM2.1), is a modified bin method program for calculating the energy consumption of residential and simple commercial buildings. ASEAM2.1 runs on an IBM PC and compatibles with at least 256 kilobytes of memory and two disk drives—either two floppy disk drives or one hard disk and one floppy disk drive. ASEAM2.1 features include:

- Input Features

Full screen editing: Entering data into ASEAM2.1 is easy and straightforward. Input questions are accessed through cursor control keys on the keyboard.

User-friendly features: ASEAM2.1 has many user-friendly features, including error checking, help messages, and default values. Data entry and editing features are included.

Quick input routine: Given a limited amount of input data, such as building shape and dimensions, percent glass, space types, and system types, ASEAM2.1 can calculate areas and use default values based on the information you provide, and can write complete input files for the calculations.

- Calculation Features

Use of standard algorithms: Wherever possible, ASEAM2.1 uses recognized algorithms from such sources as the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), Illuminating Engineering Society (IES), the DOE-2 program, and the National Bureau of Standards (NBS).

Calculation can be displayed: You can display and print the calculations simply by pressing the function keys while the calculations are being performed. Many of the calculations are displayed graphically.

Calculation Speed and Capacity: ASEAM2.1 can perform calculations for a typical five-zone building in seven minutes or less. Up to 10 thermal load zones with different secondary HVAC systems assigned to each can be specified. Thirteen different system types, five heating plants, and seven cooling plants can be simulated.

Peak Load and Equipment Sizing: ASEAM2.1 calculates both zone and building peak loads and can automatically size equipment based on these loads. You can also specify equipment sizes.

Calculation Modes: Calculations can be performed in several modes:

Single or Batch Mode: As many as 20 combinations of input files can be selected for analysis. A wide range of outputs can be selected for each analysis.

Parametric Processor Mode: The parametric processor is a powerful tool for analyzing many alternate building and system configurations. When using the parametric processor, you begin by defining the base-case input files to be modified and then selecting both the input variables to be changed and the output variables for the report. ASEAM2.1 then performs the calculations, automatically changing input values in a looping pattern. Variables can be studied individually or in combination with other variables. The selected calculation output variables are stored in a LOTUS-compatible file.

ECO Mode: Energy Conservation Opportunities (ECOs) are studied with ASEAM2.1 by comparing original (base case) energy consumption and cost with alternative (ECO) energy consumption and cost. ECOs can be studied individually or in combination with other ECOs.

> Note: After all the runs have been specified and the calculations begun, ASEAM2.1 can run unattended. Using the parametric processor, you can stack up as many as several hundred runs and leave the computer running overnight. If a printer is specified, the Building Energy Performance Standards (BEPS) report for each run will be printed. Output files will be saved on the Data disk.
>
> *Caution*: Ensure that all the output files specified will fit on the Data disk. Filling up a disk will cause ASEAM2.1 to abort.

Life-Cycle Costing: Two Life-Cycle Cost programs, developed by the National Bureau of Standards, are integrated into ASEAM2.1.

■ Output Features

Thirty-nine different calculation output reports, many of which are LOTUS-compatible, can be specified in ASEAM2.1. While the calculations are being performed, you can either display or print the calculation parameters. Input data echo reports also are provided.

■ Public Domain

The source code of ASEAM2.1 is provided. The algorithms used can be studied in detail and changed if desired. The BASIC code is structured and documented. Wherever possible, equations in the BASIC source code are referenced to outside sources such as the DOE-2 Program Manual.

■ Weather

ASEAM2.1 can use bin weather data in three formats. Data from 46 major U.S. cities' weather stations are included. You can add to or change ASEAM2.1's weather files.

1.2 How to Use This Manual

This manual is a user's manual. It is not a programmer's manual or an HVAC engineering manual. It is assumed that you have a working knowledge of the operation of your computer and a basic understanding of HVAC and building energy analysis principles. therefore, this manual does not describe how to format diskettes, copy files, or calculate U-factors.

The manual is divided into three sections: Using ASEAM2.1 (chapters 1 through 4), Reference Section (chapters 5 through 12), and the Appendix.

Using ASEAM2.1

Chapter 1, Introduction, briefly describes ASEAM2.1's features and how the program works. The organization of the manual and diskettes is described, and instructions provided concerning what to do if errors are suspected.

Chapter 2, Getting Started, describes the hardware requirements and suggests optional equipment and software for using ASEAM2.1. This chapter also explains how to make working copies of ASEAM2.1 and how to install and use ASEAM2.1 on a hard disk.

Chapter 3, Using ASEAM2.1, provides step-by-step instructions for using ASEAM2.1. You will learn how to start ASEAM2.1, select menu options, enter and edit input data, print reports, specify analysis, and run calculations. Files contained on the data diskette will be used.

Chapter 4, Modeling with ASEAM2.1, outlines a step-by-step procedure for modeling both existing and new buildings, followed by a brief discussion on zoning a building.

Reference Section

Chapter 5, Loads Input, describes the input screens and the questions for which you will supply data necessary to calculate peak and diversified zone heating and cooling loads in the building.

Chapter 6, Systems Input, describes the secondary systems simulated by ASEAM2.1 and the input screens and questions pertaining to the systems.

Chapter 7, Plant Input, describes the input questions necessary to model a building's central heating and cooling plants.

Chapter 8, ECO Input, describes how ASEAM2.1 can be used to model ECOs (Energy Conservation Opportunities). The input screens for the ECOs and a general description of their use can be found in this chapter.

Chapter 9, Quick Input, describes the features and limitations of the "quick" input program. Input screens for this program are also described.

Chapter 10, Life-Cycle Cost Programs, explains how to use two NBS Life-Cycle Cost programs (FBLCC and NBSLCC) with ASEAM2.1. These programs can be run individually (without ASEAM2.1) or as an integrated package with ASEAM2.1.

Chapter 11, Specifying Analyses, describes the various modes of performing ASEAM2.1 calculations and the input screens and questions required to specify the types of analyses and outputs you desire.

Chapter 12, Output Reports, contains samples of each of the output reports and calculation displays available.

APPENDIX

Appendix A, Weather and Solar Data, describes the file structure of ASEAM2.1's weather and solar files. You will also learn how to create new weather and solar files, and how to change the data in these files.

Appendix B, Input Screen Forms, includes copies of all input screens for ASEAM2.1 input programs.

Appendix C, Changing Input Screen Parameters, shows you how to change ASEAM2.1 input screens: what is displayed on the screen, field length, error check type and limits, default values, and help messages.

Appendix D, Changing ASEAM2.1 Source Code, describes how to make source code changes in ASEAM2.1.

Appendix E, ASEAM2.1 Files, briefly describes all files contained in ASEAM2.1. Their purpose and their relationship to other files are also described.

Appendix F, Suggested References, lists additional references that can be helpful when using ASEAM2.1.

Appendix G, Quick Input Default Files, shows you how to change the default values used by the Quick Input program.

1.3 Abbreviations and Terminology

Several abbreviations used in this manual and in the program are explained below.

1. Fx (where x represents a number from 1 to 10)

   Press the function key "x" (e.g., F5) to make ASEAM2.1 perform the listed function. Menus defining the function of these keys appear throughout the input screens and calculations.

2. ' ' (characters or numbers enclosed in single quotation marks)

   By entering the text or numbers *within* the single quotation marks, ASEAM2.1 will interpret your entry to mean the listed function. *Do not include the quotation marks in your entry.*

3. CR (Carriage Return)

   The abbreviation CR indicates that you should press the "Enter" key. You may also see this referred to as the "ENTER," "Carriage Return," or "Return" key.

4. NA (Not Applicable)

"NA" is often an appropriate response to certain input questions. If you enter NA in response to such questions, ASEAM2.1 interprets this to mean that input questions associated with and following this entry are not applicable. The NA response inhibits data entry and error checking for the associated questions.

5. Opt (Optional)

Some data entry questions are not used for calculations, but rather are for your reference only. There is no need to enter data for those items marked optional.

1.4 User's Background and Intended Audience

As stated above, the authors of this manual assume that you understand the operation of your computer as well as basic HVAC principles. A companion document is planned that will explain in more detail the algorithms used in the calculations. Technical input questions are described in detail in this manual. In the systems and plant input segments especially, default values are available by using function key F8. Using function key F9 for "help" during loads input will generally indicate the reference pages in the 1985 ASHRAE Handbook of Fundamentals or in the User's Manual.

Although ASEAM2.1 can be used by anyone interested in building energy analysis, it includes features that are particularly useful to educators, researchers, and federal energy managers. Many other fine programs are available that include automatic cost estimating and text reports for ECOs, more capabilities (e.g., number of zones, systems, and plant types modeled), less calculation time, and additional user-friendly features. The emphasis in the design of ASEAM2.1 has been to:

- show the engineering calculations;
- provide an easy means of investigating the effects of changes in input variables through the parametric processor and ECO modes of calculation;
- provide readable, structured source codes that can be changed.

1.5 ASEAM2.1 Calculation Overview

Like most building energy analysis programs, ASEAM2.1 performs calculations in four segments:

Loads: Thermal heating and cooling loads (both peak and "diversified," or average) are calculated for each zone by month and outside bin temperature. Lighting and miscellaneous electrical consumption is calculated in the loads segment.

Systems: The thermal loads calculated in the loads segment are then passed to the systems segment, which calculates "coil" loads for boilers and chillers. Note that the system coil loads are not equal to the zone loads calculated above owing to ventilation requirements, latent cooling, humidification requirements, economizer cycles, reheat, mixing, etc. Some building energy requirements are calculated in the systems segment (e.g., heat pump and fan electricity requirements).

Plant: All of the systems coil loads on the central heating and cooling plant equipment are then combined, and calculations are performed for each central plant type. Note that plant equipment can also impose loads on other plant equipment, such as cooling tower loads from chillers and boiler loads from absorption chillers or domestic hot water. The results of the plant calculations are monthly and annual energy consumption for each plant type.

Economic (optional): Energy consumption from all the building end-use categories is then totaled and reported. If specified, the life-cycle costs of the total energy requirements, combined with other parameters, are calculated and reported. Comparisons of base case with alternative cases may also be performed in the parametric and ECO calculation modes.

1.6 Steps in Using ASEAM2.1

To do a building energy analysis using ASEAM2.1, several steps are required (see chapter 4 for further details).

1. The input data necessary for modeling the building must first be collected or determined.

2. Data are entered for the loads segment, such as building component areas and U-factors, internal gains, and occupancy schedules.

3. Data are entered for the systems segment, such as system types and HVAC control setpoints.

4. Data for the plant segment, which includes data on boilers and chillers, as well as energy costs are entered.

5. Life-cycle cost (LCC) information (optional) can be entered in LCC input programs.

6. Runs to be done are defined in the Specify Analyses segment of the program.

7. The calculations are performed.

1.7 ASEAM2.1 Contents

In addition to this manual, you should have received 16 floppy diskettes that contain the ASEAM2.1 executable code, BASIC source code, and weather and solar data files. The individual files contained on each diskette are described more fully in Appendix E. Your diskettes should include:

Working Diskettes (6)

You will use primarily the four ASEAM2.1 diskettes and two life-cycle costing diskettes. Note that the program files on these diskettes are in "executable," or compiled, form.

ASEAM2.1 Input Diskette: contains the program for specifying analyses; programs for the loads, systems, and plant input segments and their input screen files.

ASEAM2.1 Calculation Diskette: contains all of the building energy analysis calculation programs (loads, systems, plant, economic).

ASEAM2.1 Supplemental Diskette: contains programs for data echo reporting, quick input, ECO input, and weather and solar input.

ASEAM2.1 Data Diskette: contains several "demo" input files and the Chicago weather files.

Life-cycle Cost Programs (executable): two diskettes that can be used either independently of ASEAM2.1 or to generate input files for integration into ASEAM2.1. The original LCC programs have been modified to provide input features similar to those in ASEAM2.1.

FBLCC Diskette: contains the Federal Building Life-Cycle Cost programs, developed by the National Bureau of Standards.

NBSLCC Diskette: contains the National Bureau of Standards Life-Cycle Cost programs, for use with private sector, or nonfederal, buildings.

ASEAM2.1 Source Code Diskettes (6)

Four of these diskettes contain the BASIC source code used to generate the executable code for the input and calculation programs. Note that ASEAM2.1 will not run in the BASIC interpreted mode. The source code files on each of these diskettes are described in Appendix E. In addition, source code diskettes are included for both LCC programs.

ASEAM2.1 Source Diskettes 1, 2, 3, and 4
FBLCC Source Diskette
NBSLCC Source Diskette

ASEAM2.1 Weather and Solar Diskettes (4)

Weather and solar files for 46 U.S. cities are included on four diskettes. Solar data files are arranged alphabetically by station name on three diskettes. Appendix A lists the stations included.

ASEAM2.1 Bin Temperature Diskette: includes bin temperature files for all 46 stations.

ASEAM2.1 Solar Data Diskette 1: includes stations alphabetically from Albuquerque through Denver.

ASEAM2.1 Solar Data Diskette 2: includes stations alphabetically from Des Moines through Nashville.

ASEAM2.1 Solar Data Diskette 3: includes stations alphabetically from New York through Washington, DC.

1.8 Errors

Every attempt has been made to provide you with "bug-free" programs. If, however, you experience errors when using ASEAM2.1, please contact: Dale R. Stanton-Hoyle, ASEAM2.1 coordinator, ACEC Research & Management Foundation, 1015 15th Street, N.W., Washington, D.C., 20005.

You can encounter three types of errors when using ASEAM2.1:

Program errors relate to how you use ASEAM2.1. For example, if you enter incorrect input data or attempt to exit a screen with incorrect or missing data, ASEAM2.1 will alert you to the error in three ways:

1. The computer will beep, indicating an error has been detected.

2. An error message will appear at the bottom of the screen for two seconds.

3. ASEAM2.1 will return to the input question with the error.

During the input programs ASEAM2.1 detects such errors as "Disk Full" and "Printer Not Ready." These errors will not cause the program to abort or result in any loss of work. See Appendix C for instructions on how to change ASEAM2.1's error-checking limits for the input screens.

During the calculations, however, only limited printer errors are "trapped" and corrected. Most typically, when a condition exists that causes ASEAM2.1 to abort, you will be given a brief message of the error number and the line number of the BASIC program where the error was detected. You must look up the error in the BASIC source code and correct it before continuing. You must, unfortunately, start over with the calculations.

Computer errors, such as damaged diskettes or hardware problems, are beyond the control of ASEAM2.1. Refer to your computer manual or DOS manual and correct the problem before proceeding.

Modeling errors may occur when you misinterpret an input question and get seemingly erroneous results from ASEAM2.1. For example, you may have entered values in "feet" instead of "inches" for exterior window shading. These are the most difficult errors to find and correct. ASEAM2.1 can only perform the energy calculations with the data you supply. Insure that all data is entered correctly before assuming errors exist in the calculation algorithms.

2 Getting Started

2 GETTING STARTED

2.1 What You Need to Get Started

Outlined below are the hardware and diskette requirements for using ASEAM2.1 and an optional list of hardware and software that will allow you to take advantage of ASEAM2.1 features.

2.1.1 Hardware Requirements

- Any IBM-PC (or compatible computer) with a minimum 256K (kilobytes) of Random Access Memory (RAM). ASEAM2.1 does not take advantage of any additional RAM your computer may have.

- Either two 360K floppy diskette drives or a hard disk and at least one 360K floppy diskette drive.

- Any monochrome or color video display terminal.

- Disk Operating System (DOS), 2.0 or higher.

2.1.2 Diskette Requirements

As outlined in Chapter 1, ASEAM2.1 consists of 16 diskettes. You should have all 16 diskettes, but, at a minimum, you will need the four working diskettes (Input, Calculations, Supplemental, and Data). Additionally, if life-cycle cost analyses are to be performed, you will need the executable (compiled) LCC diskettes (FBLCC and NBSLCC). The Data diskette provided includes files for a sample building. When you make new data diskettes for your buildings, they should also contain weather and solar data files for your locality.

2.1.3 Optional Hardware and Software

ASEAM2.1 can perform calculations with the hardware and diskette requirements outlined above, but you may find it advantageous to have the following:

- Serial or parallel printer: ASEAM2.1 does not contain codes that require a specific printer. Nor does it require a wide-carriage printer. You can run the calculations without a printer and save the output files.on the data disk for printing later.

■ Color graphics adaptor: To display the graphic calculations, it is suggested that you have an IBM color graphics adapter for your computer and a video terminal capable of displaying graphics. If your computer is not so equipped, your terminal will display only the text portion of the display and will not display the representations of HVAC system and plant equipment.

■ LOTUS 1-2-3: Many of ASEAM2.1's outputs are written in ASCII data files (.PRN extension) that can be "imported" directly into the LOTUS 1-2-3 spreadsheet without conversion.

Once in LOTUS, the data in these files can be graphed, further calculations made, and regression analyses performed on parametric input variables (only LOTUS Version 2 for regression). A spreadsheet file (AS2TEMPL.WKS) is also included in ASEAM2.1 that formats outputs by executing stored "macros." This program is recommended especially for parametric processor analyses. Note: ASEAM2.1 output files have not been tested with other spreadsheet programs which may be capable of importing the data.

■ BASIC Compiler: If changes are to be made to ASEAM2.1, you will need a BASIC compiler. ASEAM2.1 was compiled using the IBM BASIC Compiler, Version 1.0. This version is required if you will be using floppy diskettes.

Note: Although this is an older compiler that does not recognize many of the later features of DOS (e.g., subdirectories) or advanced BASIC commands, it does generate smaller executable code than later versions. The newer BASIC compilers have additional features but generate an executable program code that is too large to fit on floppy diskettes. Consequently, you would have to switch diskettes during the calculations. If you use ASEAM2.1 on a hard disk, the size of the code is generally of little concern, and you can use later version compilers. Appendix D contains information about changing the source code and compiling.

■ Hard Disk: ASEAM2.1 will operate without a hard disk, but if you are using floppy diskettes, you will be prompted to insert different diskettes as you input data, print data echo reports, and perform calculations. Besides being a convenience, the hard disk speeds up the operation of ASEAM2.1. There are, however, some limitations when using a hard disk due to the older compiler used (see above).

2.2 Making Working Copies and Backing Up

Diskettes are susceptible to damage, and therefore you should always make backup copies of original diskettes. ASEAM2.1 diskettes are no exception. Since ASEAM2.1 is in the public domain, there are no copy-protection stipulations or copyright infringements. If you run ASEAM2.1 exclusively from a hard disk, it is not necessary to make backup copies because you will use the original diskettes only once—to install ASEAM2.1.

Working Copies

The most frequently used diskettes are the three executable programs (Input, Calculations, and Supplemental) and the two executable LCC programs (FBLCC AND NBSLCC). It is imperative that you make working copies of these from the originals. Do this *now*, following these steps:

1. Format one new diskette with the operating system installed (DOS 2.0 or higher). This is required to make ASEAM2.1 automatically start on your Input diskette. See your DOS manual for instructions, if necessary.

2. Format four new diskettes *without* DOS installed (the Calculation or Supplemental program diskettes cannot be copied on a diskette with DOS installed owing to space limitations).

3. Copy the ASEAM2.1 Input diskette onto the newly formatted diskette *with* DOS installed. See your DOS manual for instructions, if necessary.

   Note: ASEAM2.1 is issued *without* the operating system installed on any diskette. Therefore, the DOS "DISKCOPY" command will not correctly install your operating system, and you will not have a diskette that automatically starts ASEAM2.1 if you use this command. It is recommended that you use the "copy *.*" command instead.

4. Copy each of the following ASEAM2.1 diskettes onto one of the newly formatted diskettes *without* the operating system:

   ASEAM2.1 Calculation diskette
   ASEAM2.1 Supplemental program diskette

5. Copy each of the following LCC diskettes onto one of the newly formatted diskettes *without* the operating system:

   FBLCC diskette
   NBSLCC diskette

6. Insure that you have correctly labeled these diskettes and put the originals in a safe place. You may also want to write-protect these disks.

Backing Up

The five working diskettes you have just made will be used in day-to-day operation of ASEAM2.1. The remaining eleven diskettes contain the BASIC source code for the ASEAM2.1 and LCC programs, weather and solar data files, and the sample data diskette you will use in Chapter 3. It is also imperative that these be backed up. You might, for example, experiment with the BASIC code, save your changes, and then not have an original copy of the source code. Follow these steps for backing up these diskettes:

1. Format 11 new diskettes *without* DOS (2.0 or higher) installed. The ASEAM2.1 diskettes you will copy onto them use most of the storage capacity of the diskettes and therefore cannot be copied on a diskette with DOS installed.

2. Copy each of the following ASEAM2.1 diskettes onto one of the newly formatted diskettes:

   Source diskettes
      Source diskettes 1, 2, 3, and 4
      FBLCC (source)
      NBSLCC (Source)
      ASEAM2.1 Data disk

Weather and Solar data files
Bin Temperature Data
Solar Data diskette 1 (Albuquerque to Denver)
Solar Data diskette 2 (Des Moines to Nashville)
Solar Data diskette 3 (New York to Washington DC)

3. Insure that you have correctly labeled these diskettes and put the originals in a safe place. You may also want to write-protect these diskettes.

4. Proceed to Section 2.4 for LCC installation.

2.3 Instructions for Hard Disk Installation

Follow these steps to install ASEAM2.1 onto your hard disk:

1. Make a new subdirectory for ASEAM2.1's working programs (e.g., "MD C:\ASEAM2.1" followed by CR).

2. Change the default directory on your hard disk to the one you just created above (e.g., "CD C:\ASEAM2.1" followed by CR).

3. Insert each of the following diskettes into your floppy disk drive (drive 'B') and type "B:HDINSTAL" followed by CR.

   ASEAM2.1 Input diskette
   ASEAM2.1 Calculation diskette
   ASEAM2.1 Supplemental Program diskette
   FBLCC (executable)
   NBSLCC (executable)

Note: All of the files on each of the floppy diskettes are not required on your hard disk. Do *not* use the "copy *.*" command to install ASEAM2.1 on your hard disk.

Note: You may want to copy the remaining diskettes (source code and weather data files) onto your hard disk. It is not required nor recommended, however. The additional storage required for these 11 diskettes of infrequently used files is very large. Nevertheless, should you wish to do so, continue with step 4; otherwise you should proceed to Section 2.4.

4. Make subdirectories for the remaining diskettes. It is recommended that you make two subdirectories, one for the source code and one for weather and solar data (e.g., "MD C:\AS2SRCE" followed by CR, and "MD C:\AS2WEATR followed by CR).
5. Insert each of the following source code diskettes into your floppy disk drive and copy them onto your hard disk (e.g., "COPY A:*.* C:\AS2SRCE" followed by CR).

   Source diskettes 1, 2, 3, and 4
   FBLCC (source)
   NBSLCC (source)

6. Insert each of the following weather data diskettes into your floppy disk drive and copy them onto your hard disk (e.g., "COPY A:*.* C:\AS2WEATR" followed by CR).

   Weather and Solar data files
      Bin temperature data
      Solar data diskette 1 (Albuquerque to Denver)
      Solar data diskette 2 (Des Moines to Nashville)
      Solar data diskette 3 (New York to Washington DC)

ASEAM2.1 is now installed on your hard disk.

2.4 Integrating LCC Calculations

ASEAM2.1 can perform Life-Cycle Cost (LCC) Calculations using either of two NBS programs - FBLCC or NBSLCC. Unfortunately, only one (but not both) of these integrated LCC subprograms can be stored on the calculation disk. If you have received original ASEAM2.1 diskettes, the FBLCC version is presently stored and used for the calculations.

To insure that the proper LCC calculation method is used, follow the steps outlined in Section 10.3.2.

3 USING ASEAM2.1

3 USING ASEAM2.1

3.0 Introduction

This chapter explains the basic requirements of running ASEAM2.1. You should read through the chapter with your computer on. Practice performing the various operations using the sample files included on the Data diskette.

3.1 Starting ASEAM2.1

Note: If you have not yet made backup copies and prepared a working copy of ASEAM2.1, do so *now* by following the instructions in chapter 2 of this manual.

Your working version of ASEAM2.1 requires four diskettes: Input, Calculations, Supplemental, and Data. In addition, if you want to perform life-cycle cost (LCC) analyses with ASEAM2.1, one of the two LCC diskettes (NBSLCC or FBLCC) is required.

To start ASEAM2.1, refer to one of the following sections depending on whether you are using floppy diskettes or a hard disk.

3.1.1 Starting ASEAM2.1 Automatically (Using Floppy Diskettes)

If you have copied your operating system onto the working copy of your ASEAM2.1 Input diskette, you can automatically begin running ASEAM2.1 by following these steps:

1. Insert the ASEAM2.1 Input diskette in drive A, and the ASEAM2.1 Data diskette in drive B.

2. Turn on your computer or perform a "soft" reboot by pressing simultaneously "Ctrl-Alt-Del."

   Note: The computer will "boot" (i.e., start up) and execute an "autoexec.bat" file. You will then see the message, Insert Data Disk in drive B.

3. Press the carriage return (CR), or Enter, key. ASEAM2.1 will then execute the Main Menu program (AS2MENU).

4. Once the program is retrieved, you should see the ASEAM2.1 Main Menu. Proceed to section 3.2.

3.1.2 Starting ASEAM2.1 from DOS (Using Floppy Diskettes)

If your computer is already on, and you want to start ASEAM2.1 from DOS without rebooting the computer (i.e., the A> prompt is on your screen) follow these steps:

1. Insert the ASEAM2.1 Input diskette in drive A, and the ASEAM2.1 Data diskette in drive B.

2. Type 'AS2MENU' and press CR. This command executes the Main Menu program (AS2MENU). Once the program is retrieved, you should see the ASEAM2.1 Main Menu. Proceed to section 3.2.

3.1.3 Starting ASEAM2.1 from a Hard Disk

If you are using a hard disk, follow these steps to start ASEAM2.1:

1. Change the default directory to the one you created and installed the working diskettes on in chapter 2. (E.g 'CD C:\ASEAM2.1', followed by CR)

2. Insert the ASEAM2.1 Data diskette in your floppy disk drive (drive B if you have two floppy disk drives).

3. Type 'AS2MENU' and press CR. This command executes the Main Menu program (AS2MENU). Once the program is retrieved, you should see the ASEAM2.1 Main Menu.

3.2 Using ASEAM2.1 Menus

If you have followed the instructions above for starting ASEAM2.1, the ASEAM2.1 Main Menu will be displayed on the screen:

ASEAM2.1 Main Menu

```
Input Data    Print Reports    Specify Analyses    Run Calcs    Exit DOS
```

3.2.1 Menu Item Selection

The ASEAM2.1 menu for each program begins with a horizontal listing of choices displayed across the screen. One of the choices is highlighted by a reverse video box (the first selection when entering a program). To access different selections, use the right and left cursor control keys (keys 4 and 6 keys on the numeric keypad) to move the highlighted area over the option you desire. To select an option, press CR, and the selected choice will either be executed or another menu will appear. Your computer will signal with a beep if you press any key other than the right or left cursor keys or CR.

Secondary menus may appear either as additional horizontal selections or as vertical "pull-down" menus under the item first selected. For example, by pressing CR when either "Input Data" or "Print Reports" is highlighted, the following pull-down menus will appear:

ASEAM2.1 Main Menu

```
 Input Data    Print Reports    Specify Analyses    Run Calcs    Exit DOS

  Loads         Loads Echo
  Systems       Systems Echo
  Plant         Plant Echo
  FBLCC         FBLCC
  NBSLCC        NBSLCC
  Quick         Weather Echo
  ECO           Misc Output
  Weather       Exit
  Exit
```

These vertical pull-down menus work exactly like the horizontal menus, except that the up and down cursor keys (instead of left and right) are used to move the highlighted selection. Press CR to select an option. Pressing any key other than these three will cause the computer to beep.

You often will see "Exit" as one of the choices on a menu. If you are in a program's horizontal menu at the top of the screen, "Exit" means to leave this program and go to another program. On a secondary menu (either horizontal or vertical), selecting "Exit" returns you to a higher level menu in ASEAM2.1.

3.2.2 ASEAM2.1 Main Menu Options

From the ASEAM2.1 Main Menu you have the following choices:

Input Data—edit or create input data files
- Loads
- Systems
- Plant
- FBLCC
- NBSLCC
- Quick
- ECO
- Weather
- Exit—returns to horizontal bar menu

Print Reports—print reports to file, screen, or printer
- Loads Echo—loads input data
- Systems Echo—systems input data
- Plant Echo—plant input data
- FBLCC—enters FBLCC program; you select report
- NBSLCC—enters NBSLCC program; you select report
- Weather Echo—bin weather and solar data
- Miscellaneous Output—peak loads and BEPS reports
- Exit—return to horizontal bar menu

Specify Analyses—choose which segments and analyses are to be done; also, specify weather data and output reports

Run Calcs—starts the calculations

Exit DOS—exit ASEAM2.1, return to the operating system

3.2.2.1 Input Data

The Input Data command from the Main Menu accesses the individual input programs for each segment. There are separate input routines for each calculation segment (Loads, Systems, Plant, and Economic), for Quick input, for ECO input, and for weather data input. To begin a particular input segment, use the up and down cursor keys to highlight the segment you want to input. Press CR.

As discussed in Section 1.5, ASEAM2.1 performs calculations in four segments. Each segment has its own input routine for entering new data and editing existing data. Note that Loads data must be entered first, followed by Systems data, and finally Plant data. Economic data can be entered either before or after the other input segments.

Loads: Enter data for building location, operating hours, thermostat setpoints, construction, infiltration, internal gains, and diversity factors. See chapter 5 for further information.

Systems: Enter data for building HVAC systems, types, modes of operation; heating, cooling, and humidification requirements; economizer cycles, reheat, etc. See chapter 6 for further information.

Plant: Enter data for building plant components, such as boilers, chillers, and cooling towers, energy costs and conversion factors, and miscellaneous energy consumption. See chapter 7 for further information.

Economic: Enter data for the economic analysis (either FBLCC or NBSLCC). See chapter 10 for further information.

Quick: Generates Loads, Systems, and Plant input files from a minimum of user-specified information. A small subset of the data values from the complete Loads, Systems, and Plant input routines is entered here. See chapter 9 for further information.

Weather: Creates temperature bin and solar data files to be used by ASEAM2.1. See Appendix A for further information.

ECO: Used to create modifications to existing Loads, Systems, or Plant data files to model ECOs. See chapter 8 for further information.

A complete ASEAM2.1 run requires only Loads, Systems, and Plant data files to have been input. The other inputs are optional.

3.2.2.2 Print Reports

After you have completed the input segments, check the data to ensure that there are no mistakes. Reports, or "data echoes," which list the input data, are available for all data files. Choose which type of data file is to be printed from the pull-down menu.

Note: The last choice on the menu, "Misc Output," cannot be used until you have created output reports by running the calculations. The peak loads and energy consumption reports are covered in Chapter 12.

3.2.2.3 Specify Analyses

Once you have a complete set of Loads, Systems, Plant, and, at your option, Economic data files, you are ready to specify the analyses. ASEAM2.1 has several calculation modes. In the Specify Analyses segment, you determine which data files and calculation modes are to be used in the calculations. See chapter 11 for further information.

Specify Analyses should <u>always</u> be immediately followed by Run Calcs. Run Calcs saves the Specify Analyses run file describing the calculation mode and the files to be used.

3.2.2.4 Running the Calculations (Run Calcs)

After the Specify Analyses segment has been completed, you are ready to begin running the calculations. Enter "Run Calcs" at this point. If you are running ASEAM2.1 from floppy disks, you will be prompted to change diskettes. See chapter 12 for further information concerning calculation reports during the execution of the calculations.

3.2.2.5 Exit DOS

This command exits from ASEAM2.1 and returns control to DOS.

3.3 ASEAM2.1 Input Conventions

3.3.1 General Information

The Loads, Systems, Plant, and Economic input segments allow you to enter data about the building, HVAC equipment, central plant equipment, and economic parameters to be simulated. It is not necessary to learn a complicated control language to enter your data. All of the input is done interactively: each screen contains a series of questions related to a particular component (e.g., walls or lighting in Loads, heating or cooling in Systems, boilers or chillers in Plant) with spaces for answers. Move the cursor to the appropriate question, and enter the data on the corresponding line.

Many of the questions are prompting; that is, you will choose your answer from a list of possible answers. If the answer is out of range or not allowed, the computer will beep, and an error message will appear briefly. Some of the questions have default answers, which you access by pressing a Function key (see section 3.3.4.2 below). If there is no default answer for a particular item, you will again hear a beep and see an error message briefly at the bottom of the screen.

3.3.2 Input Menu

To demonstrate the input features of ASEAM2.1, access the Loads input segment by highlighting "Loads" on the pull-down menu under "Input Data"; press CR.

Note: In the discussion that follows, the designation L/S/P/E refers to Loads, Systems, Plant, or Economic. Wherever you read "L/S/P/E" in this manual, you will see "Loads," "Systems," "Plant," "FBLCC," or "NBSLCC" on the screen. Data may be entered in only one segment at a time. For example, to switch between Loads and Systems data entry, you need to exit from the Loads input routine and enter the Systems input routine.

After you have marked L/S/P/E under "Input Data," the L/S/P/E Input menu will appear. Use the cursor control keys to select the operation to be performed.

ASEAM2.1 L/S/P/E INPUT

```
Get L/S/P/E File   Save L/S/P/E File   Edit L/S/P/E Data   Enter New Data   Exit
```

3.3.2.1 Get L/S/P/E File

The Get command retrieves an existing L/S/P/E data file from the data disk in drive B and loads it into memory. You must use this command before you can edit a file, since all editing works within memory and not directly from the disk.
When you select "Get L/S/P/E File," the program responds with a list of all L/S/P/E input files stored on your Data disk. Using the cursor control keys (up, down, right, left), highlight the file you want and then press CR. If the file that you want to edit is not on the list, first highlight "Exit" and press CR (to get out of "Get L/S/P/E File"); then insert the correct data disk in drive B, and try "Get L/S/P/E file" again. Once you see the file you want, mark it with the reverse video box and press CR. (Remember that to perform calculations, the Loads, Systems, Plant, and Economic data input files for the run must all be on the same disk.) The message "Retrieving Data From Disk" will appear on the screen briefly while the computer reads the file into memory. When the L/S/P/E Input Menu reappears, you are ready to "Edit L/S/P/E File."

If you use the "Get L/S/P/E File" command when data is currently in memory, a warning will be issued. Retrieving a file overwrites all data in memory with the data from the file.

3.3.2.2 Save L/S/P/E File

The Save command saves a data file so that you can use it again. This command copies the complete input data file from memory (temporary storage), where you have been editing it, to disk (permanent storage). If you do not save a file, it will be lost once you exit from the L/S/P/E input program or get a different data file. The Save command should be used each time you finish editing a file, unless you have made no changes to the file, or you have made erroneous changes and would prefer to have the previous (last saved) version of the file.

When you use the Save command, a message will be displayed asking you for the name of the file to be saved. Press CR to save the file under the same name that you previously gave to the file (the same name that you used to retrieve it). Typing a new name causes the file to be saved under that name; typing 'OOPS' aborts the Save command and returns you to the L/S/P/E Input Menu.

> *Warning:* If you enter CR for the file name, the file in memory will overwrite the file on disk. You may want to use a new file name and keep the old file as a backup.

File names may be up to eight alphanumeric characters. (Refer to your DOS manual for valid file-name characters.) Do not specify an extension or a disk drive designator ASEAM2.1 automatically assigns the following extensions to your input file:

.LID—Loads Input Data
.SID—Systems Input Data
.PID—Plant Input Data
.EID—Economic Input Data

ASEAM2.1 uses these extensions to identify file types. Therefore, the same eight-character file name can be used for Loads, Systems, and Plant data files for a building. The program will keep track of each file type by its extension.

3.3.2.3 Edit L/S/P/E Data

The Edit command allows you to review and change the contents of data files in memory. You must first "Get" a file before you can "Edit" it. When you use the Edit command, another menu that lists particular screens to edit will be displayed. You can edit either the entire data file or only one particular screen. Refer to the "Loads Input," "Systems Input," "Plant Input," and "Economic Input" chapters of this manual for further information on input screens and input questions.

Once you have selected the screens to be edited, you need to specify which zones (in the Loads segment) or systems (in the Systems segment) to edit. A list will appear on the screen. An example using the Loads segment is shown below. The Systems list is the same, but it lists system names instead of zone names.

```
Mark & Unmark Zones for Editing with CR (ESC to exit)


=>     1   South Exposure
       2   West Exposure
       3   North Exposure
       4   East Exposure
       5   Core Area - No exposures except Roof
      Edit All Zones
```

Use the up and down cursor control keys to move through the list of entries. The CR key is a toggle key; pressing CR marks (highlights) or unmarks the entry. When you have highlighted all the zones or systems to be edited, press the Escape (Esc) key. The first screen for editing will appear. The ASEAM2.1 editing function is explained in Section 3.3.4.
The information on each completed input screen is transferred into your computer's memory. After you have finished the screens that you indicated for editing, the Main L/S/P/E Menu will reappear. You can now choose to edit additional sections, save the file and begin editing another file, or exit to the Main Menu.

3.3.2.4 Enter New Data

The Enter New Data command clears the memory and allows you to begin entering a new set of data for the L/S/P/E file. All of the input screens will appear sequentially, with blank lines where you should enter values. Remember to store the file in memory before you Enter New Data. A warning message appears when data is presently in memory.

Do <u>not</u> use the Enter New Data command to continue entering additional data to an unfinished input file. If you do not complete the entire input data in one session, use the save command to store the unfinished data. Then, when you are ready to complete the input data file at a later session, use the 'Get' and 'Edit' commands to complete the data input. The Enter New Data command is used <u>only</u> when you are "starting from scratch".

3.3.2.5 Exit

The Exit command should be used when you want to leave the L/S/P/E input routine. The question "Did You Remember to Save Your Files?" will appear on the screen. If you answer 'N' and then press CR, you will be returned to the L/S/P/E input menu for another opportunity to save the file. If you answer 'Y' and press CR, a pull-down menu will appear.

Exit to Other ASEAM2.1 Programs

```
Main Menu - Specify Analyses - Run Calculations
Edit/Enter Loads Input Data
Edit/Enter Systems Input Data
Edit/Enter Plant Input Data
Edit/Enter ECO Input Data
Edit/Enter Quick Input Data
Enter Weather/Solar Data
Display/Print Loads Input Data
Display/Print System Input Data
Display/Print Plant Input Data
Display/Print Weather Data
Display/Print Miscellaneous Output Reports
Exit to All Federal Life Cycle Cost Programs
Exit to All NBS Life Cycle Cost Programs
Exit to DOS
Exit to Previous Menu
```

Note: The program you are in will not be displayed.

Main Menu: returns to the Main Menu, from which you can Specify Analyses and Run Calculations

Edit/Enter Loads, Systems, Plant, Quick, ECO, or Weather Input: accesses other Input routines

Display/Print Loads, Systems, Plant, or Weather Report: accesses report (data echo) routines

Display/Print Miscellaneous Output Reports: accesses report routines for previous calculation output reports

Exit to All Federal Life-Cycle Cost Programs: accesses FBLCC input routine, from which you can access all FBLCC programs

Exit to All NBS Life-Cycle Cost Programs: accesses NBSLCC (commercial version) input routine, from which you can access all NBSLCC programs

Exit to DOS: exit from ASEAM2.1 and return you to DOS

Exit to Previous Menu: returns to the L/S/P/E Input menu without leaving the program presently in memory

Note: If you are running ASEAM2.1 from floppy disks, you may be prompted to switch the diskettes in drive A.

3.3.3 Cautions about Memory

Memory is only temporary. The data stored in memory is destroyed when you exit any L/S/P/E input program, turn off the computer, lose power, or reboot. Only one file is held in memory at a time. Thus, if you replace the file in memory with a different file (either an existing file with "Get L/S/P/E File" or a blank file with "Enter New Data"), the file that was previously in memory will be lost. ASEAM2.1 issues a warning message whenever you use the "Get" or "Enter New Data" commands and there is existing data in memory.

To save the contents of the file in memory, you must use the "Save L/S/P/E File" command before editing other files or leaving any L/S/P/E input program. This command copies the file in memory to the data diskette in drive B, where it is stored permanently. Since the disk file is not changed until you Save, if you make mistakes or accidentally erase a lot of information while editing, you can always go back to the last-saved version of the file.

3.3.4 L/S/P/E Input Screens

This section explains how to move around, within and between input screens. The conventions are the same for editing all ASEAM2.1 screens.

Each input screen has a header stating the screen type (e.g., walls, heating, or boiler) and the file name for which the data is being entered.

The body of the screen shows a series of input questions with lines for the data input. There may be more than one column for data entry. The cursor will move only to those lines where you should input data. Cursor control is discussed in Section 3.3.4.1.

At the bottom of each input screen is a function key menu, describing the action resulting from pressing each function key. The function keys are explained in more detail in Section 3.3.4.2.

The cursor control and function key conventions are the same for all ASEAM2.1 input data screens. They apply for editing both existing and new data.

3.3.4.1 Cursor Control

There are two types of cursors in ASEAM2.1. A "smiley-face" cursor comes up on the screen at the first entry. With this cursor you can move between entries. Once you begin typing an entry, the cursor changes to a blinking underline. The cursor control keys have different functions for the two types of cursors.

Smiley-Face Cursor:

When you first enter an input screen (through either the "Edit" or the "Enter New Data" command), the screen will display a list of input questions followed either by the current values (in the case of edit) or blank lines (in the case of new data). A smiley-face cursor is in front of the first question. This cursor is used to move around the screen from one input question to another.

The following keys are used to move the smiley-face cursor:

Cursor up:	moves up to previous entry without error checking
Cursor down:	moves down to next entry without error checking
Cursor right:	moves right to next entry (down if no multiple columns) without error checking
Cursor left:	moves left to previous entry (up if no multiple columns) without error checking
PgUp:	completes error checking for entire screen. If no errors are found, moves to previous screen. If an error is found, prints an explanatory message at the bottom of the screen, beeps, and positions cursor at the incorrect entry. If current screen is the first in the editing sequence, returns to L/S/P/E Input Menu.
PgDn:	completes error checking for entire screen. If no errors are found, moves to next screen. If an error is found, prints an explanatory message at the bottom of the screen, beeps, and positions cursor at the incorrect entry. If current screen is the last in the editing sequence, returns to L/S/P/E Input Menu.
Return:	completes entry, performs error checking, moves to next entry if data is valid. If the entry is incorrect, an explanatory message is printed at the bottom of the screen, and the cursor remains at this entry.
Esc:	refreshes the screen. The data will appear as they were when you first entered the screen. Any data that were changed will be replaced with the original data.
Alt-x:	copies the data from zone or system x to the current zone or system, for this screen only.

The function keys, discussed in Section 3.3.4.2, may also be used.
Any other keystroke will be interpreted as data entry and will be written on the entry line.

Underline Cursor:

When you begin typing an entry, the cursor changes to a blinking underline. What you type is entered on the data entry line. With this cursor, you move *within* an entry, not between entries. The functions performed by the cursor control keys for the blinking underline cursor are different from those for the smiley-face cursor.

The following keys are used to move the underline cursor:

Cursor up:	completes entry, performs error checking, moves up to previous entry if answer is valid; if this is the first entry on the screen, moves to previous screen.
Cursor down:	completes entry, performs error checking, moves down to next entry if answer is valid; if this is the last entry on the screen, moves to next screen.
Return:	same as cursor down
Cursor Right:	moves cursor right to next character
Cursor left:	moves cursor left to previous character
Home:	moves to first character of entry
End:	moves to last character of entry
Delete:	deletes the character at the cursor; characters to the right of the cursor are moved to the left
Insert:	inserts characters at the cursor. The insert key is a toggle - if the insert mode is presently "on" (as indicated by a large cursor), pressing the insert key will turn it "off" and vise versa. When the insert mode is "on", characters are inserted at the cursor, and characters to the right of the cursor are moved to the right accordingly.
Backspace:	deletes the character to the left of the cursor
Ctrl-End:	deletes all characters to the right of the cursor
Escape:	clears entry

Any alphanumeric character will be entered as data.

The function keys F9 (help) and F10 (exit) can be used.

Any other keystroke will cause the computer to beep.

3.3.4.2 Function Keys

The function keys can also be used during the input sessions. When you see the blinking underline cursor, only F9 and F10 may be used. All function keys are available with the smiley-face cursor.

The function keys have the following actions:

F3: delete entry at cursor
F4: delete column at cursor (only for screens with multiple columns); all other columns move to left
F5: insert column at cursor (only for screens with multiple columns); all other columns move to the right
Warning: Data in far righthand column move off-screen and is lost.
F6: copy column at cursor (only for screens with columns); copies to column at right; if pressed again, copies further right
Warning: Data in far righthand column move off-screen and is lost.
F8: use default value (if there is one; if not, message appears)
F9: help, supplies context-specific message (if there is one)
F10: exit to L/S/P/E Input Menu

Warning: F10 exits to the input menu *without* saving changes made during this screen. Every time you PgUp or PgDn out of a screen, or move to the next screen or menu automatically, the information you input is stored in memory. But when you use F10 to return to the menu, the information from that particular screen will not be stored. If you want to save the changes you have made on an input screen, press PgDn before using the F10 key.

3.3.4.3 Error Checking

Many of the input questions have upper and/or lower numeric limits or other restrictions such as number of digits, alphanumeric strings, etc. When you enter an unacceptable value (such as a letter when a number is required), the computer will beep, and an error message will appear briefly at the bottom of the screen; the cursor will remain at that line for you to enter a new value.

You cannot exit from a screen with incorrect or missing data. If you try to do so, the cursor will be returned to the erroneous data field. You can exit from a screen using the F10 key at any time, but the data you just entered will not be saved, and the previously existing data for that screen will be kept.

The limits have been chosen with typical buildings and systems in mind, and your answers will probably fall within them. You can, however, change the limits without having to recompile the program (see Appendix C).

3.3.4.4 Default Values

Default values have been assigned for many of the input questions. To enter a default value, press the F8 key. If there is no default value, the computer will beep, and an error message will appear briefly at the bottom of the screen. The cursor will remain at the same entry if there is no default value.

Default values have been chosen with typical buildings and systems in mind. You can, however, change the default values without having to recompile the program (see Appendix C for instructions on changing the input screen parameters).

3.4 Printing Data Echo Reports

To display or print all of the data in an input file, use the Print Reports command from the ASEAM2.1 Main Menu or the Print/Display command from the Exit menu of any program. When you enter Print Reports from the Main Menu, a pull-down menu will appear on the screen (see below). Highlight the report you want to generate. The Miscellaneous Output reports can be used only after the calculations have been performed. All other reports are echoes of input data. (When you enter Print Reports from the Exit menu of any program, you will enter the Loads, Systems, Plant, Economic, or weather segment directly. See Section 3.3.2.5).

```
                    ASEAM2.1 Main Menu

 Input Data   Print Reports   Specify Analyses   Run Calcs   Exit DOS
              Loads Echo
              Systems Echo
              Plant Echo
              FBLCC
              NBSLCC
              Weather Echo
              Misc Output
              Exit
```

Note: Selecting FBLCC or NBSLCC accesses the economics input routine, from which you select reports you want to print or display.

After you choose which report is to be generated, the ASEAM2.1 L/S/P or Weather Report menu will be displayed on the screen.

```
                    ASEAM  L/S/P/W REPORT

       | Get L/S/P/W File  Print Report      Exit |
```

First, use the Get command to retrieve the file from disk. As in the input segments, a list of files on this data disk will appear on the screen. Using the cursor control keys, select the one you want and press CR. (If the file you want is not on the disk, mark exit, press CR, insert the correct data disk, and select the Get command again.) Then highlight Print Report and press CR. A second menu appears below the first:

```
                    ASEAM  LOADS REPORT

       | Get Loads File       Print Report      Exit |

                    ASEAM  OUTPUT DEVICE

       | Screen        Printer        File       Exit |
```

The data echo report may be written to the screen, to a printer, or to a file. Choose the destination and press CR. Choosing Exit returns you to the upper menu.

Screen: The data echo report will be directed to the screen. Use Control-NumLock to halt the screen to look at data; press any key to resume the display.

Printer: The data echo report will be directed to the printer. Make sure that your printer is connected to your computer and is on-line. Page skips are not included in the report.

File: The data echo report will be directed to a file on the data disk in drive B. Do not include the drive specification. You will be asked to specify a file name. Standard DOS file-naming conventions apply.

Exit: Returns to top menu.

Depending on the type of report, you may need to mark which zones (for the Loads Report) or systems (for the Systems Report) are to be used. A list of zones or systems will be shown on the screen. Mark the zones or systems to be included in the report. The CR is a toggle switch that marks (highlights) or unmarks a zone or system. Use the up and down cursor keys to move around the list. Press Escape when you have marked all the zones or systems to be included in the report. (Plant and Weather reports include all data, so this screen does not appear.)

```
Mark & Unmark Zones for Printing with CR (ESC to exit)

=>     1   South Exposure
       2   West Exposure
       3   North Exposure
       4   East Exposure
       5   Core Area - No exposures except roof
      Print All Zones
```

The data echo report will now be printed to the screen, the printer, or written to the output file. When the print or display is complete, the top part of the Loads Report menu will reappear. You may continue to select and print the reports or Exit to other programs.

3.5 Specifying Analyses

When you have a complete set of input data and weather files on the Data disk, you are ready to specify the analyses. As discussed previously, there are several modes of performing the calculations. You specify which input files, modes of calculation, and output files are to be used with the Specify Analyses command.

Select the Specify Analyses command from the ASEAM2.1 Main Menu. A series of screens will follow, depending on the types of analyses you choose. The input for these screens is discussed in detail in Chapter 11. The editing procedure for these screens is the same as for all other screens.

3.6 Run Calculations

After the analyses have been specified, you are ready to perform the calculations. Select Run Calcs from the ASEAM2.1 Main Menu. If you are running ASEAM2.1 from a two-floppy system, you will be prompted to change diskettes in drive A. You can "stack up" several sets of calculations to be done and leave the program to run unattended. Requested output will automatically be sent to the printer (if available) and stored in files for later recall.

3.7 Output Reports

Many different output reports are available. These are discussed in detail in Chapter 12.

The data disk, besides storing all the input files, is used to store the requested output files from the calculations. Therefore, it is recommended that these data disks be formatted without DOS for additional storage capability.

It is advisable to check the data disk before specifying analysis and performing the calculations. Delete any unnecessary files. A "Disk Full" error (error #61) will result during the calculations if there is insufficient storage space on the diskette. ASEAM2.1 will abort, printing error #61 occurred if this happens.

3.8 The Data Diskette

The data diskette should contain all the information needed for an analysis. The appropriate solar and weather files and all Loads, Systems, Plant, and Economic data files must be on one diskette when you run the calculations.

The data diskette issued with the program contains sample input files. It is suggested that you practice the commands discussed in previous sections.

The data disk, beside storing all the input files, is used to store the requested output files from the calculations. Therefore, it is recommended that each data disk be formatted without DOS for additional storage capability. It is advisable to check the data disk before specifying analysis and performing the calculations. Delete any unnecessary files. A "Disk Full" error (error #61) will result during the calculations if there is insufficient storage space on the diskette. ASEAM2.1 will abort, print error #61 occurred if this happens.

4 Modeling with ASEAM2.1

4 MODELING WITH ASEAM2.1

4.1 Modeling Buildings

When using any building energy analysis tool to simulate a building's energy consumption, there are several steps you must perform to complete the analysis. The steps involved depend upon whether the analysis to be performed is for new buildings (not yet built) or existing buildings.

4.1.1 Modeling New Buildings

For new buildings or those not built, several steps can be eliminated: visiting the building, collecting data, validating calculated energy consumption against actual energy bills, etc. You are also less constrained in investigating alternatives (e.g., comparing system and plant types, architectural configurations, etc.). The cost-effectiveness of the same alternatives (new versus existing buildings) may vary greatly. Not only is the installation cost lower for alternatives in new buildings (as opposed to existing buildings), but also equipment sizes and costs owing to the alternatives are reduced. If the equipment in existing buildings is not changed, alternatives with major load changes may result in oversized equipment with lower operating efficiency.

4.1.2 Modeling Existing Buildings

The steps involved in using a building energy analysis program for existing buildings are more demanding. You must survey the building to determine actual conditions. You may have to make several runs to validate predicted energy consumption against actual energy bills, and the alternatives you investigate are more constrained.

4.2 Modeling Steps

Outlined below are several steps that you may need to perform to use a building energy analysis program. The steps required will depend on the client's needs and the type of building analyzed (new or existing).

4.2.1 Step 1. Obtain Presurvey Information

Before visiting the building, you should obtain the following from your client:

1. *Architectural, Mechanical, and Electrical Blueprints*: Because you will probably mark-up the drawings, you should make copies of the most important pages: floor plans, elevations, HVAC distribution, HVAC schedules, lighting layouts, etc. There is no need to study these prints in detail at this point because there may be significant changes between the actual building and the blueprints.

You may also want to obtain a small building plan (8 1/2 x 11) for data collection while walking through the building. Your client may already have these (e.g., fire escape plans). You will need several copies, or at least one per floor.

2. *Energy Bills*: For existing buildings, ask your client to furnish recent energy bills for all utilities. Bills from the past two years should be adequate. Such factors as the addition of new equipment (e.g., computers), building additions and alterations, and changes in operating personnel (e.g., maintenance) can have a significant impact on energy usage in buildings. Energy consumption data from the bills should be used to "validate" the energy calculations. If you discover significant differences between anticipated and actual consumption, you should change the necessary input parameters to better simulate the building's energy usage (see Step 9).

3. *Name of Contact Person:* For existing buildings only, you should also obtain the names of people who are most familiar with the building's operation (e.g., maintenance foreman). Such people will be most useful because they "live" with the building and know its mechanical systems, problem areas, equipment not shown on the blueprints, and the like.

4.2.2 Step 2. Visit Building/Quick Walk-Through

After obtaining the necessary presurvey information, you should briefly visit the building, if possible. The purpose of the visit is not to perform the complete data collection, but to familiarize yourself with the building and its operation.

You should first interview your client or your client's representative to determine the building's operating schedule and learn whether there are any planned changes or alterations you should investigate. After the interview, walk through the building with the contact person to visit typical and atypical (e.g., computer rooms, kitchens, auditoriums, etc.) spaces and mechanical rooms. Make note of any changes you notice from the blueprints, and interview the contact person.

4.2.3 Step 3. Zone the Building

After the walk-through, you should "zone" the building by dividing it into smaller areas (called zones) of similar thermal and system loads. This is a very important step and is discussed in more detail in section 4.3.

4.2.4 Step 4. Detailed Walk-Through and Data Collection (Existing Buildings)

Once you have zoned the building, you are ready to begin collecting data for the simulation. If the blueprints accurately describe the building, the time you need to perform this step may be greatly reduced. You should also be familiar with the input data requirements for ASEAM2.1 for each segment (loads, systems, plant).

The input data are entered into ASEAM2.1 separately for each zone and system. It is therefore important to record the zone or system number for the data you collect. You may want to outline the different zones on the small building plans before starting this step, and then take notes on these plans.

As you walk through each area, you must look for any items that consume energy or affect the heating or cooling loads in some manner. Look for ways to save energy, and collect data for any alterations you find. Note that the alteration data also include factors that impact the alteration cost.

You should have a systematic plan to ensure complete data collection. For example, first walk around the exterior of the building to determine any security and parking lighting requirements. Next, visit several typical interior spaces to look at the type and condition of the windows, determine typical lighting type and power requirements for lighting and receptacles, and determine people density. Note any diversities you find, such as differences between average and installed capacity (e.g., overhead lighting turned off near windows, significant number of people out of the office on business or at lunchtime). You may need to ask the occupants or your contact person about typical diversity factors.

Once you have visited several typical areas, you may find a pattern emerging of similar lighting, people, and miscellaneous (receptacle) electric loads. If so, note only the exceptions on your small building plans.

After completing the data collection for typical spaces, survey areas in the building that have different characteristics. Such areas include computer rooms, kitchen areas, large conference rooms, and lobbies. The load profiles, both in terms of installed capacity and diversity factors, vary widely in these "atypical" spaces. Your contact person may be the best source of information about the diversity factors for these areas.

You may next want to visit the mechanical rooms to collect systems and plant input data. The contact person, again, should be your best source of information. It is nearly impossible, for example, to determine if a system has discriminator controls just by looking at it. Likewise, heating and cooling availability schedules, and control of outside air (ventilation) dampers, for example, are *very* important input data items that can drastically affect your energy calculations. Consult your contact person if there is any doubt.

Again, collect data not only for the base-case run but also for any energy conservation opportunities (ECOs) you want to study. If you notice any operational and maintenance (O&M) items (e.g., disconnected damper linkages or dirty coils), make note of these also. You may wish, if time and budget permit, to use instrumentation to help with your system and plant data requirements. Be forewarned, however, that measured data provide only a "snapshot" of the conditions. Measuring the boiler efficiency or fan motor power requirements for a VAV system at low load conditions, for example, may give you misleading information. The boiler may be losing steam through leaky traps or may have a much higher efficiency during the more severe heating season. You must therefore use your best judgment when using measured data.

Likewise, be forewarned that manufacturers' "nameplate" data and equipment specifications can also provide erroneous input information. If a designer calculates a VAV system needs a 32.3 horsepower fan motor, he or she may be likely to specify a much larger motor (e.g., 50 horsepower) to include a safety factor. Meanwhile, the cooling loads may have been drastically reduced through lighting modifications by your client, and so a 25 horsepower motor would be sufficient. Using the nameplate data in this case would significantly overestimate the fan energy requirements.

4.2.5 Step 5. Discuss Walk-Through Data with Client (Existing Buildings)

Having completed the data collection, discuss your findings with your client before entering any data into ASEAM2.1 for modeling. In general, you should discuss the following:

- Point out any operational and maintenance problems you found. They can have a significant impact on your energy analysis results. Because many of these items have little or no cost associated with their correction (e.g., connecting damper linkages, replacing broken windows, setting thermostats at their proper setting), your client may want you to assume the problems will be corrected for the base-case run. Note, however, that using any data for the modeling that do not reflect actual conditions will make the validation step (see Step 9) nearly impossible.

- Discuss any ECOs that you feel are appropriate. Your client may rule out some ECOs because of their expense or operational problems. Your client also may suggest a few ECOs of his or her own.

- Decide, with your client, initially what ASEAM2.1 runs are to be performed. Based on the above discussions, you and your client should have a firm understanding of what ECOs and O&M items will be studied. Time and budget constraints may make it impossible to study each ECO and O&M individually and in all possible combinations.

Warning: The number of possible runs for a given number of ECOs and O&M items grows exponentially. For example, three different ECOs can be combined in seven different ways. Assuming they are labeled A, B, and C, the following ECO combinations are possible:

A:	ECO 'A' by itself
B:	ECO 'B' by itself
C:	ECO 'C' by itself
A+B:	ECOs 'A' and 'B' in combination
A+C:	ECOs 'A' and 'C' in combination
B+C:	ECOs 'B' and 'C' in combination
A+B+C:	ECOs 'A' and 'B' and 'C' in combination

The formula for calculating these possibilities is:

NCOMB = $\cancel{2^{(NECO-1)}}$ $2^{(NECO)} - 1$

where

NCOMB = number of possible combinations

NECO = total number of ECOs and O&M items to be studied

The following table illustrates the necessity of organizing your runs:

Total Number of ECOs and O&M Items	Number of Possible Run Combinations
5	31
8	255
10	1,023
15	32,767
20	1,048,575

Note that the above table assumes that all ECOs are interactive. Many ECOs, however, are not. For example, a domestic hot water ECO would not have to be studied in all possible combinations with other ECOs because the savings would be the same.

You can suggest grouping the ECOs and O&M items that are assumed to be cost-effective into one run, labeling it "Base Case with Assumed Cost-Effective ECOs Implemented." Given your client's budget and payback criteria for implementing ECOs, you can also suggest eliminating those ECOs with higher implementation cost and marginal payback period, based on your engineering experience. You can suggest studying ECOs individually first, and eliminate those that are marginally cost-effective from any combination run performed later. This last method is recommended. However the runs are to analyzed, you and your client should agree beforehand on how and what ECOs to be investigated.

4.2.6 Step 6. Complete Input Forms

After meeting with your client, you are ready to complete the data input forms. The input forms for the loads, systems, plant, and economics input segments have been included in Appendix B. Make photocopies of these forms, and save the originals as master copies. Select those forms relevant to your analyses, and photocopy sets of them for each zone and system.

It also is useful to keep data sheets when you complete the input forms. On these you can record, for example, how the U-factor for walls and wall areas was calculated, on what blueprint page the wall construction section is found, etc.

4.2.7 Step 7. Enter Input Data into ASEAM2.1

Once the data input forms are completed, enter the base-case information into the ASEAM2.1 input programs. Since you are entering the building data for the first time. you must follow the sequence of steps outlined below. Do *not* attempt to edit previous ASEAM2.1 input files. Enter only base-case input data first; ECO inputs will be entered later, at Steps 11 and 12.

Always format a new diskette for each building you model. Do not install DOS onto the data diskette; it is not required, and it only wastes space on the diskette. The data diskette will be used to store all input files, weather files, ECO input files, life-cycle costing files (entered later), and output results. *Remember always to place the data diskette in drive B when using ASEAM2.1.*

Next, copy the required bin temperature and solar data file onto the data diskette. See Appendices A and E for a list of these files. Both a bin temperature file *and* a solar data file are required for the calculations.

Data should be entered in the following sequence:

1. Enter the Loads Input program first, and select "Enter New Data" from the main loads input menu. The screens will appear sequentially, just as they appear on the input forms.

Note: If you do not complete the loads input data entry in one sitting, be sure to *save* your work before *exiting*. When you are ready to enter additional data, use "Get Loads File" to retrieve your existing data, and then "Edit Loads Data" to continue with your data entry. Then choose the "All Data" command on the secondary bar menu, and select those zones that are not completed. Do *not* use the "Enter New Data" command, as this command erases all data in memory. These menu options are covered in more detail in Chapter 5.

2. After *all* of the loads input data has been entered and saved, enter the Systems Input program. As above, select the "Enter New Data" command from the menu bar. It is imperative that the complete loads data be entered before moving to the Systems Input program because the load zones must be assigned to systems. When using the "Enter New Data" command, you will be prompted to select the appropriate loads input file for the systems specification. ASEAM2.1 will then retrieve the number of zones and zone labels (names) from the load input file before starting any systems input questions. The note in step 1 above also applies to the systems input data entry.

3. After *all* of the systems input data has been entered and saved, you should finally enter the Plant Input program. From the main menu bar of this program, again select the "Enter New Data" command. As with the systems input program, it is imperative that systems input be completed first because the plant assignments (for the heating, cooling, preheat, coil loads) are entered on the systems input screens. When using the "Enter New Data" command, you will be prompted to select the appropriate systems input file for the plant specification. ASEAM2.1 will then retrieve the plants assigned in the systems from this system input file before proceeding with any plant input questions. The note in step 1 above also applies to the plant input data entry.

4.2.8 Step 8. Specify Base-Case Run Data and Run Calculations

Once the complete base-case input files for the loads, systems, and plant segments have been completed, you are ready to perform the first calculation. To do so, select the "Specify Analysis" command from the ASEAM2.1 Main Menu. The program will then perform a "directory" command on the data disk to determine the available input files and weather files. The "directory" command is necessary to insure that you specify valid input files for the calculations.

Once the valid file names have been determined, several input screens will appear in sequence, and here you enter configuration data and file names to be used for the calculations, as well as select output reports. The first screen in the sequence contains configuration input data (three questions). First, indicate whether a printer is available (the first question asked). Since only one set of compatible loads, systems, and plant input files should be on the data disk at this point, you will want to select "Single Run" for the calculation mode (the second question asked). Use the F8 function key and select "Enter New File" for the runfile analysis (third question asked). Enter a valid file name (e.g., 'BASECASE') to save the analysis specifications.

The second input screen is used to indicate the titles of the report and to specify the input files to be used for the calculations.

The third and fourth screens allow you to select output reports. Do not be overly ambitious when selecting the output results at this point. The Peak Loads and BEPS reports will be sufficient for the first run. See Chapter 11 for additional information about specifying analyses.

Immediately after you "Specify Analysis," you should "Run Calcs." The runtime specifications just entered will then be saved on your data disk, and you may be prompted (if using floppy diskettes) to "Insert Calculation Disk in Drive A." The calculations will then be performed. If you have a printer installed, a BEPS report (see Chapter 12) will be printed at the end of the calculations. If there is no printer available, the screen will display the BEPS report at the end of the calculations. Chapter 12 outlines how the requested calculation reports may be accessed after the calculations are performed.

4.2.9 Step 9. Validate Base Case Run (Existing Buildings)

After the first energy calculation is performed, you are ready to validate the predicted, or calculated, energy consumption against the actual energy bills, if available. In this step, you may need to change the input parameters to match the predicted and actual energy consumption more closely. This can be the most difficult and time-consuming step of all. Also, as discussed above in Step 5, if your base case input data used "assumed" cost-effective ECOs and O&M items, it may not be possible to validate the data.

Your experience with building energy analysis will help you determine which inputs should be adjusted up or down and which have a significant impact on the predicted annual consumption. Many input items can be termed "soft," and you must use assumptions when entering data for them. Examples include infiltration rates, diversity factors, ventilation rates, and equipment efficiencies. Even the "hard" inputs can be erroneous: for example, wall U-factors may be incorrect if the insulation contains moisture; you may have incorrectly calculated the wall areas; or you may have omitted a large computer's power and cooling load requirements in your modeling. The possibilities for input errors are nearly limitless.

By comparing the predicted and actual individual end-use energy consumption, you may find potential input data corrections easily. If, for example, a building's gas consumption is low, and gas is used only for heating, you need only adjust inputs that affect the heating load. If, on the other hand, predicted electricity consumption is high, you may reduce the lighting diversity factors, but you will also affect the heating load in the building. If the building uses electricity as its only energy source, your problems in finding the right input values are more severe.

Given such considerations, you should not attempt to match the energy consumption exactly. What is most valid in any building analysis are the comparative results while looking at alternatives. The predicted savings from most ECOs can be quite accurate, even though you cannot closely validate the base-case run.

When validating your base-case input data, you must change input parameters and rerun the calculations. There are two ways to perform this validation:

1. Change the suspect input data in the loads, systems, and plant input programs by editing the original file data. You may want to save the edited data with new file names. After new input data files are created, you must again "Specify Analysis" and "Run Calcs" from the ASEAM2.1 Main Menu. When the calculations are done and the new predicted consumption is determined, review the results. You may have to do this many times.

2. Use the parametric processor calculation mode to adjust the "soft" inputs, changing, for example, the infiltration rate, diversity factors, ventilation rates, and equipment efficiencies. These data items can also be investigated interactively by running "all possible combinations" of the changed variables. Once the calculations are complete, load the results into LOTUS and sort them to find which combinations of inputs give the closest match to the actual. Then adjust the input values in your base-case input files, and rerun the calculations in the "Single Run" calculation mode.

4.2.10 Step 10. Estimate ECO Costs

Having established your base-case input files through the validation step, you can begin the ECO modeling. You may first want to determine the cost for each ECO to be analyzed. Review the input data requirements for the LCC programs (see Chapter 10). The data requirements for the LCC input programs are quite complex, and you will need to obtain information from your client regarding such variables as tax rate, depreciation method, and discount rate.

If your client requires only a simple payback calculation, you can omit Step 11 below. If an LCC calculation is required, however, be prepared to explain the results.

4.2.11 Step 11. Enter ECO/LCC Input Data

To perform an LCC analysis, you need to create an LCC input file for each ECO to be analyzed. Chapter 10 discusses the LCC integration into ASEAM2.1 calculation results. If your client requires only a simple payback calculation, proceed to Step 12.

Because both the LCC input files and the ECO files need to be created before performing the integrated ECO/LCC calculations, you may choose to perform Step 12 first, before entering the LCC input data.

4.2.12 Step 12. Enter ECO Input

Your next step is to create the ECO input data files for each ECO to be investigated. There are two ways of doing this, and you can use either one or both methods.

1. Editing your original loads, systems, or plant input files to model the ECO: For more complicated ECOs (e.g., changing the system and plant types), you will have to use this method. You will use the input programs for each segment, saving each ECO with a different file name. Reread the *Warning* in Step 5 before deciding to use this method entirely.

2. Using the ECO input program discussed in Chapter 8: There are both advantages and limitations to using this program. This method is recommended wherever possible, however, and can be used in conjunction with the first method.

4.2.13 Step 13. Run ECO Calculations (Single)

As discussed in Step 5, it is recommended that you first analyze each ECO individually before performing calculations to determine the combined effects of several ECOs. By doing this, you can eliminate some ECOs from consideration before analyzing the combined ECO effects.

To do this step, you need first to create all the ECO input files using one or both of the methods described in Step 12. Then, at the ASEAM2.1 Main Menu, you should "Specify Analysis" again, and use "ECO Runs (Single)" for the calculation mode input.

Two different input screens appear in this mode. On the first screen, specify the base-case set of loads, systems, plant, and economic (if applicable) input files for the calculations. On the second input screen, which is repeated for each ECO to be analyzed, specify the ECO input file to be used. *Note*: In this mode, only *one* change is allowed—either a different input file (loads, systems, or plant) or a single ECO file created in the ECO Input Program. All other data used in the calculations will be the same as in the base-case analysis. You also will specify the type of economic analysis to be performed: none, simple payback only, or detailed LCC. If you choose the latter, you must enter the LCC input file name.

As many as 40 single ECO runs can be specified at one time. That is, based on your "specify analysis" inputs, ASEAM2.1 will calculate the base-case run first, store the results, then automatically proceed with the calculations for the first ECO case, including LCC results if specified, store the results for this analysis, automatically start the second ECO case, and so on. There is no need for you to be present during the calculations (in any mode). ASEAM2.1 will perform all analyses specified and store the results in output files. It is always advisable, however, to ensure that the first run is executed properly. You may be expecting to find volumes of output data the next morning, whereas ASEAM2.1 may abort on the first run.

> *Warning*: Input, ECO, LCC, and output files, all stored on your data disk, are used throughout ASEAM2.1. Floppy diskettes can store only a certain amount of information or number of files. Before you start calculations that may require a large amount of disk space, it is advisable to make sure there is sufficient space available on your data disk.
>
> ASEAM2.1 *never* deletes any files for you. From time to time, you must remove unnecessary files from your data disk if you expect to store more and more information on it. You can either delete or erase unneeded files, or copy files from the data diskette you are using to another storage diskette, and then delete the files from your data diskette. Both must be performed from DOS.

4.2.14 Step 14. Enter Combined ECO-LCC Input Data

Once you have performed the ECO analyses individually, analyze the results to help determine which ECO combinations should be studied. For example, if an ECO is not cost-effective by itself, it is probably not cost-effective when combined with other ECOs. You may want to establish priorities for the ECOs, run individually, from most to least cost-effective, and then discuss with your client which ECO combinations need to be analyzed. You will then need to create LCC input files for the combined ECO analyses, if an LCC analysis is to be performed. To do this, you must aggregate the individual LCC input parameters for each ECO run into one LCC input file. ASEAM2.1 cannot do this for you. For each combination ECO analysis to be performed, you must create an LCC input file that represents the combined cost input parameters for the individual ECOs.

4.2.15 Step 15. Run ECO Calculations (Combined)

Input files have already been created that model the ECO cases individually. To study the combined effects of many ECOs, it is necessary only to specify which ECO combinations you want analyzed together. There are some limitations, discussed in Chapter 8, when combining single ECOs into one run.

To perform a combined ECO analysis, you must again use the "Specify Analysis" command from the ASEAM2.1 Main Menu. Then select the "Multiple ECO Run (Combination)" calculation mode. As with the individual ECO mode, you will first select the base-case input files. The second and third input screens for each combination ECO run allow you to enter the individual ECOs that are to be combined. Up to 39 individual ECOs can be combined into one run—13 each for loads, systems, and plant type ECOs. A maximum of 20 combination runs can be specified for overnight execution. A printer is not required. The results of each ECO run, whether singularly or in combination, will be stored automatically in files on your data disk.

4.2.16 Step 16. Present Findings

The final step is to present the results of your analysis to your client. There are numerous ASEAM2.1 outputs that could be included in your report, but you must first consider your client's background. Your client may be interested only in the LCC data and find the ASEAM2.1 engineering type reports meaningless. In this case, be prepared to discuss the details of the LCC outputs with your client.

Not all ASEAM2.1 outputs are available in every calculation mode. See Chapter 11 (Specify Analysis) and Chapter 12 (Output Reports) for a discussion of available output reports and how to access and interpret them.

4.3 Zoning

As mentioned above, zoning the building is one of the most important steps in any building energy analysis program. This step *must* be performed before the data collection and data entry steps. All loads input data, except for general building data, must be entered by zone. The accuracy of the model is largely determined by how you define the thermal zones. Once you have defined the zones and entered the data into the loads input program, it is difficult to change the zoning. If you add or delete zones, the data must be collated again using the new zone definitions, and the data must be re-entered.

4.3.1 Zone Definition

A zone is an area of the building (more precisely, a volume) that is modeled as one thermal unit. It is defined to be at a uniform space temperature, and all thermal heat gains and losses are calculated on a per zone basis. Ideally, the areas served by each thermostat in the building would constitute a zone. Realistically, however, it is necessary to combine those areas in a building with similar load profiles into one zone.

The heating and cooling loads of a zone can be satisfied by only one system. (Note: baseboard heating may be added to any system and need not constitute a system in itself.) A system, on the other hand, may serve one or many zones. ASEAM2.1 can model up to 10 zones.

4.3.2 Zoning Steps

There is not one fixed, correct way to zone a building. Different definitions of the zones will result in different zone loads, equipment operating time, and energy consumption.

The zones of a building must reflect *both* architectural and systems layout. If the building is served by more than one system (not counting baseboard heaters as a separate system), the zone boundaries should reflect, first, the system boundaries and, second, the architectural layout. If the building has only one system, however, the zone boundaries should reflect the architectural layout of the building. It is usual in this case to have core and perimeter zones. Perimeter zones have exterior walls and windows, and hence the loads may be strongly driven by outdoor temperature and solar gains. The interior core zone, however, typically has relatively constant internal gains (people, lights, and equipment) and low conductive losses, since its only exterior surface may be the roof.

Because the thermal heating and cooling load profiles for the core and perimeter areas are so different, these areas should be divided into different zones. Perimeter areas often are subdivided into exposures (i.e., north, south, east, and west, or one zone per building face) because the amount of solar gain varies widely from face to face throughout the day. For example, on an afternoon with moderate (e.g., 40 degrees F) outside air temperature, an east-facing perimeter zone could require heating, and a west-facing perimeter zone could require cooling. If these two areas were combined into a single zone, the heating and cooling loads would be summed together, canceling each other to some extent, and would therefore not provide an accurate indication of the loads on the system.

The following steps may be used to zone the building:

1. Divide the building into areas served by each separate system. If the building has unitary system types (e.g., fan coil units, heat pumps, etc.), you should consider these as one system—not a separate system for each room.

2. Divide the systems areas defined above into thermostatic zones and areas with similar load profiles. Note that some central system types may have only one thermostat for a relatively large area of the building. For example, some large areas of a building may be served by a single zone system, and one duct (and discharge air temperature) serves the entire area even though the area may

have both interior and perimeter type spaces. In this case, a return air thermostat may only be used. The discharge air temperature to the entire area would be lowered if the return air temperature is high, or the discharge air temperature would be raised if the return air temperature is lower than its setpoint.

If the system is capable of controlling each space individually, you should divide the system areas (from step 1 above) into zones with similar load profiles (e.g., exposures). Such subdivisions would be appropriate only if the system has many thermostats (e.g., unitary systems), or large central systems with reheat boxes, mixing boxes (dual duct or multizone), or variable air volume boxes. If one discharge air temperature satisfies the entire area—as in the case of single zone, furnaces, or heating and ventilating units, for example—it would not be appropriate to subdivide this area into separate zones by exposure. A house, for example, has different load profiles for each exposure, but generally only one thermostat.

In subdividing system areas into zones with similar load profiles, you should consider not only exposures but also the function or use of the areas. For example, a south-facing office area would have a different load profile than a south-facing computer room, cafeteria, conference room, or entrance lobby. Because ASEAM2.1 uses diversified or average loads for occupied and unoccupied periods, the division by use or function is more important for building energy analysis programs that use hour-by-hour calculations.

Given the constraint that ASEAM2.1 can model a maximum of 10 zones, it may be necessary to combine different areas into a single zone. In this case, you must weight-average your data entries. For example, the activity of (and heat generated by) people in a gymnasium zone varies widely, and your data entry should reflect a weighted average of all the people. If you must combine office areas with storage space, corridors, and toilets, the data requirements for lighting, people, miscellaneous electrical loads, and diversity factors should also be a weighted average value for the entire zone.

Finally, you also may want to consider the ECOs in subdividing building areas into zones. If you plan to investigate several changes in one particular area of the building, it may be advantageous to make this area a unique zone. Because ECOs may only apply to certain areas, data entry can be facilitated by making these areas individual zones at the beginning rather than calculating new weighted average values (e.g., lighting) for all ECO changes.

4.4 Peak Versus Diversified Loads

ASEAM2.1 calculates both peak (design) heating and cooling loads and diversified, or average, loads during the loads calculation. A seldom-used conference room, for example, may have a large lighting and people load when occupied, and the system must be "sized" to satisfy these peak loads. On average, however, the room is generally unoccupied, and the cooling loads for lighting and people are much less than the design values.

What is most important in the prediction of annual energy use is *not* the peak loads, but the diversified, or average, loads. Peak loads are important primarily in determining the sizes of the HVAC equipment required to satisfy the worst-case heating and cooling loads. ASEAM2.1 uses "diversity factors," or average usage factors, to scale down the peak loads to the diversified or average loads.

Once ASEAM2.1 completes the loads calculations (both peak and diversified), the results are then passed to the systems calculations. Note that the systems calculations, while "autosized" based on the peak zone loads, are performed only with the "diversified" loads. The results of the systems calculations (coil loads on the boilers and chiller plants using diversified loads) then are passed to the plant calculations. *Plant loads, therefore, are based only on diversified loads—not peak loads.* Plant equipment sizes, when using the "autosizing" option, therefore are based on worst-case combinations of diversified system loads.

> *Warning:* The peak loads report from the loads calculation should be used with caution. The peak cooling and heating loads <u>DO NOT</u> include ventilation and latent cooling loads for the system. Using these peak loads to "size" the cooling and heating coils may result in drastically under-sized coils if your building has high ventilation requirements. You <u>MUST</u> manually adjust the cooling coil size to include the effects of ventilation and latent cooling. The heating coil sizes should be adjusted to include ventilation loads. Also, Do not use ASEAM2.1 to size the plant equipment. Design loads on the central heating and cooling plants may rarely be coincident with the peak loads from the loads calculations. Peak chiller loads may be driven more by high latent cooling requirements, not peak sensible loads. Boilers may experience greater humidification loads, not at lower but higher outside air temperatures when additional outside air is introduced with an economizer cycle. If the building has an extended unoccupied cycle, your peak chiller and boiler loads may not occur at 4 p.m. and 4 a.m., but rather at 7 a.m. when the systems start up to provide comfort conditions at occupancy.

When using ASEAM2.1 for estimating peak zone loads, you should always use the "installed" or maximum capacity for lighting, miscellaneous electrical, and maximum number of people in a zone, etc. If you use known system sizes (not autosizing) for the conference room in the example above, the annual energy requirements would be the same whether you used 100 people with a diversity factor of 10% *or* 10 people with a diversity factor of 100%. The peak loads, however, would be entirely different with these two methods.

5 Loads Input

5 LOADS INPUT

5.1 Introduction

The Loads Input segment of ASEAM2.1 is an interactive module that asks for all the data needed to characterize the architectural, thermal, occupancy, internal gain, and scheduling parameters of the building. Read through this chapter once quickly to get an idea of the ASEAM2.1 loads input data requirements. Blank copies of the input screens are included in Appendix B. You may want to photocopy these and use them to write down your input data before entering the program.

You can determine many of the input variables, such as wall and window types and areas, directly from blueprints. Some variables, such as U-factors, may require simple calculations. Other variables (e.g., infiltration rates) will require assumptions and judgments on your part.

ASEAM2.1 can calculate building and system loads for up to 10 zones. A zone is an area of the building (more precisely, a volume) that is modeled as one thermal unit. Zoning is discussed in greater detail in Chapter 4, section 4.3.

5.2 Entering Loads Input Data

5.2.1 Creating a New Loads Input File

To create a new loads input file, you must first access the loads input program of ASEAM2.1 from the "Exit" menu of any program or from the Main Menu. The procedure for doing this is discussed in detail in Chapter 3. Once within this program, you should choose the "Enter New Data" command from the main loads input bar menu (shown in 5.3.1).

The input screens will then appear sequentially in the order shown below. Some input screens are "conditional," that is, they will appear only if previously entered data dictate. For example, the exterior window shading screen will be accessed only if you enter a window shading model number on the input screen for windows.

Note: If you begin entering data for a building but do not complete the input process in one sitting, you should *always* save the input file, even if incomplete. Later, when you are ready to complete the data entry, use the "Get" command to retrieve this file and edit the unfinished portions. "Enter New Data" is used only when you first enter data for the building.

5.2.2 Editing an Existing Loads Input File

To modify an existing loads input file stored on the data diskette, you first need to access the loads input program and then retrieve the existing data with the "Get Loads

File" command. The procedure for doing this is discussed in detail in Chapter 3. The steps are briefly summarized below:

1. Access the loads input program from the "Exit" menu of any program or from the Main Menu.

2. Choose "Get Loads Data" from the Loads Input Menu.

3. Choose the file (on drive B) you want to edit from the list. (This will copy the loads input data from the diskette into memory.)

4. Choose "Edit Loads Data."

When editing an existing file, you have a choice of which data to edit. You may edit all data or only a particular subset.

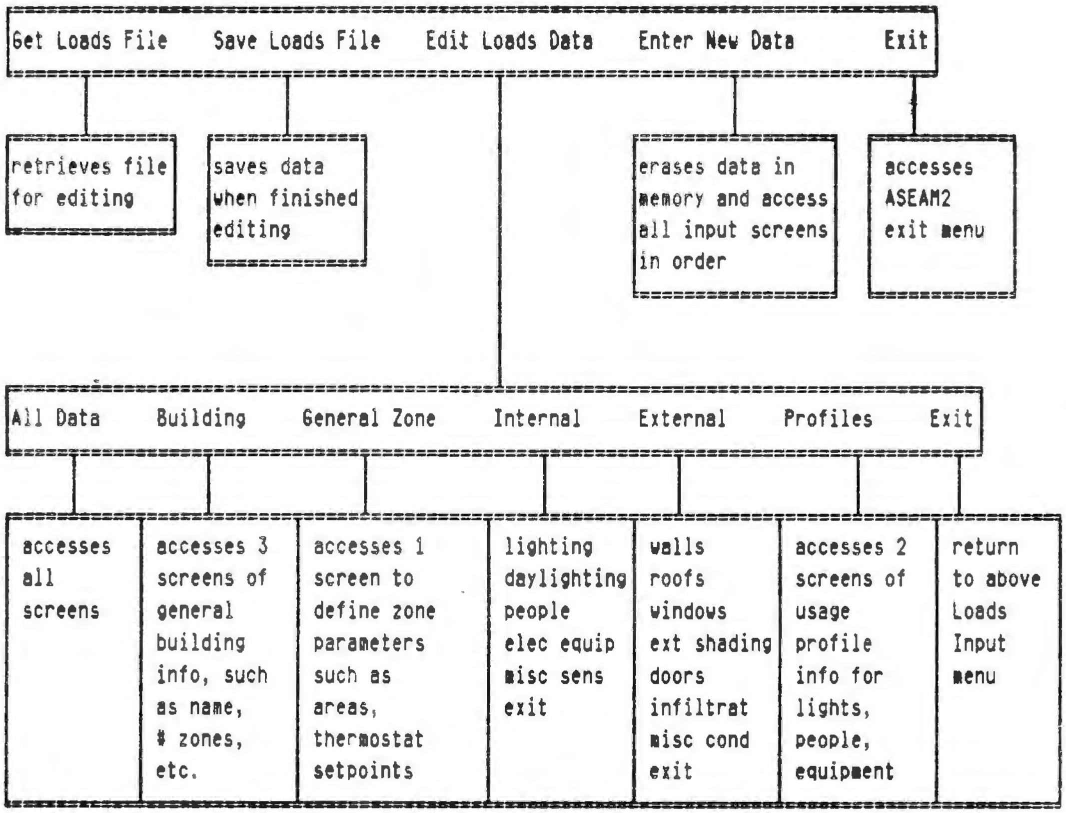
5.3 Loads Input Screen Map and Editing Sequence

After you choose "Edit Loads Data," you will be asked which input screens you want to edit. The Loads Input Screen Map in section 5.3.1 shows the arrangement of the loads input screens. There are seven different menu options. Two categories, Internal and External, are further divided into subcategories.

All Data: accesses all screens sequentially
Building: accesses three input screens for general building data
General Zone: accesses one input screen for general zone data
Internal: accesses one of five internal type load input screens
External: accesses one of seven external type load input screens
Profiles: accesses two screens for zone diversity factors
Exit: returns to the previous menu

Highlight (using the left and right cursor control keys) the category you want to edit, and then press CR to select the desired option. If you highlight "Internal" or "External," a pull-down menu will appear beneath the heading, as shown below. Once in the pull-down menu, choose the subcategory by using the up and down cursor control keys to move the reverse video box. (If you do not want to edit anything in this category, mark "Exit" at the bottom of the list, and the cursor will be returned to the main category list.) Thus, you can choose to edit any one section at a time, or all of them in succession with the "All Data" selection.

5.3.1 Loads Input Screen Map



5.3.2 General Categories

Besides the first ("All Data") and last ("Exit") options, there are five main categories of loads input data. You may edit the sections one at a time, or you may edit everything at once with the "All Data" choice. The main categories are:

1. Building: building name, location, occupancy schedule (3 screens)

2. General Zone: zone size, thermostat setpoints, zone type

3. Internal
   Lighting: light type and wattage; on this screen, you specify whether you want a daylighting analysis.
   Daylighting: geometry, reflectances, lighting levels, controls
   People: number of people and their heat generation
   Equipment: wattage of electrical equipment
   Misc Sens: amount (BTUH) of miscellaneous heat gain or loss

4. External
   Walls: wall orientation, area, U-factor, construction
   Roof: roof area, U-factor, construction
   Windows: window orientation, area, U-factor, construction

External shading: external window shading geometries
Doors: door area, U-factor, crack length
Infiltration: air change rates
Misc Cond: area, U-factor, reference temperatures for unconditioned spaces

5. Profiles: diversity factors for internal gains (2 screens)

5.3.3 Selecting Zones for Editing

After you specify one of these categories (except for the "Building" category), you will see a screen asking you to select the zones you want to edit. Each zone's label, or name, which you defined previously on the zone input screen, will be listed. An arrow points to the first zone on the list. Using the up and down cursor control keys, move the arrow until it points to the zone you want to edit, press CR, and that zone will be shown in reverse video. (CR works like a toggle switch here; if you press CR when the arrow is pointing at a marked zone, it will unmark it.) After you have marked all the zones you want to edit, press the "Escape" (ESC) key, and the screen(s) for each selected zone and category will be brought up.

If there is more than one screen for a category, the screens will appear sequentially. If there is more than one zone to edit, the screen(s) for each zone will appear one zone at a time. After you have edited all the indicated screens, you will be returned to the Loads Input Menu, where you can choose to edit additional sections or to save your file and exit this portion of the program.

5.3.4 Copying Zone Data

For any screen that appears for all zones, you can copy data from another zone to the current zone being edited by pressing Alt-'x' simultaneously, where 'x' is the zone number you want copied. The input data will then be copied from zone 'x' to the zone whose screen you are currently editing. (If 'x' is a zone that has not been defined, a screen full of blanks will be copied onto this screen.)

5.3.5 Saving Your Data

It is always wise to save your work from time to time especially if you are in an area that experiences frequent power outages. Use the F10 function key after every second or third zone to return to the Main Menu and then save your work. After saving the file, access the "Edit Loads Data" from the main loads input menu bar, and select "All Data" from the editing menu bar. You should then "select" only the unfinished zones for editing.

5.4 Loads Input Screens

If you select "Edit Loads Data" from the main loads input menu, the following screen will appear:

ASEAM2.1 LOADS INPUT

```
Get Loads File    Save Loads File    Edit Loads Data    Enter New Data    Exit
```

```
All Data    Building    Gen Zone    Internal    External    Profiles    Exit
                                    Lighting    Walls
                                    Daylighting Roofs
                                    People      Windows
                                    Elec Equip  External Shading
                                    Misc Sens   Doors
                                    Exit        Infiltration
                                                Misc Conduction
                                                Exit
```

Note: This menu is fully expanded. The pull-down menus will show on your screen if you select either Internal or External.

The following discussion focuses on the input screens and the questions that appear on each screen. Each screen is shown below, outlined by a box, as it will appear to you. Function key menus, which generally appear at the bottom of each screen, are omitted here.

The name printed above each screen is the name of the file (extension .LIS, for Load Input Screen) that contains the screen format and input parameters (i.e., help messages, error-checking limits, default values, etc.) for the screen. You can ignore this information unless you need to change these values. See Appendix C for instructions on how to change input screen parameters.

5.4.1 General Project/Building Screens

The first three input screens contain general information about the building. The location is used to refer to the latitude tables for solar heat gain factors. The number of zones that you specify here is used throughout the program. If you want to add or delete zones, you must first change the number of zones specified on this screen.

5.4.1.1 Project/Building Data

LIPROJDT

```
PROJECT/BUILDING DATA

---------------------------------------------------------------------------
Building Names & ID'S:
  Building File Name                                  ________
  Building Name                                       ________________________
  Project Number                                      ________________________

Building Location:
  Building Address                                    ________________________
                                                      ________________________
                                                      ________________________

Building Type:
  Building Type                                       ________________________

Building Areas and Zones:
  Building Gross Floor Area                           __________   ft²
  Building Net Conditioned Area                       __________   ft²
  Number of Zones                                     __
```

Building file name
For your reference only.

Building name
For your reference only.

Project number
For your reference only.

Building address
For your reference only.

Building type
For your reference only.

Building gross floor area
Enter square feet.

Building net conditioned area
Enter square feet. Enter only the total area that is conditioned.

Number of zones
Enter number 1-10. The number of zones you have defined for the building. See section 4.3 on zoning a building. The maximum number of zones ASEAM2.1 can model is 10.

5.4.1.2 Project/Building Data (Screen 2)

LIPRJ2DT

```
PROJECT DATA SCREEN 2

--------------------------------------------------------------------------------
Building Location:
  North Latitude (Use '-' for South Lat)                        ______ deg
  West Longitude (Use '-' for East Long)                        ______ deg

Operating Schedules:
  Typical weekday occupancy starting hour                       __
  Typical weekday operating hours per day                       __
    (Use only 8, 10, 12, 14, 16)

Summer thermostat schedule beginning month number               __
Summer thermostat schedule ending month number                  __

Time Zone Number                                                __
  5=Eastern    6=Central    7=Mountain    8=Pacific

Daylight Savings Time Used (Y/N)                                _
```

North latitude
: Enter decimal degrees. For example, 35 deg 30 minute north latitude is entered as 35.5. Use positive values for north latitudes and negative values for south latitudes.

West longitude
: Enter decimal degrees. Use positive values for west longitude and negative values for east longitudes.

Typical weekday occupancy starting hour
: Enter number 0-24. The number indicates the hour at which building occupancy begins on a typical weekday. Internal loads (people, lights, and equipment) are assumed to start at this hour.

Typical weekday operating hours per day
: Enter 8, 10, 12, 14, or 16 to indicate the number of hours from the starting hour that the building is occupied on a typical weekday. The number determines which cooling load factors tables are used.

Summer thermostat schedule, beginning month number
: Enter number 1-12. The number indicates the month that the summer thermostat schedule takes effect (e.g, 5 means that it starts May 1).

Summer thermostat schedule, ending month number
Enter number 1-12. The number indicates the month that the summer thermostat schedule ends (e.g., 9 means that it ends September 30).

Time zone number
Enter number 5–8. Pick the number for your time zone from the list. See Appendix A, section A.2.2, if your time zone is not listed here.

Daylight savings time
Enter 'Y' if daylight savings time is observed; otherwise enter 'N'.

5.4.1.3 Occupancy Schedules

LIOCCSDT

```
OCCUPANCY SCHEDULES

--------------------------------------------------------------------------------
    Enter the typical OCCUPIED schedule - Use military time (5:30 pm = 1730)

            Values should be in 'hundreds' of hours  - 8 am = 800

               If UNOCCUPIED for entire day - use   0  to  0

         (See Caution in User's Manual if Occupied for Entire Day)


                         Day of Week

                         Weekdays .... from  ____  to  ____
                         Saturdays ... from  ____  to  ____
                         Sundays ..... from  ____  to  ____
```

Typical occupied hours

Enter number 0 to 2400. These hours are used to determine the occupied and unoccupied time blocks for bin calculations. Unlike the hours of occupancy on the previous screen, you are not limited to even numbers of hours between 8 and 16. The hourly loads (from the loads calculations) are averaged over both the occupied and unoccupied time periods defined by these values. The HVAC system and plant calculations are performed with these averaged loads. Therefore, you may want to consider these inputs as defining the system and plant operating schedules.

Use military time (e.g., 1430 is 2:30 p.m.). Note that if the building is unoccupied for the entire day, you should use from 0 to 0. <u>INSURE THAT VALUES ARE ENTERED IN 'HUNDREDS'.</u>

Caution: You are advised *not* to use 0 to 2400 entries even if the building is occupied for the entire day. This would average the hourly loads for an entire 24-hour period, thereby eliminating the normal daytime peaks and nighttime valleys in the load profile. A better method is to enter a typical schedule here (e.g., 0600 to 1800) and specify, in systems input, that your systems operate continuously during the unoccupied cycle. With this specification, the loads on your systems and plant will follow the normal peaks and valleys of a typical load profile. Use high unoccupied diversity factors for people, lights, etc., to simulate occupancy during these times.

5.4.2 General Zones Screen

Data for the general zone input screen must be completed for each zone. The number of zones is taken from the first project/building data screen. If you wish to add (or delete) a zone, you must change the number of zones on the first project/building data screen.

5.4.2.1 Zone Screen (one per zone)

On the zone input screen, you specify the zone label (or name), size, and thermostat setpoints.

LIZONEDT

```
ASEAM  LOADS INPUT: ZONE  1 -
                                                   LOAD FILE:
-----------------------------------------------------------------------------

Zone label                          __________________________________

Zone function                                           _________
Zone area                                               _________  ft²
Zone volume                                             _________  ft3
  (or) Floor to ceiling height                          __  ft

Thermostat Set Point Temperatures
  Summer occupied temperature                           ___  °F
  Winter occupied temperature                           ___  °F
  Winter unoccupied temperature                         ___  °F
```

Zone label
: For your reference only. This label, or user-defined name, will be displayed on the screen when you select zones to edit, assign zones to systems in systems input, and on some output reports.

Zone function
: For your reference only.

Zone volume
: Enter cubic feet. You must supply either zone volume or floor-to-ceiling height, below. If you enter zone volume here, this value is used; if you do not, the volume is calculated from the zone area and floor-to-ceiling height entry, below.

Floor-to-ceiling height

Enter in feet. Not required if zone volume is specified above. Otherwise, the zone volume will be calculated as zone area times this value.

Summer occupied thermostat setpoint

Enter degrees Fahrenheit (F) to indicate the thermostat setting during the summer schedule.

Winter occupied thermostat setpoint

Enter degrees F to indicate the thermostat setting during the winter schedule and occupied times.

Winter unoccupied thermostat setpoint

Enter degrees F to indicate the thermostat setting during the winter schedule and unoccupied times. Since the unoccupied cycle thermal loads are calculated based on this assumed space temperature, use realistic values that reflect the average space temperature during the unoccupied cycle. That is, if the space temperature rarely drops below 60 degrees F at night (regardless of the thermostat) set point, you should use '60'.

5.4.3 Internal Screens

The internal screens contain input data for typical internal loads: lighting, daylighting, daylighting controls, people, infiltration, and miscellaneous sensible loads.

5.4.3.1 Lighting Screen (one per zone)

Specify the lighting input data for each zone on this screen. You can enter up to four lighting functions, that is, four different sets of lighting input. More than one lighting function may be used if you have several different types of space in one zone (e.g., office spaces, storage space, toilets, corridors, etc.). Lighting data for each space can be entered separately, using a different function column for each space.

If you are using ASEAM2.1 for daylighting analysis, you also should have a separate lighting function for each control area. (See the "Daylighting Screens" section for more information.) If you are using daylighting, there is a one-to-one correspondence between lighting function data on this screen and daylighting data entered on subsequent daylighting input screens. That is, the data from function 1 on this screen "goes with" the data for function 1 on the daylighting screens.

Lighting information is used to calculate internal heat gains and electric energy consumption produced by the lights.

On these and all other multicolumn input screens, you must enter something on the first line (function name) of each column. Entering 'NA' (not applicable) indicates that you do not want to simulate this component, and you will not be able to move the cursor down to enter data in this column. Pressing the default (F8) key will insert 'NA' on this line. Any other entry will be taken as the function name, and you will be required to enter data for the component.

LILITEDT

```
ASEAM  LOADS INPUT: ZONE  1 -
LIGHTING                                                   LOAD FILE:
-------------------------------------------------------------------------------

                                  Ltg Func 1 Ltg Func 2 Ltg Func 3 Ltg Func 4
Function name (or 'NA')           __________ __________ __________ __________
Average function area (ft²)       ________   ________   ________   ________

Installed watts/ft²               _____      _____      _____      _____
 (times) Percent of function area ___        ___        ___        ___
  (or) Total installed watts      ________   ________   ________   ________

Daylighting (Y/N)                 _          _          _          _
  Controlite filename (if appl)   ________   ________   ________   ________

Lighting system type (Opt)        __________ __________ __________ __________
Percent light heat to space (%)   ___        ___        ___        ___
'A' classification                ___        ___        ___        ___
'B' classification                _          _          _          _

          A classification - .45, .55, .65, .75  (See ASHRAE F26.19 T15)
          B classification -  A, B, C, D         (See ASHRAE F26.19 T16)
```

Function name
For your reference only. Enter 'NA' (the default value) if this function does not apply.

Average function area (ft²)
Enter square feet. Used with subsequent entries to calculate installed watts but is not used if you enter total installed watts, below.

Installed watts/ft²
Watts per square foot of lighting installed. Used with the previous question to calculate installed watts but is not used if you enter total installed watts, below.

Percent of function area
Percent of the function area, defined above, by this lighting function. Normally, if you enter actual square feet for each function area above, this value should be 100%. If the total installed wattage is not entered below, the installed lighting wattage is calculated by multiplying the function area times the installed watts per square foot times the percent of function area. You may also use the zone area as the function area (in all functions) and then enter the percent of the zone area that is corridors, office space, etc.

Total installed watts
Enter watts. Not required if installed watts per square foot, function area, and percent of function area, above, are *all* specified. If you enter a value for total installed watts, it is used instead of the calculated value.

Daylighting

Answer 'Y' if Controlite or IES method daylighting analysis is required. This calls up two screens on daylighting and controls. If the Controlite analysis is to be used, the Controlite output file must be ready for ASEAM2.1 to read. If no daylighting analysis is to be done, answer 'N'.

Controlite file name

Enter the file name for the Controlite output file (file name extension '.OUT'). This file *must* be on the data diskette.

Lighting system type (optional)

For your reference only. You can use this to indicate the type of lighting (e.g., "Rec-Fluor," "Incandescent," etc.).

Percent light heat to space

Enter percent. Remainder assumed to go to plenum (return air). Note that for system types without typical return air plenums (e.g., window air conditioners), the system load is the sum of the plenum load and the space load.

'A' classification

Enter .45, .55, .65, .75. See 1985 ASHRAE Handbook of Fundamentals, Table 15, page 26.19 (reprinted on following page).

'B' classification

Enter A, B, C, D. See 1985 ASHRAE Handbook of Fundamentals, Table 16, page 26.19 (reprinted on following page).

Table 15 Design Values of "a" Coefficient Features of Room Furnishings, Light Fixtures, and Ventilation Arrangements

a	Furnishings	Air Supply and Return	Type of Light Fixture
0.45	Heavyweight, simple furnishings, no carpet	Low rate; supply and return below ceiling ($V \leq 0.5$)[a]	Recessed, not vented
0.55	Ordinary furniture, no carpet	Medium to high ventilation rate; supply and return below ceiling or through ceiling grill and space ($V \geq 0.5$)[a]	Recessed, not vented
0.65	Ordinary furniture, with or without carpet	Medium to high ventilation rate or fan coil or induction type air-conditioning terminal unit; supply through ceiling or wall diffuser; return around light fixtures and through ceiling space. ($V \geq 0.5$)[a]	Vented
0.75 or greater	Any type of furniture	Ducted returns through light fixtures	Vented or free-hanging in air stream with ducted returns

[a] V is room air supply rate in cfm/ft² of floor area.

Table 16 The "b" Classification Values Calculated for Different Envelope Constructions and Room Air Circulation Rates

Room Envelope Construction[a] (mass of floor area, lb/ft²)	Room Air Circulation and Type of Supply and Return[b]			
	Low	Medium	High	Very High
2-in. Wood Floor (10)	B	A	A	A
3-in. Concrete Floor (40)	B	B	B	A
6-in. Concrete Floor (75)	C	C	C	B
8-in. Concrete Floor (120)	D	D	C	C
12-in. Concrete Floor (160)	D	D	D	D

[a] Floor covered with carpet and rubber pad; for a floor covered only with floor tile take next classification to the right in the same row.

[b] Low: Low ventilation rate—minimum required to cope with cooling load from lights and occupants in interior zone. Supply through floor, wall or ceiling diffuser. Ceiling space not vented and $h = 0.4$ Btu/h·ft²·F (where h = inside surface convection coefficient used in calculation of "b" classification).

Medium: Medium ventilation rate, supply through floor, wall or ceiling diffuser. Ceiling space not vented and $h = 0.6$ Btu/h·ft²·F.

High: Room air circulation induced by primary air of induction unit or by fan coil unit. Return through ceiling space and $h = 0.8$ Btu/h·ft²·F.

Very High: High room air circulation used to minimize temperature gradients in a room. Return through ceiling space and $h = 1.2$ Btu/h·ft²·F.

5.4.3.2 Daylighting Screen (one per zone)

The daylighting screen is accessed only if you indicated on the previous lighting screen that a daylighting analysis is to be performed.

On this screen you describe the characteristics of a typical room that are used to calculate the daylighting contribution to the overall lighting requirement. Daylighting saves energy only if lights that are not required can be turned down or off, so you also input the method of lighting control.

The numbers of the daylighting functions correspond to the numbers for the lighting functions on the previous screen and the numbers for the control functions on the next screen. That is, lighting function number 1 refers to the same function area and lighting system as daylighting function number 1 and daylighting control function number 1.

The daylighting algorithms used in ASEAM2.1 are those for a simplified IES method. Only side lighting from one exterior window orientation (vertical only) is considered. External shading data for windows are ignored in ASEAM2.1 daylighting calculations. Each typical room modeled may have only one window orientation. Controlite performs a much more complex analysis and can, for example, handle skylights and multiple window orientations.
Note: "Typical" room data is to be entered on the daylighting screens. The calculations simulate daylighting for a typical space, but *not* for the entire zone. The "percent of lights controlled" input question is used to apportion the "typical" room calculations over the entire zone. The limits for the dimensions for the typical space are:

	Minimum Dimension	Maximum Dimension
Room depth from window	8 ft	50 ft
Room length	8 ft	50 ft
Ceiling height	8 ft	16 ft

```
ASEAM  LOADS INPUT: ZONE  1 -
DAYLIGHTING                                                 LOAD FILE:
--------------------------------------------------------------------------------
                                  Ltg Func 1 Ltg Func 2 Ltg Func 3 Ltg Func 4
Function name (or 'NA')           ________   ________   ________   ________
Window orientation (N,NW,etc)     __         __         __         __
Ground reflectance (%)            ___        ___        ___        ___
Typical room window area (ft2)    _____      _____      _____      _____
Glass visible transmittance (%)   ___        ___        ___        ___
Room depth from window (ft)       __         __         __         __
Room length (ft)                  __         __         __         __
Ceiling height (ft)               __         __         __         __
Wall reflectance (%)              ___        ___        ___        ___

Present footcandles in space      ___        ___        ___        ___
Design footcandles for space      ___        ___        ___        ___
Sensor location                   _          _          _          _
  (1=Max   2=Mid   3=Min)

Percent of lights controlled      ___        ___        ___        ___
Control type ('D'im or 'S'tep)    _          _          _          _
```

Function name

For your reference only. The function name for the corresponding lighting function is repeated here, but you may change it if desired.

Window orientation

Enter N, NW, etc. Specify orientation with one or two letters. ASEAM2.1 can only model daylighting from one window orientation.

Ground reflectance

Enter percent. The reflectance of a surface is defined as the ratio of the amount of light (lumens) leaving a surface to the amount of light falling onto that surface. Green grass has a reflectance of about 20%. For other values, refer to the 1985 ASHRAE Handbook of Fundamentals, Table 12, page 27.9 (reprinted at the end of this section).

Typical room window area

Enter square feet. This is the total window area for a "typical" space in this zone, and *not* the total window area for the entire zone.

Glass visible transmittance

Enter percent. The visible transmittance is defined as the ratio of the amount of light that passes through the glass to the amount of light incident on it. Typical values may be found in the 1985 ASHRAE Handbook of Fundamentals, Table 30, page 27.32 (reprinted at the end of this section).

Room depth from window

Enter feet, measured perpendicular from window.

Room length

Enter feet, measured parallel to window.

Ceiling height

Enter feet.

Note: The above three dimensions (room depth from window, room length, and ceiling height) define the typical room dimensions for daylighting calculations. Interpolation routines are used to determine the coefficients of utilization ('C' and 'K' factors) based on these input values, the wall reflectance, and sensor location. Refer to 1984 IES Lighting Handbook, Reference Volume, Chapter 7, for these tables.

Wall reflectance

Enter percent. A typical value for wall reflectance is 70(%)

Present footcandles in space

Enter footcandles. Enter the lighting footcandles provided by the existing artificial lighting system. This value may be greater than the design footcandles entered below.

Design footcandles for space

Enter footcandles. Enter the lighting design requirement in footcandles for the space.

Sensor location

1=max, 2=mid, 3=min. Refers to the position of the lighting sensor (which determines how much artificial light is required to supplement the daylighting) in the room. The 'max' location is 5 feet from the window; 'min' location is 5 feet from the back wall; and the 'mid' location is centered between these two. In all cases the sensor is assumed to measure at the working plane, 30 inches above the floor and horizontal.

Percent of lights controlled

Percent of the total installed zone lighting wattage (from the previous lighting screen for each function) that uses daylighting. For example, if only 80% of the total lighting watts for this function will be available for daylighting control (the remainder may be interior corridors), enter 80(%) for this value.

Control type

Enter 'D' for Dimming (with continuous range); 'S' for Step (with up to 4 discrete step intervals). You will define the daylighting control parameters on the next screen.

Table 12 Solar Reflectances of Various Foreground Surfaces[a]

Foreground Surface	Incident Angle, deg 20	30	40	50	60	70
New Concrete	0.31	0.31	0.32	0.32	0.33	0.34
Old Concrete	0.22	0.22	0.22	0.23	0.23	0.25
Bright Green Grass	0.21	0.22	0.23	0.25	0.28	0.31
Crushed Rock	0.20	0.20	0.20	0.20	0.20	0.20
Bitumen and Gravel Roof	0.14	0.14	0.14	0.14	0.14	0.14
Bituminous Parking Lot	0.09	0.09	0.10	0.10	0.11	0.12

[a] Adapted from Ref. 10, p. 349.

Table 30 Daylight Transmittance for Various Types of Glass

Type of Glass	Visible Transmittance
1/8-in. regular sheet or float glass	0.86 to 0.91
1/8-in. gray sheet	0.31 to 0.71
3/16-in. gray sheet	0.61
7/32-in. gray sheet	0.14 to 0.56
1/4-in. gray sheet	0.52
1/4-in. green/float glass	0.75
1/4-in. gray plate glass	0.44
1/4-in. bronze plate glass	0.49
1/2-in. gray plate glass	0.21
1/2-in. bronze plate glass	0.25
Coated glasses (single, laminated, insulating)	0.07 to 0.50

5.4.3.3 Daylighting Control Screen (one per zone)

This screen appears only if you specified a daylighting analysis on the lighting screen.

The Daylighting Control screen contains information on the daylighting controls. The more daylight is available, the less artificial light is needed. Turning down the electric lighting may be performed with either step controls (discrete) or dimming (continuous) controls. In either case, both electrical energy consumption of the lights and heat gain due to the lights decrease. Again, each of the daylighting control functions entered here should correspond to the same daylighting function and lighting function. Make sure that you always enter the functions in the same order.

LIDAYCDT

```
ASEAM  LOADS INPUT: ZONE  1 -
DAYLIGHTING CONTROLS                                          LOAD FILE:
--------------------------------------------------------------------------------
                                 Ltg Func 1 Ltg Func 2 Ltg Func 3 Ltg Func 4
Function name (or 'NA')          __________ __________ __________ __________

For Dimming Control Only
  Minimum FC maintained by lights ___        ___        ___        ___
  % of total power at min FC (%)  ___        ___        ___        ___

For Stepped Control Only
  Number of Steps (max=4)         _          _          _          _
    Step 1 artificial FC          ___        ___        ___        ___
    Step 1 lighting watts         ___        ___        ___        ___
    Step 2 artificial FC          ___        ___        ___        ___
    Step 2 lighting watts         ___        ___        ___        ___
    Step 3 artificial FC          ___        ___        ___        ___
    Step 3 lighting watts         ___        ___        ___        ___
    Step 4 artificial FC          ___        ___        ___        ___
    Step 4 lighting watts         ___        ___        ___        ___
```

Function name

For your reference only. Repeat the function name for the corresponding lighting function here. You can also change it.

Minimum FC maintained by lights

Enter footcandles. This is the minimum light output, in footcandles, that is maintained with dimming controls regardless of the amount of available daylight. The power-footcandle curve is assumed to be linear between the minimum footcandle level and power required (defined below), and 100% power and design footcandle level.

Percent of total power at minimum footcandles
Enter percent. This input, for dimming control only, is the percent of the total installed artificial lighting power required to maintain the minimum footcandles entered above.

Number of steps
Enter number 1–4. This is the number of discrete steps of lighting control for stepped daylighting control.

Artificial FC
Enter footcandles. For each step defined above, proceeding from the lowest to highest footcandle level, enter the step values for the artificial footcandles and power required (below).

Lighting watts
Enter watts. For each step, above, starting with the lowest, enter the artificial lighting watts required to produce the footcandle level for that step.

Note: ASEAM2.1 will calculate the amount of artificial lighting footcandles required to meet the design footcandle level at the sensor location. It will then calculate the power required to produce this footcandle level. If dimming controls are used, a linear equation is used. If stepped controls are used, the step values are used by checking the first set of values, then the second, and so on until the required artificial footcandle first exceeds the step 'x' artificial footcandles. It is imperative, therefore, that the step functions be entered from lowest artificial footcandle-power required to the highest artificial footcandle-power required.

5.4.3.4 People Screen (one per zone)

The people screen contains information about the number of people in the zone and the amount of heat they produce. You should weight-average your data entries if the heat output per person varies.

LIPEOPDT

```
ASEAM  LOADS INPUT: ZONE  1 -
PEOPLE                                                    LOAD FILE:
-------------------------------------------------------------------------------
PEOPLE

Number of people in zone                            ____
  (or) Square feet per person                       ____
Sensible load per person                            ____   BTUH per person
Latent load per person                              ____   BTUH per person
```

Number of people in zone
: Number. Enter the number of people in the zone at full occupancy. Enter either this number or the square feet per person, below.

Square feet per person
: Number. Enter the square feet per person in the zone at full occupancy. Enter either this number or the number of people, above.

Sensible load per person
: Enter BTUH per person. See the 1985 ASHRAE Handbook of Fundamentals, Table 18, page 26.21 (reprinted on the following page).

Latent load per person
: Enter BTUH per person. See the 1985 ASHRAE Handbook of Fundamentals, Table 18, page 26.21 (reprinted on the following page).

Table 18 Rates of Heat Gain from Occupants of Conditioned Spaces[a]

Degree of Activity	Typical Application	Total Heat Adults, Male Btu/h	Total Heat Adjusted[b] Btu/h	Sensible Heat Btu/h	Latent Heat Btu/h
Seated at rest	Theater, movie	400	350	210	140
Seated, very light work writing	Offices, hotels, apts	480	420	230	190
Seated, eating	Restaurant[c]	520	580 [c]	255	325
Seated, light work, typing	Offices, hotels, apts	640	510	255	255
Standing, light work or walking slowly	Retail Store, bank	800	640	315	325
Light bench work	Factory	880	780	345	435
Walking, 3 mph, light machine work	Factory	1040	1040	345	695
Bowling[d]	Bowling alley	1200	960	345	615
Moderate dancing	Dance hall	1360	1280	405	875
Heavy work, heavy machine work, lifting	Factory	1600	1600	565	1035
Heavy work, athletics	Gymnasium	2000	1800	635	1165

[a]Note: Tabulated values are based on 78 F room dry-bulb temperature. For 80 F room dry-bulb, the total heat remains the same, but the sensible heat value should be decreased by approximately 8% and the latent heat values increased accordingly.

[b]Adjusted total heat gain is based on normal percentage of men, women and children for the application listed, with the postulate that the gain from an adult female is 85% of that for an adult male, and that the gain from a child is 75% of that for an adult male.

[c]Adjusted total heat value for eating in a restaurant, includes 60 Btu/h for food per individual (30 Btu/h sensible and 30 Btu/h latent).

[d]For bowling figure one person per alley actually bowling, and all others as sitting 400 Btu/h or standing and walking slowly 790 Btu/h.

Also refer to Tables 4 and 7, Chapter 8.
All values rounded to nearest 10 Btu/h.

5.4.3.5 Electrical Equipment Screen (one per zone)

This screen contains information on miscellaneous electrical equipment in the zone. Normally this is the electric receptacle load (e.g., personal computers, coffee machines, copiers). ASEAM2.1 will calculate both the electric KWH consumption of these loads and convert all the electric loads into space heat gains (sensible only).

LIELECDT

```
ASEAM  LOADS INPUT: ZONE  1 -
EQUIPMENT                                                   LOAD FILE:
-------------------------------------------------------------------------------
ELECTRICAL EQUIPMENT                              Type 1         Type 2

Electric equipment name (or 'NA')                 ___________    ___________

Installed watts/ft²                               ____           ____
  (times) Percent of zone area                    __             __
  (or) Total installed watts                      ______         ______

Hooded (Y/N)                                      _              _
-------------------------------------------------------------------------------

               All watts are converted to space heat gains

-------------------------------------------------------------------------------
```

Electrical equipment name
: For your reference only. Enter 'NA' (the default value) if you are not entering electrical equipment data in this column.

Installed watts/ft^2
: Enter watts per square foot. Enter the actual power requirements of the electrical equipment installed, expressed in watts per square foot. Neither this input nor the next is required if the total installed watts, entered below, is specified.

Percent of zone area
: Enter percent covered by this wattage equipment. This percentage is used with installed watts per square foot, entered above, and is not required if the total installed watts, entered below, is specified.

Total installed watts
: Enter watts. This is the total amount of installed equipment power, in watts. This value, if entered, has precedence over the installed watts per square foot and the total installed watts, entered above.

Hooded
: Enter 'Y' for Yes or 'N' for No. ASEAM2.1 determines cooling load factors for these loads from the 1985 ASHRAE Handbook of Fundamentals, Tables 22 and 23, page 26.25.

5.4.3.6 Miscellaneous Sensible Loads Screen (one per zone)

This screen contains information about miscellaneous sensible loads not covered in the previous categories of lights, people, or electrical equipment. For example, an uninsulated pipe or tank of hot or cold fluid or a gas stove would be placed in this category. Note that any electrical equipment should be listed in the electrical equipment section, so that its electrical KWH consumption is totaled. Only nonelectrical equipment should be entered on this screen.

Miscellaneous sensible loads can be either heat gains (sources) or losses (sinks). Heat gains must be entered as positive (+) numbers and heat losses as negative (-) numbers. You may use different monthly diversity factors to simulate seasonal heat gains or losses.

You may specify two different types of miscellaneous sensible loads.

LIMSENDT

```
ASEAM  LOADS INPUT: ZONE  1 -
MISCELLANEOUS SENSIBLE LOADS                                  LOAD FILE:
-------------------------------------------------------------------------
MISCELLANEOUS SENSIBLE LOADS                      Type 1         Type 2

Load source name (or 'NA')                        ____________   ____________

Installed BTUH/ft²                                ____           ____
  (times) Percent of zone area                    __             __
  (or) Total installed BTUH                       ____           ____

Hooded (Y/N)                                      _              _

Enter Heat Gains as (+) and Heat Losses as (-)
```

Load source name
: For your reference only. Enter 'NA' (default value) if you are not entering miscellaneous sensible load data in this column.

Installed BTUH/ft^2
: Enter BTUH per square foot. Enter heat gains as positive numbers and heat losses as negative numbers. This entry is used with the percent of zone area, entered below, and is not required if the total installed BTUH, also entered below, is supplied.

Percent of zone area
: Enter percent. This is used with the above entry and is not required if the total installed BTUH, entered below, is specified.

Total installed BTUH

Enter BTUH. Enter heat gains as positive and heat losses as negative numbers. Typical heat gains may be found in the 1985 ASHRAE Handbook of Fundamentals, Tables 20 and 21, pages 26.23–24 for cooking appliances.

Hooded

Enter 'Y' for Yes or 'N' for No. ASEAM2.1 determines cooling load factors for these loads from the 1985 ASHRAE Handbook of Fundamentals, Tables 22 and 23, page 26.25.

5.4.4 External Load Screens

The External Load screens are used to enter data for typical external loads: walls, roofs, windows, external shading for windows, infiltration, and miscellaneous conduction. Core, or interior, zones typically will not have any external loads, so 'NA' must be entered for names of these components.

5.4.4.1 Walls Screen (one per zone)

This screen contains information about the exterior walls of the building. It is used for calculating conductive gains and losses through the walls and the solar CLTD loads.

You may specify up to four different wall types. As in all other multicolumn screens, a name must be entered on the first row if you want to specify data for the component. Otherwise, enter 'NA' for the name.

Walls that have the same orientation, U-factor, construction group, and color correction factor, as described below, but which are not one contiguous wall, may be combined and treated as one wall. The combined wall should have an area equal to the sum of the areas of the individual walls.

LIWALLDT

```
ASEAM  LOADS INPUT: ZONE  1 -
WALLS                                                  LOAD FILE:
------------------------------------------------------------------------------
WALLS                              Wall 1     Wall 2     Wall 3     Wall 4
Name (or 'NA')                     ________   ________   ________   ________

Wall Orient (N,NE,etc)             __         __         __         __
Area (ft²)                         _____      _____      _____      _____
U-Factor (BTUH/ft²-°)              ____       ____       ____       ____

Wall Construction Group            _          _          _          _
Color Correction                   ___        ___        ___        ___

------------------------------------------------------------------------------

          Wall Construction Groups - see page F26.9 ('A' through 'G')
          Color Correction Codes     1=Dark   .83=Medium   .65=Light
```

Name
: For your reference only. Enter 'NA' (the default value) if you are not entering wall data in this column.

Wall orientation
: Enter N, NW, etc. Specify with one or two letters.

Area

Enter square feet. All walls that have the same orientation, U-factor, construction group, and color correction factor but which are not contiguous walls may be combined and treated as one wall. The area of the combined wall should be equal to the sum of the individual wall areas. *Note that this is net wall area and does not include windows or doors.*

U-factor

Enter BTUH/square foot degree F. You can calculate these values using the information in the 1985 ASHRAE Handbook of Fundamentals, Chapter 23.

Wall construction group

Enter A through G. See the 1985 ASHRAE Handbook of Fundamentals, Table 6, page 26.9. (see the "GROUP NO" reprinted on the following page). The wall construction group is used by ASEAM2.1 to refer to the correct wall CLTD factors.

Color correction

1=dark, .83=medium, .65=light. These color correction factors are found in the 1985 ASHRAE Handbook of Fundamentals, Note 2 to Table 7, page 26.10.

An actual roof construction not in this table would be thermally similar to a roof in the table, if it has similar mass, lb_m/ft^2, and similar heat capacity $Btu/ft^2 \cdot F$. In this case, use the CLTD from this table as corrected by Note (2) above.

Example: A flat roof without a suspended ceiling has mass properties = 18.0 lb/ft^2,
U = 0.20 $Btu/h \cdot ft^2 \cdot F$, and heat capacity = 9.5 $Btu/ft^2 \cdot F$. Use $CLTD_{uncorr}$ from Roof No. 13, to obtain $CLTD_{corr}$ and use the actual U value to calculate $q/A = U\ (CLTD_{corr}) = 0.20\ (CLTD_{corr})$.

(4) *Additional Insulation*

For each R-7 increase in R-value from insulation added to the roof structure, use a CLTD for a roof whose weight and heat capacity are approximately the same, but whose CLTD has a maximum value 2 h later. If this is not possible, because a roof with longest time lag has already been selected, use an effective CLTD in cooling load calculation equal to 29 deg F.

Table 6 Wall Construction Group Description

Group No.	Description of Construction	Weight (lb/ft^2)	U-Value ($Btu/h \cdot ft^2 \cdot F$)	Code Numbers of Layers (see Table 8)
4-in. Face Brick + (*Brick*)				
C	Air Space + 4-in. Face Brick	83	0.358	A0, A2, B1, A2, E0
D	4-in. Common Brick	90	0.415	A0, A2, C4, E1, E0
C	1-in. Insulation or Air Space + 4-in. Common Brick	90	0.174-0.301	A0, A2, C4, B1/B2, E1, E0
B	2-in. Insulation + 4-in. Common Brick	88	0.111	A0, A2, B3, C4, E1, E0
B	8-in. Common Brick	130	0.302	A0, A2, C9, E1, E0
A	Insulation or Air Space + 8-in. Common brick	130	0.154-0.243	A0, A2, C9, B1/B2, E1, E0
4-in. Face Brick + (*H. W. Concrete*)				
C	Air Space + 2-in. Concrete	94	0.350	A0, A2, B1, C5, E1, E0
B	2-in. Insulation + 4-in. Concrete	97	0.116	A0, A2, B3, C5, E1, E0
A	Air Space or Insulation + 8-in. or more Concrete	143-190	0.110-0.112	A0, A2, B1, C10/11, E1, E0
4-in. Face Brick + (*L. W. or H. W. Concrete Block*)				
E	4-in. Block	62	0.319	A0, A2, C2, E1, E0
D	Air Space or Insulation + 4-in. Block	62	0.153-0.246	A0, A2, C2, B1/B2, E1, E0
D	8-in. Block	70	0.274	A0, A2, C7, A6, E0
C	Air Space or 1-in. Insulation + 6-in. or 8-in. Block	73-89	0.221-0.275	A0, A2, B1, C7/C8, E1, E0
B	2-in. Insulation + 8-in. Block	89	0.096-0.107	A0, A2, B3, C7/C8, E1, E0
4-in. Face Brick + (*Clay Tile*)				
D	4-in. Tile	71	0.381	A0, A2, C1, E1, E0
D	Air Space + 4-in. Tile	71	0.281	A0, A2, C1, B1, E1, E0
C	Insulation + 4-in. Tile	71	0.169	A0, A2, C1, B2, E1, E0
C	8-in. Tile	96	0.275	A0, A2, C6, E1, E0
B	Air Space or 1-in. Insulation + 8-in. Tile	96	0.142-0.221	A0, A2, C6, B1/B2, E1, E0
A	2-in. Insulation + 8-in. Tile	97	0.097	A0, A2, B3, C6, E1, E0
H.W. Concrete Wall + (*Finish*)				
E	4-in. Concrete	63	0.585	A0, A1, C5, E1, E0
D	4-in. Concrete + 1-in. or 2-in. Insulation	63	0.119-0.200	A0, A1, C5, B2/B3, E1, E0
C	2-in. Insulation + 4-in. Concrete	63	0.119	A0, A1, B6, C5, E1, E0
C	8-in. Concrete	109	0.490	A0, A1, C10, E1, E0
B	8-in. Concrete + 1-in. or 2-in. Insulation	110	0.115-0.187	A0, A1, C10, B5/B6, E1, E0
A	2-in. Insulation + 8-in. Concrete	110	0.115	A0, A1, B3, C10, E1, E0
B	12-in. Concrete	156	0.421	A0, A1, C11, E1, E0
A	12-in. Concrete + Insulation	156	0.113	A0, C11, B6, A6, E0
L. W. and H.W. Concrete Block + (*Finish*)				
F	4-in. Block + Air Space/Insulation	29	0.161-0.263	A0, A1, C2, B1/B2, E1, E0
E	2-in. Insulation + 4-in. Block	29-37	0.105-0.114	A0, A1, B3, C2/C3, E1, E0
E	8-in. Block	47-51	0.294-0.402	A0, A1, C7/C8, E1, E0
D	8-in. Block + Air Space/Insulation	41-57	0.149-0.173	A0, A1, C7/C8, B1/B2, E1, E0
Clay Tile + (*Finish*)				
F	4-in. Tile	39	0.419	A0, A1, C1, E1, E0
F	4-in. Tile + Air Space	39	0.303	A0, A1, C1, B1, E1, E0
E	4-in. Tile + 1-in. Insulation	39	0.175	A0, A1, C1, B2, E1, E0
D	2-in. Insulation + 4-in. Tile	40	0.110	A0, A1, B3, C1, E1, E0
D	8-in. Tile	63	0.296	A0, A1, C6, B1/B2, E1, E0
C	8-in. Tile + Air Space/1-in. Insulation	63	0.151-0.231	A0, A1, C6, B1/B2, E1, E0
B	2-in. Insulation + 8-in. Tile	63	0.099	A0, A1, B3, C6, E1, E0
Metal Curtain Wall				
G	With/without air Space + 1-in./ 2-in. 3-in. Insulation	5-6	0.091-0.230	A0, A3, B5/B6/B12, A3, E0
Frame Wall				
G	1-in. to 3-in. Insulation	16	0.081-0.178	A0, A1, B1, B2/B3/B4, E1, E0

5.4.4.2 Roofs Screen (one per zone)

This section contains information about the external roofs of the building. It is assumed that the roof is horizontal and flat, as is typical of commercial buildings. Because the ASHRAE CLTD tables apply only to horizontal flat roofs, ASEAM2.1 cannot model a tilted roof. Based on the information supplied here, heat gains and losses, including the effects of solar radiation, are calculated.

LIROOFDT

```
ASEAM LOADS INPUT: ZONE  1 -
ROOFS                                                        LOAD FILE:
-------------------------------------------------------------------------------
ROOFS                              Roof 1     Roof 2
Name (or 'NA')                     __________ __________

Area (ft²)                         ______     ______
U-Factor (BTUH/ft²-°)              _____      _____

Roof Construction Code             __         __
Color Correction                   ___        ___

Susp Ceil Plenum (Y/N)             _          _

-------------------------------------------------------------------------------
      Roof Construction Codes  see ASHRAE T26.8, T5
      Color Correction Codes    1 = Dark Colored or in an industrial area
                               .5 = permanently light colored or in rural area
```

Name
: For your reference only. Enter 'NA' (default value) if you are not entering roof data in this column.

Area
: Enter square feet.

U-factor
: Enter BTUH/square foot degree F. Consult the 1985 ASHRAE Handbook of Fundamentals, Chapter 23, if necessary.

Roof construction code
: Enter number 1−13. This number describes the roof construction type. See the 1985 ASHRAE Handbook of Fundamentals, Table 5, page 26.8 (reprinted below).

Color correction

1=dark, industrial area; 0.5=light, rural area. See the 1985 ASHRAE Handbook of Fundamentals, Note 2b to Table 5, page 26.8.

Suspended ceiling plenum

Enter 'Y' for Yes, 'N' for No.

1985 Fundamentals Handbook

Table 5 Cooling Load Temperature Differences for Calculating Cooling Load from Flat Roofs

Roof No	Description of Construction	Weight lb/ft²	U-value Btu/(h · ft² · F)
1	Steel sheet with 1-in. (or 2-in.) insulation	7 (8)	0.213 (0.124)
2	1-in. wood with 1-in. insulation	8	0.170
3	4-in. l.w concrete	18	0.213
4	2-in. h.w. concrete with 1-in. (or 2-in.) insulation	29	0.206 (0.122)
5	1-in. wood with 2-in. insulation	9	0.109
6	6-in. l.w. concrete	24	0.158
7	2.5-in. wood with 1-in. insulation	13	0.130
8	8-in. l.w. concrete	31	0.126
9	4-in. h.w. concrete with 1-in. (or 2-in.) insulation	52 (52)	0.200 (0.120)
10	2.5-in. wood with 2-in. insulation	13	0.093
11	Roof terrace system	75	0.106
12	6-in. h.w. concrete with 1-in. (or 2-in.) insulation	(75) 75	0.192 (0.117)
13	4-in. wood with 1-in. (or 2-in) insulation	17 (18)	0.106 (0.078)

(1) ***Direct Application of Table 5 Without Adjustments:***

Values in Table 5 were calculated using the following conditions:

- Dark flat surface roof ("dark" for solar radiation absorption)
- Indoor temperature of 78 F
- Outdoor maximum temperature of 95 F with outdoor mean temperature of 85 F and an outdoor daily range of 21 deg F
- Solar radiation typical of 40 deg North latitude on July 21
- Outside surface resistance, R_o = 0.333 ft² • F • h/Btu
- Without and with suspended ceiling, but no attic fans or return air ducts in suspended ceiling space
- Inside surface resistance, R_i = 0.685 ft² • F • h/Btu

(2) ***Adjustments to Table 5 Values:***

The following equation makes adjustments for deviations of design and solar conditions from those listed in (1) above.

$$CLTD_{corr} = [(CLTD + LM) \cdot K + (78 - T_R) + (T_o - 85)] \cdot f$$

where CLTD is from this table

(a) LM is latitude-month correction from Table 9 for a horizontal surface,

(b) K is a color adjustment factor applied after first making month-latitude adjustments. Credit should not be taken for a light-colored roof except where permanence of light color is established by experience, as in rural areas or where there is little smoke

K = 1.0 if dark colored or light in an industrial area

K = 0.5 if permanently light-colored (rural area)

(c) $(78 - T_R)$ is indoor design temperature correction

(d) $(T_o - 85)$ is outdoor design temperature correction, where T_o is the average outside temperature on design day

(e) f is a factor for attic fan and or ducts above ceiling applied after all other adjustments have been made

f = 1.0 no attic or ducts

f = 0.75 positive ventilation

Values in Table 5 were calculated without and with a suspended ceiling, but made no allowances for positive ventilation or return ducts thru the space. If ceiling is insulated and a fan is used between ceiling and roof, CLTD may be reduced by 25% (f = 0.75). Use of the suspended ceiling space for a return air plenum or with return air ducts should be analyzed separately.

(3) ***Roof Constructions Not Listed in Table:***

The U-Values listed are to be used only as guides. The actual value of U as obtained from tables such as Tables 3 and 4, Chapter 23 or as calculated for the actual roof construction should be used.

5.4.4.3 Windows Screen (one per zone)

The windows screen contains information that will be used to calculate solar gains and conductive gains and losses through windows. Infiltration for windows is calculated using the crack length method.

You can input as many as four different window types. If several windows have the same characteristics, they may be modeled together as one large window. In this case, the area must be the sum of all the individual areas, and the crack length the sum of all the individual crack lengths.

Important: On this screen, specify whether a window has external shading by entering a "model number." Unlike other zone screens, however, window shading details for each model number apply to the entire building; they are not zone specific. Thus, if you enter a window shading model number of '1', for example, the data entered for shading model '1' apply to windows *in all zones*. Therefore, windows in zones 2, 3, 4, etc. can *all* refer to model #1 without having to re-enter the same window geometry for each zone. However, if you change the geometry entries in model #1, you have also changed the values for all zones. There is only one window shading geometry screen, but it applies to *all* zones. You may have up to three different window shading geometries for the entire building.

LIWNDODT

ASEAM LOADS INPUT: ZONE 1 - WINDOWS — LOAD FILE:

WINDOWS	Window 1	Window 2	Window 3	Window 4
Name (or 'NA')	________	________	________	________
Window orient (N,NE,etc)	__	__	__	__
Fenestration area (ft^2)	_____	_____	_____	_____
Shading coefficient	___	___	___	___
U-Factor (BTUH/ft^2-^{o})	___	___	___	___
Space mass code (1=light 2=medium 3=heavy)	_	_	_	_
Crack length (lin ft)	_____	_____	_____	_____
Leakage coefficient	__	__	__	__
INPUTS REQUIRED FOR SHADING				
Window shading model # 0=None OR 1,2, or 3	_	_	_	_
Percent window area	___	___	___	___

Name

For your reference only. Enter 'NA' (default value) if you are not entering window data in this column.

Window orientation

Enter N, NW, etc.

Fenestration area

Enter square feet. Enter the total window area, in square feet, regardless of whether exterior window shading is used or not. The "percent window area" entry below determines the amount of the total window area that has exterior shading.

Shading coefficient

Enter number 0 or 1. The shading coefficient is defined as the ratio of the solar heat gain of fenestration to the solar heat gain of reference glass. Values for a range of commonly used glasses are reprinted at the end of this section from the 1985 ASHRAE Handbook of Fundamentals, Table 29, page 27.29; if the building has internal shades or blinds, refer to ASHRAE Tables 23–39, pages 27.34–37.

ASEAM2.1 assumes that the shading coefficient is the same for every hour of the year (i.e., movable insulation or shading is not explicitly modeled).

U-factor

Enter BTUH/square foot degrees F. See the 1985 ASHRAE Handbook of Fundamentals, Table 13, page 27.10, if necessary (reprinted at the end of this section).

Space mass code

1=light: frame exterior wall, 2" concrete floor slab (30 pounds per square foot)
2=medium: 4" concrete exterior wall, 4" concrete floor slab (70 pounds per square foot)
3=heavy: 6" concrete exterior wall, 6" concrete floor slab (130 pounds per square foot)

Consult the 1985 ASHRAE Handbook of Fundamentals, Table 13, page 26.17, if additional information is needed (reprinted at the end of this section).

Crack length

Linear feet. This is the total perimeter crack length for all windows, not a typical window.

Leakage coefficient

1=tight-fitting window. Approximately 1/64-inch crack (weatherstripped).
2=average-fitting window. Approximately 1/64-inch crack (nonweatherstripped) or 3/32 inch crack (weatherstripped).
6=loose-fitting window. Approximately 3/32-inch crack (nonweatherstripped).

See the table printed at the end of this section.

Window shading model

Enter number 0–3. This number corresponds to the number of the window shading model to be used. '0' indicates no external window shading. Up to three different external shading models may be specified for the entire building. *They are not zone specific.* Configurations of the shading models are specified on the following screen.

Percent window area

Enter percent. This is the percent of the total window area specified above that is shaded by the specified shading model. For example, if you have five 3 by 5 foot windows, three of which are shaded by overhangs, the total window area is 75 square feet, and the percent window area shaded is 45 square feet, or 60%.

Shading Coefficients for Single Glass and Insulating Glass[a]

Type of Glass	Nominal Thickness[b]	Solar Trans.[b]	Shading Coefficient h_o=4.0	Shading Coefficient h_o=3.0
A. Single Glass				
Clear	1/8 in.	0.86	1.00	1.00
	1/4 in.	0.78	0.94	0.95
	3/8 in.	0.72	0.90	0.92
	1/2 in.	0.67	0.87	0.88
Heat Absorbing	1/8 in.	0.64	0.83	0.85
	1/4 in.	0.46	0.69	0.73
	3/8 in.	0.33	0.60	0.64
	1/2 in.	0.24	0.53	0.58
B. Insulating Glass				
Clear Out, Clear In	1/8 in.[c]	0.71[e]	0.88	0.88
Clear Out, Clear In	1/4 in.	0.61	0.81	0.82
Heat Absorbing[d] Out, Clear In	1/4 in.	0.36	0.55	0.58

[a] Refers to factory-fabricated units with 3/16, 1/4 or 1/2-in. air space or to prime windows plus storm sash.
[b] Refer to manufacturer's literature for values.
[c] Thickness of each pane of glass, not thickness of assembled unit.
[d] Refers to gray, bronze and green tinted heat-absorbing float glass.
[e] Combined transmittance for assembled unit.

Window Classification

	Wood Double-Hung (Locked)	Other Types
Tight Fitting Window k = 1.0	Weatherstripped Average Gap (1/64 in crack)	Wood Casement and Awning Windows; Weatherstripped Metal Casement Windows; Weatherstripped
Average Fitting Window k = 2.0	Non-Weatherstripped Average Gap (1/64 in. crack) or Weatherstripped Large Gap (3/32 in. crack)	All Types of Vertical and Horizontal Sliding Windows; Weatherstripped. Note: if average gap (1/64 in. crack) this could be tight fitting window Metal Casement Windows; Non-Weatherstripped Note: if large gap (3/32 in. crack) this could be a loose fitting window
Loose Fitting Window k = 6.0	Non-Weatherstripped Large Gap (3/32 in. crack)	Vertical and Horizontal Sliding Windows; Non-Weatherstripped

Table 13 Overall Coefficients of Heat Transmission (*U*-Factor) of Windows, Sliding Patio Doors, and Skylights for Use in Peak Load Determination and Mechanical Equipment Sizing Only and Not in Any Analysis of Annual Energy Usage, Btu/h·ft²·F

Part A. Exterior[a] Vertical Panels

	No Storm Sash				Glass Outdoor Storm Sash 1-in. Air Space[b] Added to Described Product			
	No Shade		Indoor Shade		No Shade		Indoor Shade	
	Winter*	Summer**	Winter*	Summer**	Winter*	Summer**	Winter*	Summer**
Flat Glass[c]								
Single Glass, Clear	1.10	1.04	0.83	0.81	0.50	0.50	0.44	0.49
Single Glass, Low Emittance Coating[d]								
$\epsilon = 0.60$	1.02	1.00	0.76	0.80	0.47	0.60	0.39	0.55
$\epsilon = 0.40$	0.91	0.90	0.68	0.70	0.44	0.60	0.37	0.55
$\epsilon = 0.20$	0.79	0.75	0.59	0.55	0.40	0.50	0.33	0.45
Insulating Glass, Double[e]								
3/16-in. air space[f]	0.62	0.65	0.52	0.58	0.37	0.40	0.29	0.37
1/4-in. air space[f]	0.58	0.61	0.48	0.55	0.35	0.39	0.28	0.36
1/2-in. air space[g]	0.49	0.56	0.42	0.52	0.32	0.39	0.25	0.37
1/2-in. air space low emittance coating[h]								
$\epsilon = 0.60$	0.43	0.53	0.38	0.49	0.41	0.30	0.24	0.37
$\epsilon = 0.40$	0.38	0.47	0.36	0.43	0.27	0.39	0.22	0.35
$\epsilon = 0.20$	0.32	0.39	0.30	0.36	0.24	0.33	0.20	0.30
Insulating Glass, Triple[e]								
1/4-in. air space[f]	0.39	0.44	0.31	0.40	0.27	0.32	0.22	0.30
1/2-in. air space[i]	0.31	0.39	0.26	0.36	0.23	0.31	0.19	0.29

	Glass Indoor Storm Sash 1-in. Air Space[b] Added to Described Product				Acrylic Indoor Storm Sash 1-in. Air Space[b] Added to Described Product			
	No Shade		Indoor Shade		No Shade		Indoor Shade	
	Winter*	Summer**	Winter*	Summer**	Winter*	Summer**	Winter*	Summer**
Flat Glass[c]								
Single Glass, Clear	0.50	0.50	0.44	0.49	0.48	0.48	0.42	0.47
Single Glass, Low Emittance Coating[d]								
$\epsilon = 0.60$	0.47	0.50	0.39	0.45	0.45	0.50	0.38	0.45
$\epsilon = 0.40$	0.42	0.45	0.36	0.40	0.41	0.45	0.35	0.40
$\epsilon = 0.20$	0.37	0.35	0.32	0.30	0.36	0.35	0.31	0.30
Insulating Glass, Double[e]								
3/16-in. air space[f]	0.37	0.40	0.29	0.36	0.35	0.39	0.28	0.35
1/4-in. air space[f]	0.35	0.39	0.28	0.36	0.34	0.38	0.27	0.34
1/2-in. air space[g]	0.31	0.38	0.25	0.35	0.30	0.37	0.24	0.33
1/2-in. air space, Low emittance coating[h]								
$\epsilon = 0.60$	0.29	0.37	0.24	0.33	0.28	0.35	0.23	0.31
$\epsilon = 0.40$	0.27	0.33	0.22	0.30	0.26	0.32	0.22	0.29
$\epsilon = 0.20$	0.25	0.29	0.20	0.26	0.24	0.28	0.20	0.25
Insulating Glass, Triple[e]								
1/4-in. air space[f]	0.27	0.32	0.22	0.30	0.26	0.31	0.22	0.29
1/2-in. air space[i]	0.23	0.30	0.19	0.28	0.22	0.29	0.18	0.28

5.4.4.4 External Shading for Windows Screen (one per zone)

The external shading screen is accessed only if you specified external shading to be available on the windows screen by entering a nonzero value for at least one of the external shading models. Note that data may be entered only for the model numbers specified.

This screen contains data for the external shading calculations for a *typical* window located in the zone. The orientation of the window is taken from the previous window screen. All dimensions apply to the typical window, not to the entire zone. Fixed overhangs and side fins are external shading devices. Movable shading devices are not modeled by ASEAM2.1.

Up to three types of external shading can be modeled, but note that this is *per building, not per zone*. After you complete this screen for any one zone, the information is automatically transferred to all other zones. Based on the information supplied here, ASEAM2.1 calculates a percentage of window area shaded due to the overhang and/or side fins for each hour. This is then multiplied by the percentage of windows that have this shading model, as specified on the windows screen.

Important: All dimensions are entered in inches, not feet. All "left" and "right" fin details are entered as viewed from the outside looking at the window, *not* from the inside looking out.

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```
ASEAM  LOADS INPUT: ZONE  1 -
EXTERNAL SHADING FOR WINDOWS                                     LOAD FILE:
---------------------------------------------------------------------------------
SHADING DETAILS (All dimensions in inches)        Model 1    Model 2    Model 3
Window Model Name (or 'NA')                       _________  _________  _________
Window Width                                      ____       ____       ____
Window Height                                     ____       ____       ____
Overhang Details
 Overhang Depth                                   ___        ___        ___
 Top of Window to Overhang                        ___        ___        ___
 Overhang extension beyond left edge of window    ___        ___        ___
 Overhang extension beyond right edge of window   ___        ___        ___
 Depth of vert projection at end of overhang      ___        ___        ___
Left Fin Details
 Depth of left fin                                ___        ___        ___
 Left fin extension above top of window           ___        ___        ___
 Distance from left edge of window to left fin    ___        ___        ___
 Dist from left fin bottom to bottom of window    ___        ___        ___
Right Fin Details
 Depth of right fin                               ___        ___        ___
 Right fin extension above top of window          ___        ___        ___
 Dist from right edge of window to right fin      ___        ___        ___
Dist from right fin bottom to bottom of window    ___        ___        ___
```

ASEAM2.1 uses the ASHRAE window shading algorithm. A sketch of a typical overhang and side fin configuration is shown at the end of this section. After each input description, below, the corresponding labels on the sketch are given.

Window model name
For your reference only.

Window width
Actual glass dimension in inches, for a typical window only, not the combined width of all windows. (FL)

Window height
Actual glass dimension in inches, for a typical window only, not the combined window height. (HT)

Overhang depth
Measured in inches from wall out to the end of the overhang. If there is no overhang on this model number, enter '0'. (FP)

Top of window to overhang
Measured in inches from top of glass to bottom edge of overhang. (AW)

Overhang extension beyond left edge of window
Measured in inches from left edge of glass to left edge of overhang. (BWL). Use an arbitrarily high number (e.g. 9999) to simulate continuous overhangs.

Overhang extension beyond right edge of window
Measured in inches from right edge of glass to right edge of overhang. (BWR). Use an arbitrarily high number (e.g. 9999) to simulate continuous overhangs.

Depth of vertical projection at end of overhang
Measured in inches from top to bottom of overhang at free end. (D)

Depth of left fin
Measured in inches out from window. (FP1)

Left fin extension above top of window
Measured in inches from top of glass to top of fin. (A1)

Distance from left edge of window to left fin
Measured in inches from edge of glass to edge of fin. (B1)

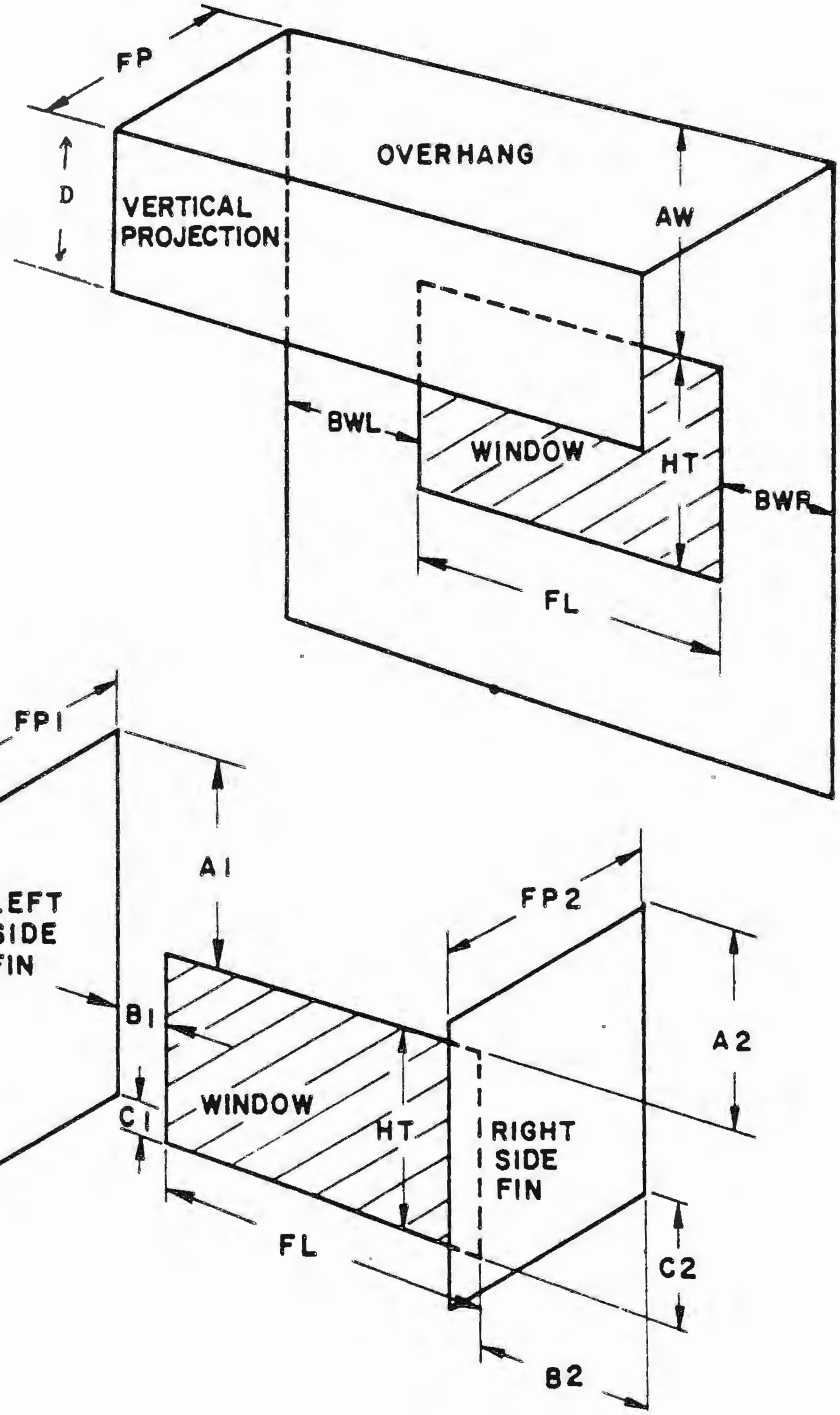
Distance from left fin bottom to bottom of window
Measured in inches from bottom of fin down to bottom of window. (C1)

Depth of right fin
Measured in inches out from window. (FP2)

Right fin extension above top of window
Measured in inches from top of glass to top of fin. (A2)

Distance from right edge of window to right fin
Measured in inches from edge of glass to edge of fin. (B2)

Distance from right fin bottom to bottom of window
Measured in inches from bottom of fin down to bottom of window. (C2)


FP
D
VERTICAL PROJECTION
OVERHANG
AW
BWL
WINDOW
HT
BWR
FL
FP1
A1
LEFT SIDE FIN
B1
C1
WINDOW
HT
FL
FP2
A2
RIGHT SIDE FIN
C2
B2

5.4.4.5 Doors Screen (one per zone)

This section contains data about doors in exterior walls. Infiltration due to the doors is calculated by the crack length method.

You can specify up to two types of doors in each zone. If there are multiple doors of the same type, you can combine them all into one door with an area equal to the sum of the individual door areas; the crack length is the sum of the individual door crack lengths. If no doors are to be simulated, enter 'NA' for the name in both columns.

LIDOORDT

```
ASEAM  LOADS INPUT: ZONE  1 -
DOORS                                                  LOAD FILE:
---------------------------------------------------------------------
DOORS                                     Door 1        Door 2

Name (or 'NA')                            _________     _________

Area (ft²)                                _____         _____
U-Factor (BTUH/ft²-°)                     ____          ____

Crack length (lin ft)                     _____         _____
Leakage coefficient                       __            __
```

Name
: For your reference only.

Area
: Enter square feet; actual door area only.

U-factor
: Enter BTUH/square foot degree F. Refer to the 1985 ASHRAE Handbook of Fundamentals, Table 5A, if needed (reprinted on next page).

Crack length
: Enter in linear feet.

Leakage coefficient
: 1=tight-fitting door; 2=average-fitting door; 6=loose-fitting door. Refer to the 1984 ASHRAE Cooling and Heating Load Calculation Manual, Table 5.7 (reprinted on next page).

Table 5A Coefficients of Transmission (U) for Wood Doors[a], Btu/h·ft²·F

Door Thickness, in.[d]	Description	Winter[b] No Storm Door	Winter[b] Wood Storm Door[e]	Winter[b] Metal Storm Door[f]	Summer[c] No Storm Door
1-3/8	Hollow core flush door	0.47	0.30	0.32	0.45
1-3/8	Solid core flush door	0.39	0.26	0.28	0.38
1-3/8	Panel door with 7/16-in. panels	0.57	0.33	0.37	0.54
1-3/4	Hollow core flush door	0.46	0.29	0.32	0.44
	with single glazing[g]	0.56	0.33	0.36	0.54
1-3/4	Solid core flush door	0.33	0.28	0.25	0.32
	With single glazing[g]	0.46	0.29	0.32	0.44
	With insulating glass[g]	0.37	0.25	0.27	0.36
1-3/4	Panel door with 7/16-in. panels[h]	0.54	0.32	0.36	0.52
	With single glazing[i]	0.67	0.36	0.41	0.63
	With insulating glass[i]	0.50	0.31	0.34	0.48
1-3/4	Panel door with 1-1/8-in. panels[h]	0.39	0.26	0.28	0.38
	With single glazing[i]	0.61	0.34	0.38	0.58
	With insulating glass[i]	0.44	0.28	0.31	0.42
2-1/4	Solid core flush door	0.27	0.20	0.21	0.26
	With single glazing[g]	0.41	0.27	0.29	0.40
	With insulating glass[g]	0.33	0.23	0.25	0.32

Table 5B Coefficients of Transmission (U) for Steel Doors[a], Btu/h·ft²·F

Door Thickness, in.[d]	Description	Winter[b] No Storm Door	Winter[b] Wood Storm Door[e]	Winter[b] Metal Storm Door[f]	Summer[c] No Storm Door
1-3/4	Solid urethane foam core with thermal break[11]	0.19	0.16	0.17	0.18
1-3/4	Solid urethane foam core without thermal break[12]	0.40	—	—	0.39

[a] Values for doors are based on nominal 3'8" by 6'8" door size. Interpolation and moderate extrapolation are permitted for glazing areas and door thicknesses other than those specified.
[b] 15 mph outdoor air velocity; 0 F outdoor air; 70 F inside air temp, natural convection.
[c] 7.5 mph outdoor air velocity; 89 F outdoor air; 75 F inside air temp., natural convection.
[d] Nominal thickness.
[e] Values for wood storm door are approximately 50% glass area.
[f] Values for metal storm door are for any percent of glass area.
[g] 17% exposed glass area; insulating glass contains 0.25 inch air space.
[h] 55% panel area.
[i] 33% glass area; 22% panel area; insulating glass contains 0.25 inch air space.

Table 5.7 Residential-Type Door Classification

Tight Fitting Door $k = 1.0$	Very small perimeter gap and perfect fit weatherstripping — often characteristic of new doors
Average Fitting Door $k = 2.0$	Small perimeter gap having stop trim fitting properly around door and Weatherstripped
Loose Fitting Door $k = 6.0$	Large perimeter gap having poor fitting stop trim and weatherstripped or Small perimeter gap with no weatherstripping

5.4.4.6 Infiltration Screen (one per zone)

This section contains information on the air change infiltration rate. It does not include infiltration by the crack length method, since that is accounted for separately in the windows and doors sections. The air change method can be used to account for infiltration caused by opening and closing of doors and windows, outlets and other penetrations through the building envelope. The total infiltration for a zone is the sum of the infiltrations calculated by the air change and the crack length methods.

Note: The ASEAM2.1 systems calculations do not check to insure that the outside air entering a zone (through infiltration and ventilation) is equal to the air exiting in the zone (through exfiltration, exhaust, and return). Therefore, if the zone has high exhaust requirements that are not made up by additional ventilation air, then you should enter this difference through infiltration.

LIINFLDT

```
ASEAM  LOADS INPUT: ZONE  1 -
INFILTRATION                                              LOAD FILE:
---------------------------------------------------------------------------
INFILTRATION

Occupied air change rate                             ____  air changes per hour

Unoccupied air change rate                           ____  air changes per hour

---------------------------------------------------------------------------

          These entries exclude infiltration by crack length method

---------------------------------------------------------------------------
```

Occupied air change rate
: Enter air changes per hour. One air change per hour is defined as the volume of the zone being replaced once every hour.

Unoccupied air change rate
: Enter air changes per hour for the unoccupied cycle only.

5.4.4.7 Miscellaneous Conduction Screen (one per zone)

The miscellaneous conduction screen is used to simulate any miscellaneous conduction losses and/or gains of the {U-factor * area * [T(space)-T(ref)]} type that have not been accounted for by walls, windows, roofs, or doors. Generally, the miscellaneous conduction screen is used to model heat losses and/or gains to reference temperatures other than ambient, or outdoor temperature.

Examples of miscellaneous conduction losses or gains may include zones that are adjacent to unconditioned garages, a refrigerated warehouse, basement, or crawl spaces. Both the area and the U-factor for the common wall or floor of the zone experiencing the conductive loss or gain must be entered. In addition, reference temperatures for the adjacent space at both design summer and design winter outside conditions are entered. ASEAM2.1 will interpolate linearly between these temperatures to find the temperature of the adjacent space at any given ambient temperature. This calculated reference temperature is used to calculate the conduction heat loss or gain from the zone to the adjacent space.

To model a constant-temperature adjacent space, such as a refrigerated warehouse, enter the same temperature for both winter and summer design reference temperatures. A below-grade basement will lose heat not to ambient but to ground temperature. For this case, estimate the ground temperature for both winter and summer design temperatures and combine all the below-ground wall and floor areas into one area (if the U-factors are the same). Miscellaneous conduction gains or losses are independent of orientation because it is assumed that there is no solar effect. You can specify up to two miscellaneous conduction types per zone.

LIMCONDT

```
ASEAM  LOADS INPUT: ZONE  1 -
MISCELLANEOUS CONDUCTION                                  LOAD FILE:
------------------------------------------------------------------------
MISCELLANEOUS CONDUCTION                             Type 1       Type 2

Name (or 'NA')                                       __________   __________

Area (ft²)                                           _____        _____
U-Factor (BTUH/ft²-°)                                ____         ____

Reference temperature at design summer (°F)          ____         ____
Reference temperature at design winter (°F)          ____         ____
```

Name

For your reference only. Enter 'NA' (default value) if you are not entering miscellaneous conduction data in this column.

Area

Enter square feet. This is the heat transfer surface area between the zone and the adjacent space. Different walls or floors may be combined and treated as one area (e.g., basement walls and floor) providing the U-factors are equal. If the U factors are not equal for multiple sections, you should "weight-average" the U factor for the combined areas. Alternatively, if there is only two adjacent spaces, you may enter data for each space in a separate column (type 1 and type 2). These conductive gains/losses are independent of orientation.

U-factor

Enter BTUH/square foot degree F. This is the heat transfer coefficient for the wall or floor between the conditioned zone and adjacent space.

Reference temperature at design summer

Enter in degrees F. Enter the temperature of the adjacent space when the outside air temperature is at design summer conditions.

Reference temperature at design winter

Enter in degrees F. Enter the temperature of the adjacent space when the outside air temperature is at design winter conditions.

5.4.5 Profile Screens

The profile screens contain information on profiles or diversity factors. Internal energy gains due to people, lighting, electrical equipment, and miscellaneous sensible loads have been specified on previous input screens. These gains probably are not constant throughout the day or the year. To account for "average," or diversified, loads for these internal gains, occupied and unoccupied diversity factors are entered on this screen.

Each internal load component has its own diversity factor. If you entered more than one type of lighting, each function name will appear to the left of the diversity factor. Enter the appropriate diversity factor for each function type. Functions not previously entered will be labeled 'NA', and you will not be able to enter data for them.

A diversity factor is defined as the percent of total occupancy, installed watts, or BTUH that occurs *on average*. For example, if a conference room is used only four hours a day in an occupied period of eight hours, and the lights are turned off at other times, both the occupancy and lighting diversity factors for the occupied period might be 0.50 and 0.0 for the unoccupied period. Diversity factors need not be 0.0 during unoccupied periods, however. It is typical to leave some of the lights on at all times (for security or fire exit lighting, for example).

A monthly diversity factor table number must also be entered for each component. Diversity factors can vary month by month; the table number references the hourly schedule to the monthly schedule on the second screen. Examples of buildings with differing monthly diversities are schools (lower diversities during vacations and holiday seasons) and retail stores (higher people diversities during Christmas, etc.).

Warning: Like the external shading screen, there is *one* monthly diversity factor input screen for the entire building. This monthly screen is *not* zone specific. You must reference the appropriate "table number" from the first screen. It is possible that all internal load components use the same monthly diversity factor table number. Note, however, that when you change the values in a monthly diversity table number, you have changed them for all components in all zones that reference this table number. Four different monthly diversity factor tables can be used.

ASEAM2.1 calculates the "peak" loads for these components assuming a 100% diversity factor, that is, the installed capacity is used. When the diversified loads are calculated, however, the occupied and unoccupied diversity factors as well as the monthly diversity factors are used as scalar multipliers. For example, assume a zone has 1000 watts of lighting installed. The peak hourly cooling load would be given by the following equation:

Hourly peak cooling load due to lights = 1000 watts * 3.413 BTUH/watt * CLF
where CLF is the hourly cooling load factor.

The equation for diversified lighting loads, on the other hand, is:

Hourly diversified cooling load due to lights = 1000 watts * 3.413 BTUH/watt * CLF * DF1 * DF2

where CLF is the hourly cooling load factor;
DF1 is the occupied or unoccupied cycle diversity factor (in decimal form);
DF2 is the monthly diversity factor (in decimal form).

Note: The example above is actually a simplification. ASEAM2.1 uses the principle of "superposition" to determine the cooling load factors. The ASHRAE tables assume a "step" function in determining the cooling load factors; the tables do not account for the fact that a portion of these lights, for example, may be on during the unoccupied cycle. The ASEAM2.1 values for cooling load factors, therefore, will be identical to the ASHRAE values only when you use '0' for the unoccupied cycle diversity factor. If other values are used, the cooling load factors used by ASEAM2.1 will be higher.

5.4.5.1 Internal Load Diversity Factors

LIDIVRDT

```
ASEAM  LOADS INPUT: ZONE  1 -
OPERATING USE PROFILES (DIVERSITIES)                        LOAD FILE:
------------------------------------------------------------------------------
                                          OCCUPIED  UNOCCUPIED  MONTHLY DIV FC
                                           PERIOD     PERIOD     TABLE # (1-4)
People:
             Avg % of full occupancy       ____       ____        ____

Lights:
function 1   Avg % of installed capacity   ____       ____        ____
function 2   Avg % of installed capacity   ____       ____        ____
function 3   Avg % of installed capacity   ____       ____        ____
function 4   Avg % of installed capacity   ____       ____        ____

Electric Equipment:
type 1       Avg % of installed capacity   ____       ____        ____
type 2       Avg % of installed capacity   ____       ____        ____

Miscellaneous Sensible Loads:
type 1       Avg % of installed capacity   ____       ____        ____
type 2       Avg % of installed capacity   ____       ____        ____
```

People: average percent of full occupancy

Enter percent. The first two columns are the average percent of full occupancy, as defined on the "People" screen, for both the occupied and unoccupied periods. The last column references the monthly diversity table number, specified on the screen below, which is to be used as an additional diversity factor.

Lights: average percent of installed capacity

Enter percent. The first two columns are the average percent of installed capacity, as defined on the "Lighting" screen, for both the occupied and unoccupied periods. The last column references the monthly diversity table number, specified on the screen below.

Electric equipment: average percent of installed capacity

Enter percent. The first two columns are the average percent of installed capacity, as defined on the "Electric Equipment" screen, for both the occupied and the unoccupied periods. The third column references the monthly diversity table number.

Miscellaneous sensible loads: average percent of installed capacity

Enter percent. The first two columns are the average percent of installed capacity, as defined on the "Miscellaneous Sensible Loads" screen, for both the occupied and unoccupied periods. The last column references the monthly diversity table number.

5.4.5.2 Monthly Diversities

The monthly diversity factors are input on this screen. The schedules of people, equipment, etc. may change from month to month. For example, an office building may close for a week during winter vacation. ASEAM2.1 cannot model the building being operated for three weeks and shut down for a fourth, but you can, for example, set the monthly diversity factor for December at 0.75, which models the building operating with only 75% of the lights on during the month. Note that this 75% value is an additional scalar multiplier to be applied to the previously entered occupied and unoccupied diversity factors. The default values for these inputs are 100, or no monthly diversities.

Warning: There is *one* monthly diversity input factor screen for the entire building. This screen is *not zone specific*. When you change the values in a monthly diversity table number, you have changed them for all zones that reference this table number.

Up to four different schedules of monthly diversity factors can be modeled. Make sure that the monthly diversity table number entered on the previous screen corresponds to the schedules entered on this screen.

LIMONDDT

```
ASEAM LOADS INPUT: ZONE  1 -
MONTHLY DIVERSITIES                                            LOAD FILE:
--------------------------------------------------------------------------

     Enter Monthly Diversity Factors (0 - 100 %) for each month/schedule

  Month                     Mon Sch 1    Mon Sch 2    Mon Sch 3    Mon Sch 4
  January                      ___          ___          ___          ___
  February                     ___          ___          ___          ___
  March                        ___          ___          ___          ___

  April                        ___          ___          ___          ___
  May                          ___          ___          ___          ___
  June                         ___          ___          ___          ___

  July                         ___          ___          ___          ___
  August                       ___          ___          ___          ___
  September                    ___          ___          ___          ___

  October                      ___          ___          ___          ___
  November                     ___          ___          ___          ___
  December                     ___          ___          ___          ___
```

This concludes the description of the Loads Input screens. After data have been entered for all screens, you are ready to run a Loads analysis or to enter Systems data. When exiting from the Loads Input segment of ASEAM2.1, *remember to use the Save Files command before you Exit.*

6 Systems Input

6 SYSTEMS INPUT

6.1 Introduction

The systems input segment of ASEAM2.1 is an interactive program that asks for all the data needed to characterize the mechanical system(s) supplying the building zones with heating and cooling. The energy requirement of the HVAC system(s) is calculated and then passed to the plant segment, boilers, chillers, etc. which calculates the energy consumption necessary to satisfy the system energy requirements.

ASEAM2.1 can model many different types of systems:

A. Heating and Cooling Systems
1. Double Duct or Multizone (DDMZ)
2. Constant Volume Reheat (CVRH)
3. Variable Air Volume Reheat (VAVR)
4. Ceiling Bypass Variable Air Volume (CBVAV)
5. Single Zone Reheat (SZRH)
6. Fan Coil Unit (FCU)
7. Water Source Heat Pump (WSHP)
8. Air-to-Air Heat Pump (AAHP)

B. Heating Only Systems
9. Baseboard (BB)
10. Furnace (FURN)
11. Unitary Heater (UH)
12. Heating and Ventilation Unit (HV)

C. Cooling Only System
13. Window Air Conditioner (WAC)

Enter the data for the input questions in the same manner as in the loads input segment. (See also Chapter 3 for ASEAM2.1 editing conventions.) However, in the loads input segment, the questions are "universal" (i.e., all buildings have walls and lights), whereas in the systems input segment they are "conditional" (i.e., not all questions are appropriate for all system types). The input screens are as general as possible because they are used for all system types. Not all questions are applicable to your system type. Therefore, the cursor will skip over some questions, or entire input screens may not be used. You should enter responses at all places where the cursor stops. Leaving an answer blank is sometimes interpreted as a default response; this is stated explicitly in the input question.

6.2 Entering Systems Input Data

6.2.1 Creating a New Systems Input File

To create a new systems input file, you must first access the systems input program from either the "Exit" menu of any program or from the Main Menu program. The procedure for doing this is discussed in detail in Chapter 3. Once within this program, you should then use the "Enter New Data" command from the main loads input bar menu (shown in 5.3.1).

All of the input screens will then appear sequentially in the order shown below. Note that many input screens are "conditional"; that is, they will appear only if previously entered data dictates. For example, the heat pump questions will be accessed only if you are entering data for a heat pump system.

Note: If you begin entering systems data but do not complete the input process in one sitting, you should *always* save the input file, even if incomplete. Later, when you are ready to complete the data entry, you should retrieve (Get) this file and edit the unfinished portions. "Enter New Data" is used only when there are no existing data for the building.

6.2.2 Editing an Existing Systems Input File

To modify an existing systems input file stored on the data diskette, you first need to access the systems input program and then retrieve the existing data with the "Get Systems File" command. The procedure for doing this is discussed in detail in Chapter 3. Briefly, you should follow these steps:

1. Access the systems input program from the "Exit" menu of any program or from the Main Menu program.

2. Choose "Get Systems Data" from the Systems Input menu.

3. Choose the file (on drive B) you wish to edit from the list. This will copy the systems input data from the diskette into memory.

4. Choose "Edit Systems Data."

When editing an existing file, you have a choice of editing all data or only a particular subset of data in which you are interested.

6.2.3 Selecting Screens and Systems for Editing

After you choose "Edit Systems Data," you will first select the system components (input screens) to edit. Move the highlighted box using the right and left cursor control keys, and then press CR to select your option. A pull-down menu of individual screens is accessed by pressing CR at the "Screen Menu" command. You may select a particular screen from this menu.

ASEAM2.1 EDIT MENU

```
All Data      Zone-System Assignment      Screen Menu      Exit
                                          Heating
                                          Cooling
                                          Preheat
                                          Humidification
                                          Baseboard
                                          Fan
                                          Outside Air
                                          Heat Pump Cooling
                                          Heat Pump Heating
                                          Furnace
                                          Air Flow
                                          DX Cooling
                                          Zone CFM
                                          Zone Fan KW
                                          Zone Total Cooling
                                          Zone Sensible Cooling
                                          Zone Heat Pump Heating
                                          Zone Backup Heating
                                          Exit
```

You must then indicate which systems you want to edit. A list of systems (as specified in the first system screen) will appear. Mark those systems for which you want to edit data by pressing CR. The CR is a toggle switch, which will mark unmarked systems and unmark marked systems. Move up and down the list with the cursor control keys. When you have marked all the systems you want to edit, press the Escape (ESC) key. The Systems Input screen(s) selected will now appear.

6.2.4 Copying Systems Data

There may be times when you want to enter the same data for more than one system. Data can be copied from one system to another by pressing Alt-'x' simultaneously, where 'x' is the system number you want copied. The input data will then be copied from system 'x' to the screen you are currently editing. If 'x' is a system that has not been defined, a screen full of blanks will be copied onto this screen. Only the current screen data are copied with this command.

6.3 Using Default Data and Autosizing

6.3.1 Using Default Data

There may be many input questions in both the systems and plant input programs that are unfamiliar to you. Use the default key (F8) when you are unsure of the answer to these questions. ASEAM2.1 uses the same typical default values as the DOE-2 program.

6.3.2 Autosizing

ASEAM2.1 can autosize the zone air flow, fan power requirement, and capacities of the equipment in both the systems and plant calculations.

The zone air required is autosized based on the peak loads calculated in the loads program and the space and design discharge temperatures. There are also data entries that will allow you to "oversize" the equipment.

Warning: Please review the warning message in Section 4.4 concerning peak versus diversified leads and equipment sizing.

The fan power requirements are autosized based on default values (KW per 1000 CFM). The default values are system specific; that is, central systems will require more fan KW than unitary systems to deliver the same air flow rate.

Autosized plant equipment capacities are determined by first finding the maximum hourly load on the equipment. Again, you may "oversize" the equipment if desired.

Autosizing equipment has several potential disadvantages:

1. Unrealistic equipment sizes will occur, instead of the nominal values that equipment manufacturers make. In many cases, present equipment could be substantially oversized (allowing for building expansion, changes in building loads through energy conservation, etc.). This oversizing, depending on the amount, can significantly affect the efficiency.

2. If, during an ASEAM analysis, an alteration is investigated involving a large change in the building load, the primary equipment capacities, if autosized, will change between analyses. The fact that existing equipment whose capacity remains constant could be greatly oversized (and operating less efficiently) would not be considered in the analysis when autosizing is selected.

3. As outlined in Chapters 4 and 5, only the diversified loads (from the loads calculations) are satisfied by the systems. The peak loads are used only to determine the "autosizing" air flow rates for the systems. The systems will *never* experience the peak load. Once the system coil loads are determined for all systems, these diversified loads are then totaled and passed to the plant calculations. Therefore, the plant capacities, if autosized, are based on worst-case diversified system loads. *Do not use ASEAM2.1 to size your plant equipment; doing so will result in undersized equipment.*

The difference between the peak and diversified loads is determined not only by the diversity factors entered in loads input but also by the fraction percent sunshine values in your solar file. Therefore, for buildings with a large percentage of glass, the average or diversified loads may be substantially less than the peak cooling loads.

6.4 Systems Modeled by ASEAM2.1

The 13 system types modeled by ASEAM2.1 are described in this section. The input data requirements for each system type can be found in Section 6.5.

6.4.1 Double Duct or Multizone (DDMZ)

System Description: A Double Duct System is also referred to as a dual duct system. This air system has a central fan system, a hot deck, and a cold deck. Two sets of supply air ducts transfer heated and cooled air from the central air-handling unit to individual zones. The hot and cold air streams are mixed in a terminal mixing box located in or near the zone to be conditioned, in order to supply the required temperature as indicated by a thermostat in the zone.

A Multizone System is similar to a dual duct system. However, the mixing of hot and cold air streams is done at the air-handling unit by thermostatically controlled dampers. The discharge air is then distributed to each zone through a single duct system.

For both systems, if there is no hot deck discriminator, the hot deck temperature will be reset according to the outdoor air temperature, assuming a linear relationship. You specify the maximum and minimum hot deck temperatures, and the outdoor air temperatures at which they occur, and these two points determine the linear reset schedule. Then, for any outdoor air temperature, the hot deck temperature is uniquely determined. A discriminator control is superior because it will reset the hot deck to the lowest temperature required to satisfy the worst-case zone.

Comment: These systems may require simultaneous heating and cooling to control space conditions. Therefore, it may be necessary to allow the heating plant to operate during the cooling mode. This is done by two user-defined parameters on the Heating Screen. These two parameters are the months during which heat is available and the outside temperature above which heating is off. Note that for the heating to be on, *both* of the conditions must be met; that is, it must be a month during which heating is available, and the outside air temperature must be below the temperature at which heating is turned off. During warmer outside temperatures, the mixed air temperature in DDMZ systems will be warmer than room air temperature, thereby providing control without the need for heating plant operation.

6.4.2 Constant Volume Reheat (CVRH)

System Description: A Constant Volume Reheat (CVRH) System is also known as a Terminal Reheat system. It is simulated in ASEAM2.1 as a constant volume, variable temperature system which may be equipped with preheating and cooling coils located at the central fan location. The system is equipped with thermostatically controlled terminal reheat coils located in or near the zones they serve. A CVRH system can also have a discriminator, in which case the cool discharge air from the central fan would be reset to the temperature needed to satisfy the zone with the lowest discharge temperature requirement. The CVRH would then perform the same way as a Single Zone Reheat system.

Comment: The cooling discharge temperature will either be constant at the temperature required to meet summer design conditions (typically 55 degrees F) or, if the system has a discriminator, reset at the lowest required discharge temperature for any zone. In either case, most of the zones will need air warmer than this, so the heating plant needs to be on for reheating. As in the DDMZ system, heat is available only during the months specified and when the outdoor temperature is below the maximum heat cutoff point.

6.4.3 Variable Air Volume Reheat (VAVR)

System Description: The Variable Air Volume system is an air system with a central air-handling unit consisting of a fan, cooling coils, and optional preheat coils and humidifier, which distributes cool air to thermostatically controlled terminal air devices referred to as variable air volume (VAV) boxes. VAV boxes are controlled by zone thermostats to regulate the volume of supply air to meet zone requirements. When there are marginal cooling loads or heating loads, the VAV boxes are first throttled to minimum flow, and reheat coils are used to increase the discharge temperature. Three types of fan control are available: variable speed fan, variable position discharge dampers, and adjustable inlet vanes (also called vortex dampers). Discriminator controls can be used to reset the discharge temperature, but this will also affect the air volume required.

Comment: The minimum air flow fraction is entered on Screen H (Fans). This is the percent of design air flow that must be delivered to each zone with heating loads. Note also that ASEAM2.1 models the ventilation requirements as a percent of the design air flow. That is, the minimum percent outside air multiplied by the design air flow rate is always brought in through the outside air dampers.

6.4.4 Ceiling Bypass Variable Air Volume (CBVAV)

System Description: The Ceiling Bypass VAV system is like the VAV system discussed above in that the supply air volume delivered to any zone is controlled by a thermostat. In the ceiling bypass system, however, the VAV box diverts the air from the zone to the ceiling return air plenum. The supply fan pushes a constant volume of air, although only part of it goes to the conditioned spaces. Thus, this system does not take advantage of the fan power savings normally associated with VAV systems. The CBVAV boxes are sometimes referred to as dump boxes.

6.4.5 Single Zone Reheat (SZRH)

System Description: The Single Zone system maintains comfort conditions in the zone by providing a constant volume of air at temperatures that vary according to the load. This system is often referred to as a constant volume system or a variable temperature single zone system. Note that this system is modeled almost identically to a CVRH with a discriminator. SZRH systems also are generally much smaller (limited number of zones) than CVRH systems.

Simulation of the SZRH system assumes that the control thermostat is located in the space, not the return air duct. The availability of heating and cooling depends on the monthly schedules for availability and also on the outside air temperature cutoffs for heating and cooling.

Comment: The SZRH is a flexible building block for simulating many types of HVAC equipment. For example, a gas-fired, packaged rooftop unit with DX cooling can be "built-up" as follows:

System: SZRH
Heat type: furnace
Cool type: direct expansion

See the discussion of heating and cooling plant equipment for additional options.

6.4.6 Fan Coil Unit (FCU)

System Description: Fan Coil Units are small unitary systems that condition spaces by passing air over heating and/or cooling coils. The coils can be electric resistance (for heating) or water coils (both heating and cooling). The fluids are generally conditioned at a central plant (boiler or chiller) and circulated through the coils by pumps. The units can be supplied with outdoor dampers for ventilation.

Fan Coil Units are usually of the two-pipe or four-pipe configuration. Two-pipe systems generally may be used only for heating or for cooling (but not both simultaneously), and seasonal changeover occurs at either preselected outdoor temperatures or by monthly schedules. Four-pipe systems can supply both heating and cooling simultaneously. ASEAM2.1 does not explicitly ask whether you have a two- or a four-pipe system, but you supply this information implicitly in the heating and cooling availability schedules (see comment, below).

Comment: Simulation of either a two-pipe or a four-pipe system is accomplished by appropriate selection of the heating and cooling availability schedules, as well as maximum outdoor temperature for heating and minimum outdoor temperature for cooling.

- Two-pipe operation: Set the maximum outdoor temperature for heating and the minimum outdoor temperature for cooling to the same value (often this is 65 degrees F) to simulate changeover. You also may choose the heating and cooling availability based on monthly schedules.

- Four-pipe operation: Set the maximum outdoor temperature for heating and the minimum outdoor temperature for cooling so that they overlap to provide heating and cooling as required. Doing so provides for both heating and cooling over a temperature range. Note that reheating energy is not used; the fan coil units will be either in a heating or cooling mode, but not in both at the same time.

6.4.7 Water Source Heat Pump (WSHP)

System Description: In water source heat pump systems, individual (i.e., "distributed") heat pumps are located in or near the zones they serve. They use marginally conditioned water from a water loop system supplied from the central plant (usually a boiler/heat rejection unit). The water loop is used both as a heat source during the heating mode and a heat sink during the cooling mode.

Individual units may be heating or cooling as required by zone conditions. They may either supply heat to or take heat from the zone and pass this load to the water loop. This system operates most efficiently when there is a match between the zones' heating and cooling requirements. That is, during the winter interior core zones add heat to the water loop, and exterior zones take heat from the water loop. Excess heat is generally removed by a cooling tower to provide a maximum water loop temperature for efficient heat pump operation. Likewise, boost heat is generally satisfied by a hot water boiler, in order to keep the water loop at a minimum temperature for safe and efficient operation of the zonal heat pumps.

6.4.8 Air-to-Air Heat Pump (AAHP)

System Description: Air-to-air heat pump systems are smaller unitary systems having integral heat pumps that can operate either in a heating mode or a cooling mode. When in a heating mode, a backup source of heating (e.g., furnace or electrical resistance) may be specified to operate at lower outside air temperatures.

Comment: Unlike most other system types, energy consumption of an air-to-air heat pump system is calculated directly in the systems segment (i.e., there is no coil load for boilers or chillers).

6.4.9 Baseboard (BB)

System Description: Baseboard heaters are located along the walls within a zone. They provide heating only and may be supplied by hot water or steam from the heating plant, or they may be electric resistance heaters. Note that baseboards may also be specified in combination with other systems (e.g., DDMZ). Where specified in combination, ASEAM2.1 assumes that the baseboard unit satisfies as much of the heating load as it has capacity, with the remaining (reduced) heating load satisfied by the primary system.

Comment: In ASEAM2.1, baseboard heat output may be controlled either thermostatically or by specifying a reset schedule relating heat output to outside air temperature.

6.4.10 Furnace (FURN)

System Description: A furnace system supplies heat only. Unlike most of the other system types, energy consumption of the furnace is computed directly in the systems segment (as gas or oil consumption), and the heating load is not passed on to the plants segment.

Comment: The furnace system may also be specified as a backup heating source for the AAHP system.

6.4.11 Unitary Heater (UH)

System Description: A unitary heater supplies heat only to a zone. This system cycles on the zone heating demand. No outside air is simulated with unit heaters.

6.4.12 Heating and Ventilating Unit (HV)

System Description: A heating and ventilating unit supplies heat only. This system is nearly identical to the single zone system except that cooling coils are not provided in this system.

6.4.13 Window Air Conditioner (WAC)

System Description: A window air conditioner consists of a direct expansion air conditioning system with an integral compressor, an evaporator section for cooling zone air, and a condenser section for rejecting heat. The unit can also be equipped to introduce outside air for ventilation.

6.5 Systems Input Screen Guide

The following table is used to indicate the data that must be entered for each system type. Locate the systems type at the top of the page, and then read down the appropriate column to see which questions require responses, screen by screen. Note that the input screens are lettered A through N, and within each screen the questions are numbered.

Key to table:

X:	answer required
Z#:	answer may be required depending on answer to question Z# (Z is the screen letter and # the question number)
'blank':	no entry indicates question not applicable to system
Xbd:	an answer is required, but a blank will be interpreted as a default.

SCREEN A - SYSTEM DEFINITIONS	DDMZ	CVRH	VAVR	CBVAV	SZRH	FCU	WSHP	AAHP	BB	FURN	UH	HV	WAC
A1 Total number of systems ------------------------------------	X	X	X	X	X	X	X	X	X	X	X	X	X
A2 System # System Label ------------------------------------	X	X	X	X	X	X	X	X	X	X	X	X	X

SCREEN B - ZONE - SYSTEM ASSIGNMENTS	DDMZ	CVRH	VAVR	CBVAV	SZRH	FCU	WSHP	AAHP	BB	FURN	UH	HV	WAC
B1 Zone Zone Heating Heating Cooling													
Number Label Cooling ONLY ONLY ------------------	X	X	X	X	X	X	X	X	X	X	X	X	X
from loads input Sys # System # System #													

SCREEN C - HEATING	DDMZ	CVRH	VAVR	CBVAV	SZRH	FCU	WSHP	AAHP	BB	FURN	UH	HV	WAC
Energy Source for Heating													
C1 Heating coil plant type ---------------------------------	X	X	X	X	X	X	X			X	X	X	
Heating Availability													
C2 Outside temperature above which heating is off ----------	X	X	X	X	X	X	X			X	X	X	
C3 Heating available beginning month # ---------------------	X	X	X	X	X	X	X			X	X	X	
C4 Heating available ending month # ------------------------	X	X	X	X	X	X	X			X	X	X	
Heating Discharge Conditions													
C5 Design heating coil discharge temperature ---------------	X	X	X	X	X	X	X			X	X	X	
(Dual Duct System Only)													
C6 Discriminator Control (Y/N) -----------------------------	X												
C7 Outside temperature at maximum hot deck temperature -----	C6												
C8 Maximum hot deck temperature ---------------------------	C6												
C9 Outside temperature at minimum hot deck temperature -----	C6												
C10 Minimum hot deck temperature --------------------------	C6												

SCREEN D - COOLING	DDMZ	CVRH	VAVR	CBVAV	SZRH	FCU	WSHP	AAHP	BB	FURN	UH	HV	WAC
Energy Source for Cooling													
D1 Cooling coil plant type ---------------------------------	X	X	X	X	X	X							
Cooling Availability													
D2 Outside temperature below which cooling is off ----------	X	X	X	X	X	X	X	X					X
D3 Cooling available beginning month # ---------------------	X	X	X	X	X	X	X	X					X
D4 Cooling available ending month # ------------------------	X	X	X	X	X	X	X	X					X
Cooling Discharge Conditions													
D5 Design cooling coil discharge temperature ---------------	X	X	X	X	X	X	X	X					X
D6 Discriminator control (Y/N) -----------------------------	X	X	X	X									
D7 Maximum cooling coil discharge temperature --------------	D6	D6	D6	D6	X								

SCREEN E - PREHEAT		DDMZ	CVRH	VAVR	CBVAV	SZRH	FCU	WSHP	AAHP	BB	FURN	UH	HV	WAC
	Energy Source for Preheat													
E1	Preheat coil plant type	X	X	X	X	X							X	
	Preheat Availability													
E2	Outside temperature above which preheat is off	X	X	X	X	X							X	
E3	Preheat available beginning month #	X	X	X	X	X							X	
E4	Preheat available ending month #	X	X	X	X	X							X	
	Preheat Discharge Conditions													
E5	Design preheat coil discharge temperature	X	X	X	X	X							X	

SCREEN F - HUMIDIFICATION		DDMZ	CVRH	VAVR	CBVAV	SZRH	FCU	WSHP	AAHP	BB	FURN	UH	HV	WAC
	Energy Source for Humidification													
F1	Humidification plant type	X	X	X	X	X							X	
	Humidification Availability													
F2	Outside temperature above which humidification is off	X	X	X	X	X							X	
F3	Humidification available beginning month #	X	X	X	X	X							X	
F4	Humidification available ending month #	X	X	X	X	X							X	
F5	Humidification available during unoccupied cycle (Y/N)	X	X	X	X	X							X	
	Humidification Discharge Conditions													
F6	Minimum relative humidity maintained (% RH)	X	X	X	X	X							X	

SCREEN G - BASEBOARD		DDMZ	CVRH	VAVR	CBVAV	SZRH	FCU	WSHP	AAHP	BB	FURN	UH	HV	WAC
	Energy Source for Baseboard													
G1	Baseboard plant type	X	X	X	X	X	X	X	X	X			X	
	Baseboard Availability													
G2	Outside temperature above which baseboard is off	X	X	X	X	X	X	X	X	X			X	
G3	Baseboard available beginning month #	X	X	X	X	X	X	X	X	X			X	
G4	Baseboard available ending month #	X	X	X	X	X	X	X	X	X			X	
	Baseboard Control and Capacity													
G5	Baseboard control type	X	X	X	X	X	X	X	X	X			X	
G6	Percent of design heating load satisfied at design winter	X	X	X	X	X	X	X	X	X			X	
G7	Percent of design heating load satisfied at balance temp	G5	G5	G5	G5	G5	G5	G5	G5	G5			G5	

SCREEN H - FAN		DDMZ	CVRH	VAVR	CBVAV	SZRH	FCU	WSHP	AAHP	BB	FURN	UH	HV	WAC
	Supply Fans													
H1	Total supply fan power required (blank=default)	Xbd	Xbd	Xbd	Xbd	Xbd					Xbd		Xbd	
H2	(or) Supply fan power per 1000 CFM	H1	H1	H1	H1	H1					H1		H1	
H3	Supply fan temperature rise (blank=default)	Xbd	Xbd	Xbd	Xbd	Xbd					Xbd		Xbd	
	Return Fans													
H4	Total return fan power required (blank=default)	Xbd	Xbd	Xbd	Xbd	Xbd					Xbd		Xbd	
H5	(or) Return fan power per 1000 CFM	H4	H4	H4	H4	H4					H4		H4	
H6	Return fan temperature rise (blank=default)	Xbd	Xbd	Xbd	Xbd	Xbd					Xbd		Xbd	
H7	(VAV) Minimum percent of design air volume when heating			X	X									
H8	(VAV) Air volume control method			X	X									
	Fan Control Methods													
H9	Occupied cycle fan control method						X	X	X					X
H10	Unoccupied cycle fan control method	X	X	X	X	X	X	X	X				X	X

SCREEN I - OUTSIDE AIR CONTROLS	DDMZ	CVRH	VAVR	CBVAV	SZRH	FCU	WSHP	AAHP	BB	FURN	UH	HV	WAC
Occupied Cycle Only													
I1 Outside air damper control method	X	X	X	X	X	X	X	X				X	X
I2 Minimum percent outside air intake	I1	I1	I1	I1	I1	I1	I1	I1				I1	I1
I3 Dry bulb switchover temperature	I1	I1	I1	I1	I1	I1	I1	I1				I1	I1
Unoccupied Cycle Only													
I4 Outside air damper control method	X	X	X	X	X	X	X	X				X	X
I5 Minimum percent outside air intake	I4	I4	I4	I4	I4	I4	I4	I4				I4	I4
I6 Dry bulb switchover temperature	I4	I4	I4	I4	I4	I4	I4	I4				I4	I4

SCREEN J - HEAT PUMP COOLING	DDMZ	CVRH	VAVR	CBVAV	SZRH	FCU	WSHP	AAHP	BB	FURN	UH	HV	WAC
Heat Pump Cooling Capacity (Total Cooling)													
J1 Zonal total cooling capacity method							X	X					X
J2 (if autosized) Percent of design total load met							J1	J1					J1
Heat Pump Cooling Capacity (Sensible Cooling)													
J3 Zonal sensible cooling capacity method							X	X					X
J4 (if autosized) Percent of design sensible load met							J3	J3					J3
Cooling Performance													
J5 Design coefficient of performance							X	X					X
Water Source Heat Pump Only													
J6 Outside temperature at minimum fluid loop temperature							X						
J7 Minimum fluid loop temperature							X						
J8 Outside temperature at maximum fluid loop temperature							X						
J9 Maximum fluid loop temperature							X						

SCREEN K - HEAT PUMP HEATING	DDMZ	CVRH	VAVR	CBVAV	SZRH	FCU	WSHP	AAHP	BB	FURN	UH	HV	WAC
Heat Pump Heating Capacity													
K1 Zonal heating capacity method							X	X					
K2 (if autosized) Percent of max heat pump load met							K1	K1					
Air/Air Heat Pump Backup													
K3 AAHP backup heating source								X					
K4 Outside temperature below which backup heating is on								X					
K5 Zonal electric resistance backup heating capacity meth.								X					
K6 (if autosized) Percent of design heating load met								K5					
Heating Performance													
K7 Design heating coefficient of performance							X	X					

SCREEN L - FURNACE	DDMZ	CVRH	VAVR	CBVAV	SZRH	FCU	WSHP	AAHP	BB	FURN	UH	HV	WAC
Furnace Energy Source													
L1 Furnace fuel source	C1	C1	C1	C1	C1			K3		X		C1	
Furnace Heat Output													
L2 Furnace capacity (blank=autosize)	Xbd	Xbd	Xbd	Xbd	Xbd			Xbd		Xbd		Xbd	
L3 (if autosized) Percent of design load satisfied	L2	L2	L2	L2	L2			L2		L2		L2	
Furnace Efficiency													
L4 Furnace efficiency at design load	X	X	X	X	X			X		X		X	
Furnace Losses													
L5 Losses as percent of design load (at design load)	X	X	X	X	X			X		X		X	
L6 Losses as percent of design load (at no load)	X	X	X	X	X			X		X		X	
L7 Pilot gas annual consumption	L1	L1	L1	L1	L1			L1		L1		L1	

SCREEN M - ZONE AIR		DDMZ	CVRH	VAVR	CBVAV	SZRH	FCU	WSHP	AAHP	BB	FURN	UH	HV	WAC
	Zone Air Flow Sizing													
M1	Zonal air volume method	X	X	X	X	X	X	X	X		X	X	X	X
M2	(if autosized) Percent of design default air flow	M1	M1	M1	M1	M1	M1	M1	M1		M1	M1	M1	M1
	Zone Fan Power													
M3	Zonal fan power method						X	X	X		X	X	X	X
M4	(if autosized) Percent of design default fan KW						M3	M3	M3		M3	M3	M3	M3

SCREEN N - DX COOLING		DDMZ	CVRH	VAVR	CBVAV	SZRH	FCU	WSHP	AAHP	BB	FURN	UH	HV	WAC
	DX Cooling Capacity (Total Cooling)													
N1	DX total cooling capacity (blank=autosized)	Xbd	Xbd	Xbd	Xbd	Xbd								
N2	(if autosized) Percent of design total load met	N1	N1	N1	N1	N1								
	Cooling Performance													
N3	Design coefficient of performance	X	X	X	X	X								
N4	Minimum unloading ratio (% of capacity)	X	X	X	X	X								
N5	Minimum hot gas bypass ratio (% of capacity)	X	X	X	X	X								
	DX Condenser													
N6	Condenser fan KW (blank=default)	Xbd	Xbd	Xbd	Xbd	Xbd								
N7	Outside temperature below which condenser fan is off	X	X	X	X	X								

Note: Screens 'O' through 'T' allow you to enter zone capacities for several parameters. These screens will repeat the zone names assigned to this system, and you will enter the zone value for each zone at the right side of the screen.

Screen O: Zone CFM. Allows you to enter the design CFM delivered to each zone assigned to this system. This screen will appear only if you do not "autosize" the zone air on question M1.

Screen P: Zone Fan KW. Allows you to enter the fan KW required for each zone assigned to this unitary system. This screen will appear only if you do not "autosize" the zone fan power method on question M3. This screen only applies to unitary systems (FCU, WSHP, AAHP, UH, WAC).

Screen Q: Zone Total Cooling. Allows you to enter the total cooling capacity of the zonal heat pumps and window air conditioners for each zone assigned to this system. This screen will appear only if you do not "autosize" the zonal total cooling capacity method on question J1. This screen only applies to unitary heat pump systems (WSHP, AAHP, WAC).

Screen R: Zone Sensible Cooling. Allows you to enter the sensible cooling capacity of the zonal heat pumps and window air conditioners for each zone assigned to this system. This screen will appear only if you do not "autosize" the zonal sensible cooling capacity method on question J3. This screen only applies to unitary heat pump systems (WSHP, AAHP, WAC).

Screen S: Zone Heat Pump Heating. Allows you to enter the heating capacity of the zonal heat pumps for each zone assigned to this system. This screen will appear only if you do not "autosize" the zonal heating capacity method on question K1. This screen only applies to unitary heat pump systems (WSHP, AAHP).

Screen T: Zone Backup Heating. Allows you to enter the electric resistance backup heating capacity of the air-to-air heat pumps for each zone assigned to this system. This screen only applies to air-to-air heat pump systems (AAHP).

6.6 Systems Input Screens

The following discussion focuses on the systems input screens. Each screen is shown exactly as it will appear on your computer. Above each screen display is a seven- or eight-letter name that identifies the .SIS file that creates the screen. Should you wish to change the default values or limits, this is the file you would need to access. See Appendix C for a discussion of how to change the input screen appearance and input parameters.

6.6.1 Screen A: System Definitions

On the first screen you identify how many systems there are in the building and the types of systems. Only one heating and cooling (Types 1-8) system can serve a given zone, but many zones can be conditioned by one system. Two systems can be entered for a zone provided one system is heating only (Types 9-12) and the other system is a window air conditioner (Type 13). Baseboard heating can be added to any system type (except the window air conditioner) and need not constitute a system in itself. *This screen is accessed only once.*

SISYSDAT

```
SYSTEM DEFINITIONS

------------------------------------------------------------------------------
Total number of systems   __

System #     System Label                                  System Type
                                                         (Use Codes Below)
    1    ________________________________________              __
    2    ________________________________________              __
    3    ________________________________________              __
    4    ________________________________________              __
    5    ________________________________________              __
    6    ________________________________________              __
    7    ________________________________________              __
    8    ________________________________________              __
    9    ________________________________________              __
   10    ________________________________________              __

------------------------------------------------------------------------------
                        Heating and Cooling System Types
1=DDMZ    2=CVRH    3=VAVR    4=CBVAV    5=SZRH    6=FCU    7=WSHP    8=AAHP

      Heating Only  Systems                    Cooling Only Systems
9=BB     10=FURN   11=UH     12=HV                    13=WAC
```

Total number of systems

Enter number 1–10. This is the number of systems conditioning the entire building.

System #

The systems are numbered sequentially, one through however many system types you have specified above. This is done automatically.

System label

For your reference only. The label, or user-defined name, will be used when you are asked which systems you want to edit, and will also be printed on some output reports.

System type

Enter number 1–13. This number, corresponding to the list at the bottom of the input screen, indicates the type of system:

1. Dual duct or multizone (DDMZ)
2. Constant volume reheat (CVRH)
3. Variable air volume reheat (VAVR)
4. Ceiling bypass variable air volume (CBVAV)
5. Single zone reheat (SZRH)
6. Fan coil unit (FCU)
7. Water source heat pump (WSHP)
8. Air-to-air heat pump (AAHP)
9. Baseboard (BB)
10. Furnace (FURN)
11. Unitary heater (UH)
12. Heating and ventilating unit (HV)
13. Window air conditioner (WAC)

6.6.2 Screen B: Zone-System Assignments

This screen is used to indicate which zones (as defined in loads) are served by which systems. No more than one system may serve a particular zone, but many zones may be conditioned by the same system. Two systems can be entered for a zone provided one system is heating only (Types 9-12) and the other system is a window air conditioner (Type 13). Baseboard heating may be included as a part of any system except for a window air conditioner. *This screen is accessed only once.*

SIZONDAT

```
ZONE - SYSTEM ASSIGNMENTS

-----------------------------------------------------------------------------

 Zone     Zone                                        Heating   Heating   Cooling
Number    Label                                       Cooling    ONLY      ONLY
                                                     System #  System #  System #
-----------------------------------------------------------------------------

  NOTE - THE ZONE NUMBERS AND LABELS                    __        __        __
         (AS DEFINED IN LOADS INPUT)                    __        __        __
         WILL BE PRINTED HERE                           __        __        __
                                                        __        __        __
                                                        __        __        __
                                                        __        __        __
                                                        __        __        __
                                                        __        __        __
                                                        __        __        __
                                                        __        __        __
```

Zone number

Zones are numbered 1 through as many zones as you defined in the loads segment of the program. ASEAM2.1 automatically inserts these numbers on the input screen.

Zone label

Zone labels, corresponding to zone numbers, that you defined in the loads segment of the program are automatically inserted on the input screen by ASEAM2.1.

Heating/cooling system #

Enter number 1–10. This is the system number from the previous screen (*not* the system type number). Enter the system number in this column if the system type provides both heating and cooling.

Heating ONLY system #

Enter number 1–10. This is the system number from the previous screen (*not* the system type number). Enter the system number in this column if the system type provides heating only.

Cooling ONLY system #

Enter number 1–10. This is the system number from the previous screen (*not* the system type number). Enter the system number in this column if the system type provides cooling only.

6.6.3 Screen C: Heating (one screen per system)

On this screen you define the heating energy source, when heating is available, and the heating discharge temperatures.

This screen appears once for each system for the following system types: DDMZ, CVRH, VAVR, CBVAV, SZRH, FCU, WSHP, FURN, UH, HV.

SIHTGDAT

```
SYSTEMS DATA:  HEATING PARAMETERS FOR SYSTEM:
System Label:                                                   File:
------------------------------------------------------------------------------
Energy Source for Heating
  Heating coil plant type (see codes below)                    _

Heating Availability
  Outside temperature above which heating is off               ___ °F
  Heating available beginning month #                          __
  Heating available ending month #                             __

Heating Discharge Conditions
  Design heating coil discharge temperature                    ___ °F

(Dual Duct System Only)
  Discriminator Control (Y/N)                                  _
  Outside temperature at maximum hot deck temperature          ___ °F
    Maximum hot deck temperature                               ___ °F
 Outside temperature at minimum hot deck temperature           ___ °F
   Minimum hot deck temperature                                ___ °F
------------------------------------------------------------------------------
                          Heating Coil Plant Types
0=None  1=Boiler   2=Elect Resist   3=District Heat   4=DB Chiller   5=Furnace
------------------------------------------------------------------------------
```

Heating coil plant type

Enter number 0–5. These numbers define the energy source for heating:

0—none
1—boiler
2—electric resistance
3—district heat
4—double bundle chiller
5—furnace

If you enter '0', there is no heating, and the remainder of this screen does not apply. If you do have heating, you should enter values for the following questions.

The next four questions are asked for any system with heating capability:

Outside temp. above which heating is off

Enter in degrees F. This is the maximum outdoor temperature at which heating is available. With this input question, you can avoid the simultaneous use of both heating and cooling in reheat and fan coil systems. See the note below.

Heating available—beginning month #

Enter number 1–12. Month number when heating first available, inclusive (e.g., 9 means that heating is available beginning Sept. 1). See note below.

Heating available—ending month #

Enter number 1–12. Month number when heating last available, inclusive (e.g., 5 means that heating is available until May 31).

Note: For heating to be available, both the month availability and the outside temperature criteria must be satisfied.

Design heating coil discharge temperature

Enter degrees F. Expresses the temperature of the heated air that satisfies the winter design load. When units are cycling to satisfy a space heating load, this discharge temperature is assumed for determination of the equipment run time.

The following questions apply *only* to dual duct and multizone systems:

Discriminator control

Enter 'Y' for Yes or 'N' for No. A discriminator determines which zone has the greatest heating temperature requirement and resets the hot deck temperature so that this load is met (but not exceeded) at full hot deck flow. When reset in this manner, the hot deck temperature is typically cooler than that for design winter conditions, and so zones with smaller heating loads require less mixing to lower the temperature.

If your system has discriminator control, the hot deck temperature is reset to meet the highest heating load sensed in the zones, as defined above. If your system does not have discriminator control, the hot deck temperature is controlled by outdoor air reset. You enter the maximum and minimum hot deck temperatures and the outdoor air temperatures at which they occur. For any given outdoor air temperature, the hot deck temperature can be reset linearly between these two values. Note that for outdoor air temperatures above the maximum or below the minimum you specified, the hot deck temperature remains at its maximum or minimum value, respectively.

The following questions apply *only* to systems *without* discriminator control:

Outside temperature at maximum hot deck temperature

Enter degrees F. This is the outside temperature at which the maximum hot deck temperature occurs.

Maximum hot deck temperature

Enter degrees F. This is the maximum hot deck temperature, which occurs when the outside temperature is at (or below) the temperature entered above. Note that this temperature is also used for determining the amount of unoccupied cycling required.

Outside temperature at minimum hot deck temperature

Enter degrees F. This is the outside temperature at which the minimum hot deck temperature occurs.

Minimum hot deck temperature

Enter degrees F. This is the minimum hot deck temperature, which occurs when the outside temperature is at (or above) the temperature entered above.

6.6.4 Screen D: Cooling (one screen per system)

On this screen you define the cooling energy source, when cooling is available, and the cooling discharge temperature. Note that if you specify autosizing for the zone air flow (which is done on a subsequent screen), ASEAM2.1 uses the peak zone cooling load (determined in the loads calculations) and the design cooling discharge and space temperatures to calculate the zone air volume.

This screen appears once per system for the following system types: DDMZ, CVRH, VAVR, CBVAV, SZRH, FCU, WSHP, AAHP, WAC.

SICLGDAT

```
SYSTEMS DATA:  COOLING PARAMETERS FOR SYSTEM:
System Label:                                                File:
-----------------------------------------------------------------------------
Energy Source for Cooling
  Cooling coil plant type (see codes below)                _

Cooling Availability
  Outside temperature below which cooling is off           ___  °F
  Cooling available beginning month #                      __
  Cooling available ending month #                         __

Cooling Discharge Conditions
  Design cooling coil discharge temperature                ___  °F
  Discriminator control (Y/N)                              _
  Maximum cooling coil discharge temperature               ___  °F


-----------------------------------------------------------------------------
                        Cooling Coil Plant Types
 0=None     1=DX      2=Centrifugal     3=Absorption      4=District Cooling
 5=Double Bundle      6=Cooling Tower (WSHP only)         7=Reciprocating
-----------------------------------------------------------------------------
```

Coiling coil plant type

Enter number 0–7. These numbers define the energy source for cooling. Choose from the following:

- 0—none
- 1—direct expansion (DX)
- 2—centrifugal chiller
- 3—absorption chiller
- 4—district cooling
- 5—double bundle chiller
- 6—cooling tower (WSHP only)
- 7—reciprocating chiller

If you specify '0' there is no cooling, and the remainder of this screen does not apply. If you specify any type of cooling, you should answer the following questions. Note that cooling towers can be used only with WSHP systems.

The next four questions are asked for any system type with cooling capability:

Outside temperature below which cooling is off

Enter degrees F. This is the lowest outdoor temperature at which mechanical cooling is supplied. The use of operable windows for natural ventilation could be modeled by entering a value of, for example, 70 degrees F, implying that, if the outdoor temperature is less than 70 degrees F, no mechanical cooling is available regardless of the cooling load. See Note below.

Cooling available—beginning month #

Enter number 1–12. Month number when cooling first available, inclusive (e.g., 5 means that cooling is available beginning May 1). See Note below.

Cooling available—ending month #

Enter number 1–12. Month number when cooling last available, inclusive (e.g., 9 means that cooling is available until September 30).

Note: For cooling to be on, both the outside temperature and the month availability criteria must be satisfied.

Design cooling coil discharge temperature

Enter degrees F. Enter the cooling discharge temperature required to satisfy the summer design load. The cooling discharge temperature is generally set to this value unless the system has discriminator control. The design cooling coil discharge temperature input (usually about 55 degrees F), along with the maximum calculated zone load and summer thermostat setpoint, is used to "autosize" the air flow to individual zones. A discriminator determines the lowest discharge temperature required for any zone and resets the discharge temperature to this value. When reset in this manner, the cooling discharge temperature is typically warmer than for design summer conditions, and the air flow to the zones with smaller cooling loads requires less reheating or mixing.

The next two questions concerning discriminator control are asked for the central fan system types (DDMZ, CVRH, VAVR, CBVAV). It is assumed that the cooling discharge temperature for single zone systems is already reset so as to satisfy the load of the worst-case zone. Unitary or "zonal" systems, such as window air conditioners, are modeled as separate systems in each zone. With unitary system, each system has a different discharge temperature based on the zone load.

Discriminator control

'Y' for Yes, 'N' for No. With discriminator control, the cooling discharge temperature required for the worst-case zone is used to reset the system cold deck discharge temperature. For unitary systems, ASEAM2.1 assumes each zone has a separate system, and therefore, a different discharge temperature. If the unit is cycling, the discharge temperature is assumed to be constant. If the unit runs continuously, the cooling capacity is adjusted by changing the discharge temperature.

The next question is asked only if the system has a discriminator control:

Maximum cooling coil discharge temperature

Enter degrees F. This question is asked only if a discriminator is indicated in the previous question. You can limit how high the cooling discharge temperature is permitted to rise above the design supply temperature, thus somewhat limiting excessive space humidity levels. ASEAM2.1 does not explicitly model cooling discharge temperatures reset by space or return humidity levels.

6.6.5 Screen E: Preheat (one screen per system)

On this screen, you define the preheat energy source, when preheating is available, and the design discharge conditions. Preheat coils are assumed to be located after the mixed air plenum, if return air is used.

This screen appears once per system for the following system types: DDMZ, CVRH, VAVR, CBVAV, SZRH, HV.

SIPRHDAT

```
SYSTEMS DATA: PREHEAT PARAMETERS FOR SYSTEM:
System Label:                                                  File:
-----------------------------------------------------------------------------
Energy Source for Preheat
  Preheat coil plant type (see codes below)                   _

Preheat Availability
  Outside temperature above which preheat is off              ___ °F
  Preheat available beginning month #                         __
  Preheat available ending month #                            __

Preheat Discharge Conditions
  Design preheat coil discharge temperature                   ___ °F

-----------------------------------------------------------------------------
                           Preheat Coil Plant Types
   0=None      1=Boiler      2=Electric Resistance      3=District Heat
-----------------------------------------------------------------------------
```

Preheat coil plant type

Enter number 0-3 to define the energy source for preheat. Choose from the following:

- 0—none
- 1—boiler
- 2—electric resistance
- 3—district heat

Entering '0' indicates that your system has no preheating, and therefore the rest of the questions on this screen do not apply. Otherwise, answer the following questions.

Outside temperature above which preheat is off

Enter degrees F. This is the maximum outside temperature at which preheating is available. See Note below.

Preheat available—beginning month #

Enter number 1–12. Month number when preheating first available, inclusive (e.g., 9 means that preheating is available beginning Sept. 1). See Note below.

Preheat available—ending month #

Enter number 1–12. Month number when preheating last available, inclusive (e.g., 3 means that preheating is available until March 31).

Note: For preheating to be available, both the outside temperature and the monthly availability criteria must be satisfied.

Design preheat coil discharge temperature

Enter degrees F. When the calculated mixed air temperature is lower than this value, and preheat energy is available (specified above), preheat coil energy will be used to raise the mixed air temperature to the preheat coil discharge temperature.

6.6.6 Screen F: Humidification (one screen per system)

On this screen you enter the humidification plant type, monthly availability, and design conditions.

This screen appears once per system for the following system types: DDMZ, CVRH, VAVR, CBVAV, SZRH, HV.

SIHUMDAT

```
SYSTEMS DATA: HUMIDIFICATION PARAMETERS FOR SYSTEM:
System Label:                                                      File:
--------------------------------------------------------------------------------
Energy Source for Humidification
  Humidification plant type (see codes below)                     _

Humidification Availability
  Outside temperature above which humidification is off           ___  °F
  Humidification available beginning month #                      __
  Humidification available ending month #                         __
  Humidification available during unoccupied cycle (Y/N)          _

Humidification Discharge Conditions
  Minimum relative humidity maintained (% RH)                     __   % RH

--------------------------------------------------------------------------------
                       Humidification Plant Types
 0=None       1=Boiler       2=Electric Resistance       3=District Heat
--------------------------------------------------------------------------------
```

Humidification plant type

Enter number 0–3. Enter the energy source for humidification, using numbers from the following list:

0—none
1—boiler
2—electric resistance
3—district heat

Entering '0' indicates that you have no humidification, and therefore the rest of the questions on this screen do not apply. Otherwise, answer the next five questions.

Outside temperature above which humidification if off

Enter degrees F. This is the maximum outside temperature at which humidification is available. See Note below.

Humidification available—beginning month #

Enter number 1–12. Month number when humidification first available, inclusive (e.g., 10 means humidification is available beginning Oct 1). See Note below.

Humidification available—ending month #

Enter number 1–12. Month number when humidification last available, inclusive (e.g., 4 means humidification is available through April 30).

Note: For humidification to be available, both the outside temperature and the monthly availability criteria must be satisfied.

Minimum relative humidity maintained

Enter percent. When the calculated return air humidity, without humidification, would result in return air humidity levels below this value, and humidification is available, energy will be used to raise the discharge air humidity so that the return air humidity is maintained at this level.

Note that ASEAM2.1 performs a moisture balance on the system. That is, the space or zone humidity level and, therefore, return air humidity level, are determined by considering the effects of moisture gains in the space (through people and miscellaneous sources), infiltration latent load, ventilation air flow, outside air humidity level, and discharge humidity (when latent cooling). ASEAM2.1 uses return air humidity, not individual zone humidity, to activate humidification.

6.6.7 Screen G: Baseboard (one screen per system)

On this screen you define the baseboard plant type, when baseboard heating is available, and the control type and capacity for the heaters.

This screen appears once per system for the following system types: DDMZ, CVRH, VAVR, CBVAV, SZRH, FCU, WSHP, AAHP, BB, HV.

SIBBDAT

```
SYSTEMS DATA: BASEBOARD PARAMETERS FOR SYSTEM:
System Label:                                                  File:
----------------------------------------------------------------------------
Energy Source for Baseboard
  Baseboard plant type (see codes below)                       _

Baseboard Availability
  Outside temperature above which baseboard is off            ___ °F
  Baseboard available beginning month #                       __
  Baseboard available ending month #                          __

Baseboard Control and Capacity
  Baseboard control type                                       _
    (1 = thermostatic   2 = reset by outside temperature)

Percent of design heating load satisfied at design winter     ___ %
Percent of design heating load satisfied at balance temp      ___ %

----------------------------------------------------------------------------
                         Baseboard Plant Types
   0=None      1=Boiler      2=Electric Resistance       3=District Heat
----------------------------------------------------------------------------
```

Baseboard plant type

Enter number 0–3. This defines the energy source for the baseboard heaters. Choose from the following list:

- 0—none
- 1—boiler
- 2—electric resistance
- 3—district heat

Entering '0' indicates that you have no baseboard heaters, and therefore the rest of the questions on this screen do not apply. Otherwise, answer the following questions.

Outside temperature above which baseboard if off

Enter degrees F. This is the maximum temperature at which baseboard heating is available. See Note below.

Baseboard available—beginning month #

Enter number 1–12. Month number when baseboard heating is first available, inclusive (e.g., 9 means that baseboard heating is available beginning Sept. 1). See Note below.

Baseboard available—ending month #

Enter number 1–12. Month number when baseboard heating is last available, inclusive (e.g., 4 means that baseboard heating is available until Apr. 30).

Note: For baseboard heating to be available, both the outside temperature and the monthly availability criteria must be satisfied.

Baseboard control type

Enter '1' for thermostatic baseboard control; '2' for outdoor air reset baseboard control. When baseboard heating is combined with another primary system, ASEAM2.1 can simulate two different methods of controlling the baseboard output:

1. *Thermostatic*: In this case, the heating output of the baseboard follows the load profile. That is, the baseboard will attempt to satisfy the zone heating load, if it can. Three cases may occur:

(a) If the zone heating load is greater than the baseboard capacity, the baseboard heating system will be at full capacity. The zone heating load on the heating system (e.g., dual duct) will be reduced by the amount of the baseboard output. The primary, therefore, makes up the difference between the zone heating load and the baseboard output.

(b) If the zone heating load is less than or equal to the baseboard capacity, the baseboard system is assumed to satisfy the complete heating load, and the main heating system load is set at zero. Depending on the system type (unitary or central) and the ventilation requirements, the main unit may still be operating continuously and consuming heating energy for the outside air intake.

(c) If the zone has a cooling load, ASEAM2.1 will simulate that the thermostatic baseboard will be off, and there will be no effect on the main heating or cooling system.

2. *Reset on outdoor air temperature*: The baseboard's heating output is reset on the outside air temperature. In this case, the baseboard heating output is solely dependent on outside air temperature, *not* the space heating load.

Although the thermostatic baseboard method will never "overheat" the zone by adding more heat than necessary, the reset baseboard method can be used to simulate "wild" baseboard (such as hot water temperature reset controls for the baseboard supply water) or overheating by baseboard. As with the thermostatic method, the zone load on the primary heating system (e.g., dual duct) will be adjusted according to the amount of the baseboard output. If the baseboard heating output is *more* than the space heating load, the primary system will experience a cooling load.

Percent of design heating load satisfied at design winter

Enter percent. This is the percent of the design heating load satisfied by the baseboard units at design winter conditions.

The following data are needed only for systems with outdoor air reset control:

Percent of design heating load satisfied at balance temperature

Enter percent. This is the percent of the design heating load satisfied at the balance temperature, which is defined to be the outdoor air temperature at which the building experiences no net heating load. Note that the temperature cutoff availability criteria may be used to turn off the baseboard.

6.6.8 Screen H: Fans (one screen per system)

On this screen you define the central fan sizes, fan temperature rises, and fan control methods. If you do not know these values, leave the spaces blank, and ASEAM2.1 will autosize the fans.

This screen appears once per system for the following central fan system types: DDMZ, CVRH, VAVR, CBVAV, SZRH, HV. The fan input data for the unitary systems are entered on Screen M. Unitary systems have a separate fan for each zone.

SIFANDAT

```
SYSTEMS DATA: FAN PARAMETERS FOR SYSTEM:
System Label:                                               File:
---------------------------------------------------------------------------
Supply Fans
  Total supply fan power required (blank=default)           ___  KW
    (or) Supply fan power per 1000 CFM                      ____ KW/1000 CFM
  Supply fan temperature rise (blank=default)               ____ °F

Return Fans
  Total return fan power required (blank=default)           ___  KW
    (or) Return fan power per 1000 CFM                      ____ KW/1000 CFM
  Return fan temperature rise (blank=default)               ____ °F

  (VAV) Minimum percent of design air volume when heating   ___  %
  (VAV) Air volume control method                           _
   (1=Variable Speed   2=Discharge Dampers   3=Inlet Vanes)

Fan Control Methods  (See Codes Below)
 Occupied cycle fan control method                          _
 Unoccupied cycle fan control method                        _
---------------------------------------------------------------------------
                            Fan Control Methods
                  1=On Continuously      2=Cycles with load
---------------------------------------------------------------------------
```

Total supply fan power required
: Enter kilowatts. This is the total supply fan power required. If you do not know this value, leave the question blank, and a default value will be used.

Supply fan power per 1000 CFM
: Enter kilowatts per 1000 CFM. The supply fan power can also be specified this way. This input is not required if you have filled in a value or wish autosizing, above. A value entered here has precedence over the autosizing option, above.

Supply fan temperature rise

Enter degrees F. This is the temperature rise in the air flow across the supply fan. If you leave this line blank, the temperature rise will be defaulted. ASEAM2.1 assumes that the coil location is blow through (i.e., fan is located upstream of the cooling coil).

Total return fan power required

Enter kilowatts. This is the total return fan power required. If you do not know this value, leave the question blank, and a default value will be used. If you do not have a return fan, enter '0'.

Return fan power per 1000 CFM

Enter kilowatts per 1000 cfm. The return fan power can also be specified this way. This input is not required if you have filled in a value or wish autosizing, above. A value entered here has precedence over the autosizing option, above.

Return fan temperature rise

Degrees F. This is the temperature rise in the air flow across the return fan. If you leave this line blank, the return fan temperature rise will be defaulted.

The next two questions apply to variable air volume systems only.

Minimum percent of design air volume when heating

Enter percent. During periods of minimal cooling loads or heating loads, variable air volume systems reduce the quantity of cool air delivered to the zone. Usually, in order to provide adequate air movement, and ventilation, the flow rate reduction is limited to around 50% of design air flow. If this reduced air flow still overcools the space, ASEAM2.1 assumes reheat energy is used to deliver the required discharge temperature.

Air volume control method

'1'=variable speed; '2'=discharge dampers; '3'=inlet vanes. One of these methods of regulating the volume of air delivered by the supply fan to the spaces must be entered. Note that ceiling bypass VAV systems (CBVAV) have constant flow through the supply fans, and, therefore, this question will not be asked.

The following questions refer to the method of fan control:

Occupied cycle fan control method

'1'=on continuously; '2'=cycles with load. This question is not asked for central fan system types (DDMZ, CVRH, VAVR, CBVAV, SZRH), since ASEAM2.1 assumes that larger central fan systems serving multiple zone systems must stay on during occupied periods for ventilation requirements. Only unitary fan systems are permitted to cycle during the occupied cycle.

You must choose one of these operating methods. It should be noted that the energy consumption calculated, and the assumptions ASEAM2.1 uses for the calculations, are entirely different.

If the first option (continuous operation) is chosen, ASEAM2.1 calculates the discharge temperature that is needed for the hourly zone load assuming the unit operates for the full hour. With this method, ventilation air will also be introduced for the full hour.

If the second option (cycling operation) is chosen, ASEAM2.1 calculates the required operating time assuming that the discharge temperature is at the design cooling or heating temperature, depending on the load. With this method, ventilation air will only be introduced while the system is operating, which can be minimal during low-load conditions.

Unoccupied cycle fan control method

'1'=on continuously; '2'=cycles with load. This question is asked for all systems except baseboard.

6.6.9 Screen I: Outside Air Controls (one screen per system)

On this screen you define the parameters related to outside air intake.

This screen appears once per system for the following system types: DDMZ, CVRH, VAVR, CBVAV, SZRH, FCU, WSHP, AAHP, HV, WAC.

SIOACDAT

```
SYSTEMS DATA: OUTSIDE AIR PARAMETERS FOR SYSTEM:
System Label:                                               File:
--------------------------------------------------------------------------
Occupied Cycle Only
  Outside air damper control method (see codes below)       _
  Minimum percent outside air intake                        ___ %
  Dry bulb switchover temperature                           ___ °F

Unoccupied Cycle Only
  Outside air damper control method (see codes below)       _
  Minimum percent outside air intake                        ___ %
  Dry bulb switchover temperature                           ___ °F

--------------------------------------------------------------------------
                    Outside Air Damper Control Methods
    1=No Outside Air     2=Fixed Dampers      3=Dry Bulb       4=Enthalpy
                                            (Economizer)     (Economizer)
--------------------------------------------------------------------------
```

The following questions are asked twice, once for the occupied cycle and once for the unoccupied cycle:

Outside air damper control method

Enter number 1–4. Choose the method of outside air damper control from the following list:

1—no outside air
2—fixed dampers
3—dry-bulb (economizer)
4—enthalpy (economizer)

While any of the above four options can be selected for any system, it should be noted that only options 1 and 2 are generally applicable to unitary systems.

Economizer cycle controls permit additional outside intake during cooler weather to eliminate or reduce mechanical cooling requirements. When the outside air temperature becomes warm or humid, possibly increasing the cooling requirement, two methods are generally used to switch the outside air dampers to minimum position:

Enthalpy Economizer: Outside air dampers return to minimum position when the outside air enthalpy is larger than the return air enthalpy. Thus, both temperature and humidity levels (enthalpy) are used in determining the proper damper position.

Dry-Bulb Economizer: When outside air temperature exceeds the "switchover" temperature, the outside dampers return to minimum position. Generally this value is slightly lower than the return air temperature.

A mixed air controller (without a true "switchover" to minimum outside air) can be simulated by using the dry-bulb economizer option and setting the dry-bulb switchover temperature to 120 degrees.

Note that economizer cycles are assumed to be "sequenced" with the cooling discharge temperature. For example, if ASEAM2.1 calculates that a 60 degree cooling temperature is necessary, and this temperature could be achieved through the correct mixture of return and cool outside air, the outside dampers will be opened the proper amount.

Minimum percent outside air intake

Enter percent. This input data will be required except when no outside air intake is indicated above. For variable air volume systems (VAVR), where the system total air flow varies with the load, a minimum amount (not percent) of outside air intake is used. For example, if 20% is indicated as the minimum percent outside air, and the design air flow is 50,000 CFM, then at least 10,000 CFM (20% of 50,000) of outside air will be introduced through the outside air dampers, regardless of the system air flow volume and loads.

Dry-bulb switchover temperature

Enter degrees F. If a dry-bulb economizer is indicated as the outside air damper control method, this question is asked. When the outside air temperature exceeds this value, the outside air dampers will return to their minimum position value as defined above.

6.6.10 Screen J: Heat Pump Cooling (one screen per system)

On this screen you define the heat pump cooling parameters. This screen appears once per system for the following system types: WSHP, AAHP, WAC.

SIHPCDAT

```
SYSTEMS DATA: HEAT PUMP COOLING PARAMETERS FOR SYSTEM:
System Label:                                             File:
-----------------------------------------------------------------------------
Heat Pump Cooling Capacity (Total Cooling)
  Zonal total cooling capacity method                                _
    (1=Capacities Entered by Zone  2=Autosized)
    (if autosized)  Percent of design total load satisfied          ___  %

Heat Pump Cooling Capacity (Sensible Cooling)
  Zonal sensible cooling capacity method                             _
    (1=Capacities Entered by Zone  2=Autosized)
    (if autosized)  Percent of design sensible load satisfied       ___  %

Cooling Performance
  Design coefficient of performance                                 ____

Water Source Heat Pump Only
  Outside temperature at minimum fluid loop temperature            ___  °F
   Minimum fluid loop temperature                                  ___  °F
 Outside temperature at maximum fluid loop temperature             ___  °F
   Maximum fluid loop temperature                                  ___  °F
```

Zonal total cooling capacity method

Enter '1' for capacities entered by zone; '2' for autosizing. You must choose one of these methods for entering *total* (sensible plus latent) cooling capacity. If you select the first option, a separate input screen will appear later on which you will specify each zone's *total* cooling capacity. If you choose to "autosize" the total cooling capacity, the next question is asked.

Percent of design total load satisfied

Enter percent. When autosizing is selected, you can specify the equipment's total cooling capacity as a percent of the calculated peak cooling load. A value of 100 (%) for this input indicates "perfect" sizing. Values greater than 100(%) indicate oversizing. Note that *all* zones assigned to this system would be sized by this input question.

Zonal sensible cooling capacity method

Enter '1' for capacities entered by zone; '2' for autosizing. You must choose one of these methods for entering the *sensible* cooling capacity *only*. If you select the first option, a separate input screen will appear later on which you specify each zone's sensible cooling capacity. If you choose to "autosize" the total cooling capacity, the next question is asked.

Percent of design sensible load satisfied

Enter percent. When autosizing is selected, this question allows you to specify the equipment's sensible cooling capacity as a percent of the peak cooling load. A value of 100(%) for this input indicates "perfect" sizing. Values greater than 100(%) indicate oversizing. Note that *all* zones assigned to this system would be sized by this input question.

Design coefficient of performance

Dimensionless. Note that the COP under ARI rating conditions is requested. ASEAM2.1 calculates the bin efficiency or COP using algorithms found in DOE systems and plant programs.

The next four questions are asked for water-source heat pump systems only. They define the water loop reset schedule (as a function of outside air temperature).

Outside temperature at minimum fluid loop temperature

Enter degrees F. When the outside temperature is below this value, ASEAM2.1 assumes that the fluid temperature remains constant at the minimum fluid temperature (next question). This is accomplished by adding heat to the water loop through the heating energy source specified on the heating screen.

Minimum fluid loop temperature

Enter degrees F. This is the minimum fluid loop temperature maintained at or below the outside temperature specified above.

Outside temperature at maximum fluid loop temperature

Enter degrees F. When the outside temperature is above this value, the water loop temperature is assumed to be controlled at the maximum fluid temperature (next question). The plant type for this cooling requirement (usually a cooling tower) is specified earlier on the cooling screen.

Maximum fluid loop temperature

Enter degrees F. This is the maximum fluid loop temperature maintained at or above the outside temperature specified above.

By answering all the fluid temperature inputs, a reset schedule is generated that can model earth-coupled as well as groundwater heat pumps. While the dynamic hour-by-hour calculation methods can use previously calculated hourly water temperature values to more accurately simulate the water loop, the modified bin method will not permit this dynamic modeling.

6.6.11 Screen K: Heat Pump Heating (one screen per system)

On this screen you enter the parameters for a heat pump heating system. This screen appears only for water-source or air-to-air heat pumps.

SIHPHDAT

```
SYSTEMS DATA: HEAT PUMP HEATING PARAMETERS FOR SYSTEM:
System Label:                                              File:
--------------------------------------------------------------------------
Heat Pump Heating Capacity
  Zonal heating capacity method                                  _
    (1=Capacities Entered by Zone  2=Autosized)
    (if autosized)  Percent of max heat pump load satisfied     ___  %

Air/Air Heat Pump Backup
  AAHP backup heating source                                     _
    (1=Furnace     2=Electric Resistance)

  Outside temperature below which backup heating is on         ___  °F

  Zonal electric resistance backup heating capacity method       _
    (1=Capacities Entered by Zone  2=Autosized)
    (if autosized)  Percent of design heating load satisfied    ___  %

Heating Performance
 Design heating coefficient of performance                     ____
```

Zonal heating capacity method

Enter '1' for capacities entered by zone; '2' for autosizing. You must choose one of these methods for entering the heating capacity of the heat pump.

Note: Only the *heat pump* capacity is requested. Do *not* include any auxiliary backup heating capacity. If you select the first option, a separate input screen will appear later on which you will specify each zone's heat pump heating capacity. If you choose to autosize the zone capacity, the next question is asked.

Percent of max. heat pump load satisfied

Enter percent. When autosizing is selected, this question allows you to specify the equipment's total heat pump heating capacity as a percent of calculated maximum heat pump load. If an air-to-air heat pump has been specified, normally a backup source of heating is used during colder weather when air source heat pumps cannot extract heat efficiently. For this reason, the backup heating source and changeover temperature questions are asked next. For purposes of sizing the heat pump capacity, however, the design heating load on the heat pump is the calculated load at the changeover temperature (while heating is still provided by the heat pump). A value of 100(%) for this input indicates "perfect" sizing. Values greater than

100(%) indicate oversizing. Note that *all* zones assigned to the system would be used in sizing this input.

The following four questions are asked for air-to-air heat pumps only:

AAHP backup heating source

Enter '1' for furnace; '2' for electric resistance. This defines the source of backup heating for the heat pump. If you select a furnace (e.g., an add-on heat pump), questions pertaining to furnaces will be asked on a different screen.

Outside temperature below which backup heating is on

Enter degrees F. This is the minimum outdoor temperature at which the heat pump operates. ASEAM2.1 assumes that the air-to-air heat pump is heating either in the heat pump mode (with no supplemental backup) or heating completely with the backup source (no heat provided by the heat pump).

Zonal electric resistance backup heating capacity method

'1' for capacities entered by zone; '2' for autosizing. This question defines the method of backup heating capacity, if the backup heating source for the AAHP is electric. The capacity of the backup source determines the amount of cycling by the unit.

Percent of design heating load satisfied

Enter percent. If autosizing is selected for the above, this question is asked. Enter the percent of the design zone heating load. A value of 100% represents perfect sizing.

Design heating coefficient of performance

Dimensionless. Since ASEAM2.1 uses algorithms from the DOE program, the calculated heating efficiency changes in each bin. Note that the heating COP under ARI rating conditions is requested (47 degrees F).

6.6.12 Screen L: Furnace (one screen per system)

On this screen you define the furnace parameters, such as fuel source, capacity, efficiency, and losses.

This screen appears once for each system that uses a furnace as the heating energy source, or if the backup heating source for an air-to-air heat pump system is a furnace.

SIFURNDAT

```
SYSTEMS DATA: FURNACE PARAMETERS FOR SYSTEM:
System Label:                                                File:
------------------------------------------------------------------------------
Furnace Energy Source
  Furnace fuel source (see codes below)                  _

Furnace Heat Output
  Furnace capacity (blank=autosize)                      ______ KBTUH
    (if autosized) Percent of design load satisfied      ___    %

Furnace Efficiency
  Furnace efficiency at design load                      ___    %

Furnace Losses
  Losses as percent of design load (at design load)      ___    %
  Losses as percent of design load (at no load)          ___    %
  Pilot gas annual consumption                           ___    therms

------------------------------------------------------------------------------
                           Furnace Fuel Codes
      1=Electric    2=Natural Gas    3=#2 Oil    4=#4 Oil    5=#6 Oil
------------------------------------------------------------------------------
```

Furnace fuel source

Enter number 1–5. Define the fuel source of the furnace from the following:

1—electric
2—natural gas
3—#2 oil
4—#4 oil
5—#6 oil

Furnace capacity

Enter KBTUH. Enter the furnace capacity here, if known. Note that the requested input value is in *output* heating energy, not input energy rate. If you do not know the capacity, leave this line blank, and the furnace will be autosized.

Percent of design load satisfied

Enter percent. When autosizing is selected for the furnace capacity, you will be asked for the percent of the calculated maximum heating load that the furnace can satisfy. A furnace that can just satisfy the calculated maximum heating load, but no more, would have a value of 100(%). You can undersize the heating capacity (values less than 100%) or substantially oversize it.

If the furnace (or any other equipment) is undersized for the load under consideration, ASEAM2.1 will not calculate any additional energy that is required. Thus, a 50,000 BTUH furnace under a 60,000 BTUH load will still only consume 50,000 BTUH. If the furnace or other equipment is oversized for the load, ASEAM2.1 will calculate the decrease in efficiency that results from lower part-load operation.

Furnace efficiency at design load

Enter Percent. ASEAM2.1 uses efficiency and COP algorithms used by the DOE systems and plant programs, and, therefore, the actual bin efficiency or COP is a function of several variables:

- Load on equipment: includes actual space loads or system requirements and any inefficiencies specified.

- Equipment capacities: In many cases, the equipment heating or cooling capacity is adjusted on a bin-by-bin basis. For example, window air conditioners and heat pump cooling capacities are increased in moderate weather conditions.

- Curve fit equations: In general, the operating efficiency is adjusted via curve fit coefficients that may use part-load ratio as the independent variable.

- Design efficiencies: Based upon the operating efficiency at design conditions, the operating efficiency at other conditions is calculated.

Losses as percent of design load (at design load)

Enter percent of capacity. For the furnace heating systems, as well as other heating equipment, additional loads besides the space or system load can occur. Examples include keeping a boiler operating under minimal load conditions, uninsulated heating ducts, and steam trap losses. See Note below.

Losses as percent of design load (at no load)

Enter percent of design load.

Note: To allow you to enter these losses, the above two questions are asked. Furnace system losses are represented via a reset schedule, with losses (in percent of design load) calculated as a linear function of the outside air temperature.

These losses are considered the same as a load, and not as direct additional consumption. Thus a 1 BTUH loss entered in this manner, with an operating efficiency of 50%, will result in a 2 BTUH increase in consumption.

Pilot gas annual consumption

Enter therms. When gas furnaces are specified, the annual consumption of the pilot should be entered.

6.6.13 Screen M: Zone Air (one screen per system)

On this screen you define the zone air flow parameters. This screen is displayed for both unitary and central air systems, and is used to determine the amount of air flowing in each assigned zone. The fan power input questions apply only to unitary systems.

SIAIRDAT

```
SYSTEMS DATA: ZONE AIR PARAMETERS FOR SYSTEM:
System Label:                                             File:
---------------------------------------------------------------------------
Zone Air Flow Sizing
  Zonal air volume method                                _
    (1=Air Flows Entered by Zone     2=Autosized)
    (if autosized)  Percent of design default air flow   ___ %

Zone Fan Power
  Zonal fan power method                                 _
    (1=Zone Fan KW Entered by Zone    2=Autosized)
    (if autosized)  Percent of design default fan KW     ___ %
```

Zonal air volume method

'1' for air flows entered by zone; '2' for autosizing. You must choose one of these methods for entering the zone air flow. If you select the first option, a separate input screen will appear later on which you will specify the air flow of each assigned zone. If you choose autosizing, the next question is asked.

Percent of design default air flow

Enter percent. When autosizing is selected, you can specify the air flow of each zone as a percent of required air flow, as calculated using the peak cooling load along with space and minimum cooling supply temperatures entered previously. A value of 100% indicates perfect sizing. Values greater than 100% indicate oversizing. All zones assigned to this system will be sized in the same manner by this input.

The following two questions pertain only to unitary systems:

Zonal fan power method

'1' for zone fan KW entered by zone; '2' for autosizing. You must choose one of these methods for entering the zone fan power requirements (in KW). If you choose the first option, a separate input screen will appear later on which you will specify the fan power requirements of each assigned zone. If you choose to autosize the fan KW, the next question will be asked.

Percent of design default fan KW

Enter percent. If you autosize the fan KW, you can specify the fan power of each zone, as a percent of the DOE program default values for KW per CFM air flow. A value of 100% here will utilize the DOE default values for KW per CFM. Values greater than 100% indicate proportionately more power for the air flow of this zone. All zones assigned to this system will be sized the same by this input.

6.6.14 Screen N: Direct Expansion Cooling (one screen per system)

On this screen you define the direct expansion input parameters. This screen is accessed only if you choose DX as the cooling source on screen D.

SIDXDAT

```
SYSTEMS DATA: DIRECT EXPANSION COOLING PARAMETERS FOR SYSTEM:
System Label:                                             File:
-----------------------------------------------------------------------
DX Cooling Capacity (Total Cooling)
  DX total cooling capacity (blank=autosized)              _____ tons
    (if autosized)  Percent of design total load satisfied ___   %

Cooling Performance
  Design coefficient of performance                        ____
  Minimum unloading ratio (% of capacity)                  ___   %
  Minimum hot gas bypass ratio (% of capacity)             ___   %

DX Condenser
  Condenser fan KW (blank=default)                         ___   KW
  Outside temperature below which condenser fan is off     ___   °F
```

DX total cooling capacity
: Enter in tons if capacity is entered. Leave 'Blank' for autosizing. You must choose one of these methods for entering the total capacity. If you choose to autosize the total cooling capacity, the next question is asked.

Percent of design total load satisfied
: Enter percent. When autosizing is selected, this question allows you to specify the equipment's total cooling capacity as a percent of the calculated peak load. A value of 100 (%) for this input indicates perfect sizing. Values more than 100 (%) would indicate oversizing.

Design coefficient of performance
: Dimensionless. Note that the COP under ARI rating conditions is requested. ASEAM2 calculates the bin efficiency or COP using algorithms found in the DOE systems and plant programs.

Minimum unloading ratio (% of capacity)
: Enter percent. When the calculated part-load operating ratio is less than this value, the compressor unloading stops and hot gas bypass begins, false loading itself to this minimum part load ratio.

Minimum hot gas bypass ratio (% of capacity)

Enter percent. When the calculated part load operating ratio is less than this value, the hot gas bypass stops and the equipment cycles on an off to meet the load. The minimum hot gas bypass ratio should be equal to or less than the minimum unloading ratio. If these values are equal, there is no hot gas bypass capability, and the equipment moves from the unloading immediately to cycling. If both values are 100 (70) the unit does not unload and cycles from full load down to zero load.

Condenser fan KW

Enter KW or leave blank for autosizing. If the condenser fan KW is known, enter the fan KW; otherwise leave this entry blank, and ASEAM2 will use a default value.

Outside temperature below which condenser fan is off

Enter degrees F. When the outside temperature falls below this value, the condenser fan is assumed to be off.

6.6.15 Screen O: Zone CFM (one screen per system)

This screen allows you to enter the air flow rates to each zone assigned to a system. This screen is accessed only if you chose "Air Flows Entered by Zone" (not autosizing) on Screen M.

The input screen is self-explanatory. The zone numbers and labels (from the loads input) are printed at the left side of the screen, and you enter the zone CFM for each zone on the right side of the screen.

```
SYSTEMS DATA: ZONE CFM FOR SYSTEM:
System Label:                                                  File:
------------------------------------------------------------------------------
Loads      Zone Name                                             Zone
Zone #      or Label                                             CFM

                                                                _______
 +--------------------------------------------------+           _______
 | NOTE - THE ZONE NUMBER AND LABEL FOR EACH ZONE   |           _______
 |        ASSIGNED TO THIS SYSTEM IS PRINTED HERE   |           _______
 +--------------------------------------------------+           _______
```

6.6.16 Screen P: Zone Fan KW (one screen per system)

This screen allows you to enter the fan KW required for each zone of a unitary system. This screen is accessed only if you chose "Zone Fan KW Entered by Zone" (not autosizing) on Screen M.

The input screen is self-explanatory. The zone numbers and labels (from the loads input) are printed at the left side of the screen, and you enter the zone Fan KW for each zone on the right side of the screen.

```
SYSTEMS DATA: ZONE FAN KW FOR SYSTEM:
System Label:                                                    File:
-----------------------------------------------------------------------------
Loads        Zone Name                                            Zone
Zone #        or Label                                           Fan KW
                                                                 ______
  NOTE - THE ZONE NUMBER AND LABEL FOR EACH ZONE                 ______
         ASSIGNED TO THIS SYSTEM IS PRINTED HERE                 ______
                                                                 ______
                                                                 ______
```

6.6.17 Screen Q: Zone Total Cooling Capacity (one screen per system)

This screen allows you to enter the total cooling capacity (both sensible and latent) for each zone of a unitary system. This screen is accessed only if you chose "Capacities Entered by Zone" (not autosizing) on Screen J, and applies only to WSHP, AAHP, and WAC systems.

The input screen is self-explanatory. The zone numbers and labels (from the loads input) are printed at the left side of the screen, and you enter the total cooling capacity in tons, for each zone on the right side of the screen.

```
SYSTEMS DATA: ZONE TOTAL CLG FOR SYSTEM:
System Label:                                               File:
------------------------------------------------------------------
Loads       Zone Name                                 Zone Total Clg
Zone #       or Label                                 Capacity (Tons)
                                                         _______
  NOTE - THE ZONE NUMBER AND LABEL FOR EACH ZONE         _______
         ASSIGNED TO THIS SYSTEM IS PRINTED HERE         _______
                                                         _______
                                                         _______
```

6.6.18 Screen R: Zone Sensible Cooling Capacity (one screen per system)

This screen allows you to enter the total sensible cooling capacity for each zone of a unitary system. This screen is accessed only if you chose "Capacities Entered by Zone" (not autosizing) on Screen J, and applies only to WSHP, AAHP, and WAC systems.

The input screen is self-explanatory. The zone numbers and labels (from the loads input) are printed at the left side of the screen, and you enter the total sensible capacity in tons, for each zone on the right side of the screen.

```
SYSTEMS DATA: ZONE SENS CLG CAPACITY FOR SYSTEM:
System Label:                                                  File:
----------------------------------------------------------------------------
Loads      Zone Name                                        Zone Sens Clg
Zone #      or Label                                       Capacity (Tons)
                                                              _______
  +------------------------------------------------+          _______
  | NOTE - THE ZONE NUMBER AND LABEL FOR EACH ZONE |          _______
  |        ASSIGNED TO THIS SYSTEM IS PRINTED HERE |          _______
  +------------------------------------------------+          _______
```

6.6.19 Screen S: Zone Heat Pump Heating Capacity (one screen per system)

This screen allows you to enter the total heat pump heating capacity for each zone of a unitary system. This screen is accessed only if you chose "Capacities Entered by Zone" (not autosizing) on Screen K, and applies only to WSHP and AAHP systems.

The input screen is self-explanatory. The zone numbers and labels (from the loads input) are printed at the left side of the screen, and you enter the total heat pump heating capacity in tons, for each zone on the right side of the screen.

```
SYSTEMS DATA: ZONE HP HEATING CAPACITY FOR SYSTEM:
System Label:                                                   File:
-------------------------------------------------------------------------------
Loads      Zone Name                                           Zone HP Htg
Zone #      or Label                                         Capacity (Tons)
                                                                 _______
  NOTE - THE ZONE NUMBER AND LABEL FOR EACH ZONE                 _______
         ASSIGNED TO THIS SYSTEM IS PRINTED HERE                 _______
                                                                 _______
                                                                 _______
```

6.6.20 Screen T: Zone Backup Heating Capacity (one screen per system)

This screen allows you to enter the total backup electric resistance heating capacity for each zone of an air-to-air heat pump system. This screen is accessed only if you chose "Capacities Entered by Zone" (not autosizing) on Screen K, and only applies to AAHP systems.

The input screen is self-explanatory. The zone numbers and labels (from the loads input) are printed at the left side of the screen, and you enter the total backup electric resistance heating capacity in kw, for each zone on the right side of the screen.

```
SYSTEMS DATA: ZONE BACKUP HTG KW FOR SYSTEM:
System Label:                                          File:
------------------------------------------------------------------
Loads       Zone Name                               Zone Electric
Zone #       or Label                           Backup Heating KW
                                                     _______
  +-----------------------------------------+        _______
  | NOTE - THE ZONE NUMBER AND LABEL FOR EACH ZONE | _______
  |        ASSIGNED TO THIS SYSTEM IS PRINTED HERE | _______
  +-----------------------------------------+        _______
```

This concludes the discussion of the Systems Input screens. After you have entered information for the system type(s) for your building, save your data file and exit from this segment of the program. You are now ready to input plant data.

7 Plant Input

7 PLANT INPUT

7.1 Introduction

The plant input segment of ASEAM2.1 is an interactive program that asks for all the data needed to characterize the plant equipment for supplying heating, cooling, and domestic hot water. Some energy costs are also requested in this segment for use in estimating annual energy costs. The plant equipment is actually selected in the systems input routine, when you chose a plant type for a system component energy source (e.g., heating and cooling coils). After the systems input data have been entered for all systems, the various plant energy assignments are compared. Although only one type of chiller can be assigned to system #1, a different chiller type could be assigned to system #2.

Because ASEAM2.1 uses the DOE program algorithms, many additional input parameters have been included. If you are unsure of a proper response to a question, it is suggested that you use the default key (function key F8) to enter a typical value.

7.2 Entering Plant Input Data

7.2.1 Creating a New Plant Input File

To create a new plant input file, you must first access the plant input program of ASEAM2.1 from the "Exit" menu of any program or from the Main Menu program. The procedure for doing this is discussed in detail in Chapter 3. Once within this program, choose "Enter New Data" from the main plant input bar menu (shown in 7.3).
Your selection of plant components to meet the coil loads, as specified in the systems input file, will determine which input screens subsequently appear. You do not have a choice of the order for the data entry. Fill out each screen, as it appears, with the parameters of the plant equipment.

Note: If you begin entering plant data but do not complete the input process in one sitting, you should save the input file. Later, when you are ready to complete the data entry, use the "Get" command to retrieve this file and edit it. "Enter New Data" is used only when there is no existing data entered for the building.

7.2.2 Editing an Existing Plant Input File

To modify an existing plant input file stored on the data diskette, you first need to access the plant input program and then retrieve the existing data with the "Get Plant File" command. The procedure for doing this is discussed in detail in Chapter 3. Briefly, you should use the following steps:

1. Access the plant input program from the "Exit" menu of any program or from the Main Menu program.

2. Choose "Get Plant File" from the Plant Input Menu.

3. Choose the file (on drive B) you wish to edit from the list. (This will copy the plant input data from the diskette into memory.)

4. Choose "Edit Plant Data."

7.3 Input Sequence

When editing an existing file, you have a choice of which data to edit. You may edit all data or only a particular subset in which you are interested. The Plant Input menu, with the editing menu, is shown below.

ASEAM2.1 Plant Input

```
Get Plant File     Save Plant File     Edit Plant Data     Enter New Data     Exit
```

```
All Data     Energy Costs & BTU     Misc Energy Cons     Screen Menu     Exit
                                                        Centrifugal Chiller
                                                        Absorption Chiller
                                                        Double Bundle Chiller
                                                        Reciprocating Chiller
                                                        Cooling Tower
                                                        Domestic Hot Water
                                                        Boiler
                                                        Exit
```

Note: Although all possible plant components appear on the pull-down menu, only components specified in the systems data file are used in the calculations. If you try to edit data for an unspecified component, an error message will be issued. You may add data for the component at this point, but the data will never be used unless you go back and assign this plant component in the systems input file.

7.4 Plant Input Screens

The plant input screens will now be discussed individually. Each screen is shown exactly as it will look on your computer. The seven- or eight-letter name above each screen is the name of the .PIS file that defines screen appearance and input parameters. See Appendix C for a discussion on changing input screen parameters.

The input screens for the various chiller types contain many of the same questions, so all of the chiller screens are reprinted first, and the line-by-line discussion follows. There are a few additional questions for specific chillers.

7.4.1 Energy Costs and BTU Conversion Screen

On this screen you specify unit costs and energy conversion factors (site and source) for the building's fuel types. Default values may be used by pressing the F8 function key.

PIENEDAT

```
ASEAM2 PLANT INPUT
ENERGY COSTS/CONVERSIONS                                  PLANT FILE:
------------------------------------------------------------------------------
Fuel Type          Energy      Unit Cost      Conversion Factors (BTU/Unit)
                    Units      $ / Unit           Site             Source
------------------------------------------------------------------------------
Electricity          KWH        _____            _____             _____
Natural Gas        Therms       _____            _____             _____
#2 Oil             Gallons      _____            _____             _____
#4 Oil             Gallons      _____            _____             _____
#6 Oil             Gallons      _____            _____             _____
Dist Heating         MBTU       _____            _____             _____
Dist Cooling         MBTU       _____            _____             _____
```

Unit cost

Enter dollars per unit. This is the cost of the energy source in dollars per unit. Average unit cost, including demand and fuel adjustment charges, should be entered for electricity.

Conversion factors

Enter MBTU/energy unit of fuel type. These conversion factors are multiplied by the energy consumption (in the units listed to the left on the input screen) to yield the consumption in MBTU. The site conversion factor yields site energy consumption; the source conversion factor yields source energy consumption.

7.4.2 Miscellaneous Energy Consumption Screen

On this screen you enter miscellaneous building energy consumption that would not normally be part of a building energy analysis. Examples include exterior lighting, cooking and process energy consumption, elevators, etc. Each of the five consumption items will appear in the building energy end-use summary (BEPS report) as a separate line item and will be totaled in the final building energy consumption.

PIMECDAT

```
ASEAM2 PLANT INPUT
MISCELLANEOUS ENERGY CONSUMPTION                          PLANT FILE:
--------------------------------------------------------------------------

Label for Miscellaneous              Fuel Units        Annual Consumption
Energy Consumption               (See Codes Below)       in Energy Units
--------------------------------------------------------------------------

 ________________________________        _              ____________
 ________________________________        _              ____________
 ________________________________        _              ____________
 ________________________________        _              ____________
 ________________________________        _              ____________

--------------------------------------------------------------------------
                    Fuel Code        Fuel Type       Energy Units
                    ---------        ---------       ------------

                        1            Natural Gas        therms
                        2            Oil                gallons
                        3            Electricity        KWH
                        4            Dist Heating       MBTU
                        5            Dist Cooling       MBTU
```

Label

For your information. This user-entered name appears as a separate item in the building energy end-use summary at the end of the calculations.

Note: The categories of energy end-use calculated by ASEAM2.1 are printed with a capital letter first (e.g., Fans). If you enter all capital letters, they will appear in the summary as capital letters also.

Fuel units

Enter the code number for fuel type and units:

1—natural gas (therms)
2—oil (gallons)
3—electricity (KWH)
4—district heating (MBTU)
5—district cooling (MBTU)

Note: The notation MBTU in ASEAM2.1 means 'millions' of BTUS; the abbreviation 'KBTU' is used for 'thousands' of BTUS.

Annual consumption

Enter the annual energy consumption of the miscellaneous item in the units specified in the previous column.

7.4.3 Chiller Screens

ASEAM2.1 can model reciprocating, absorption, centrifugal, and double bundle chillers. The input screens for these four types of chillers are nearly identical so line-by-line definitions for many questions are the same for all four screens. Additional questions pertaining to both the absorption and double bundle chiller are also discussed.

PICENDAT

```
ASEAM2 PLANT INPUT
CENTRIFUGAL CHILLER                                        PLANT FILE:
------------------------------------------------------------------------------
                                                        Type 1    Type 2
Centrifugal Chiller Cooling Capacity
  Chiller cooling capacity (per chiller)                ______    ______    tons
    (or) Percent design load satisfied per chiller      ___       ___       %
  Number of chillers of this capacity                   _         _

Cooling Performance
  Design coefficient of performance                     ____      ____
  Minimum unloading ratio (% of capacity)               __        __        %
  Minimum part load ratio (% of capacity)               __        __        %
  Load management/operating method                      _         _
    (1 = always on   2 = as needed)

Chilled Water Parameters
  Chilled water temperature at design load              ___       ___       oF
  Chilled water temperature at minimum load             ____      ____      oF
  Chilled water flow (blank=autosized)                  ____      ____      gpm
  Chilled water pump KW (blank=autosized)               ____      ____      KW
```

PIABCDAT

```
ASEAM2 PLANT INPUT
ABSORPTION CHILLER                                          PLANT FILE:
--------------------------------------------------------------------------
                                                      Type 1    Type 2
Absorption Chiller Cooling Capacity
  Chiller cooling capacity per chiller (or 'NA')      _____     _____   tons
    (or) Percent design load satisfied per chiller    ___       ___     %
  Number of chillers of this capacity                 _         _
  Heat input energy source (1=Boiler  2=Dist Heat)    _         _

Cooling Performance
  Design coefficient of performance                   ____      ____
  Minimum part load ratio (% of capacity)             __        __      %
  Number of absorption stages                         _         _
  Load management/operating method                    _         _
    (1 = always on   2 = as needed)

Chilled Water Parameters
  Chilled water temperature at design load            ___       ___     °F
  Chilled water temperature at minimum load           ____      ____    °F
  Chilled water flow (blank=autosized)                ____      ____    gpm
  Chilled water pump kw (blank=autosized)             ____      ____    KW
```

PIDBCDAT

```
ASEAM2 PLANT INPUT
DOUBLE BUNDLE CHILLER                                       PLANT FILE:
--------------------------------------------------------------------------
                                                      Type 1    Type 2
Double Bundle Chiller Cooling Capacity
  Chiller cooling capacity (per chiller)              _____     _____   tons
    (or) Percent design load satisfied per chiller    ___       ___     %
  Number of chillers of this capacity                 _         _
Cooling Performance
  Design coefficient of performance                   ____      ____
  Minimum unloading ratio (% of cap - clg mode)       __        __      %
  Minimum unloading ratio (% of cap - htg mode)       __        __      %
  Minimum part load ratio (% of capacity)             __        __      %
  Load management/operating method                    _         _
    (1 = always on   2 = as needed)
Chilled Water Parameters
  Chilled water temperature at design load            ____      ____    °F
  Chilled water temperature at minimum load           ____      ____    °F
  Chilled water flow (blank=autosized)                ____      ____    gpm
  Chilled water pump KW (blank=autosized)             ___       ___     KW
Heat Recovery Parameters
 Design heat recovery temperature                     ___       ___     °F
 Heat recovery backup (1=Boiler   2=Dist Htg)         _         _
```

PIRECDAT

```
ASEAM2 PLANT INPUT
RECIPROCATING CHILLER                                       PLANT FILE:
---------------------------------------------------------------------------
                                                        Type 1    Type 2
Reciprocating Chiller Cooling Capacity
  Chiller cooling capacity (per chiller)                ____      ____      tons
    (or) Percent design load satisfied per chiller      ___       ___       %
  Number of chillers of this capacity                   _         _

Cooling Performance
  Design coefficient of performance                     ____      ____
  Minimum unloading ratio (% of capacity)               __        __        %
  Minimum part load ratio (% of capacity)               __        __        %
  Load management/operating method                      _         _
    (1 = always on    2 = as needed)

Chilled Water Parameters
  Chilled water temperature at design load              ____      ____      °F
  Chilled water temperature at minimum load             ____      ____      °F
  Chilled water flow (blank=autosized)                  ____      ____      gpm
  Chilled water pump KW (blank=autosized)               ___       ___       KW
```

Chiller cooling capacity per chiller

Enter tons *per chiller*. Note that because ASEAM2.1 calculates the chiller's cooling capacity for each bin from variables such as chilled water and condenser water temperatures, the capacity at ARI rating conditions should be entered. This capacity value is then adjusted for conditions other than ARI rating conditions. If multiple chillers are available in the cooling plant, you should specify the cooling capacity of *one* chiller and indicate there are multiple chillers available with this capacity. If you leave this entry blank, the chiller cooling capacity will be autosized, and the next question is asked.

Percent design load satisfied per chiller

Enter percent. The sum of all system energy requirements (using diversified loads) on a given chiller type is used to determine the peak load for the chiller. If you enter 100% (and there is only *one* chiller), the chiller would be perfectly sized (with no excess capacity). If multiple chillers are installed, enter the value *per chiller*.

Design coefficient of performance

Dimensionless. As with the cooling capacity, the cooling COP should be entered at ARI rating conditions. ASEAM2.1 adjusts the design COP for each bin according to the DOE program algorithms.

Minimum unloading ratio

Enter percent of capacity. The minimum unloading ratio is defined as the lowest part-load ratio at which the chiller will operate without false loading itself. If the part-load ratio (actual load/capacity) is less than this value, the chiller is assumed to false load itself up to this part-load ratio. For double bundle chillers, the unloading ratio is specified also for the heat recovery mode.

Minimum part-load ratio

Enter percent of capacity. The minimum part-load ratio is defined as the lowest part-load ratio at which the chiller will operate continuously. That is, if the part-load ratio (actual load/capacity) is less that this value, the chiller is assumed to be cycling on and off.

Number of absorption stages

Enter number 1 or 2. This question is asked for absorption chillers only.

Load management/operating method

Enter the load management/operating method: 1, always on; 2, on as needed. The first method will simulate that all chillers are "on" (regardless of load), possibly causing a low part-load operating efficiency at marginal chiller loads. The second method will simulate that additional chillers will be activated if the total chiller load exceeds the capacity of one chiller.

Chilled water temperature at design load

Enter degrees F. This temperature is used to determine a chilled water reset schedule. See also the following question.

Chilled water temperature at minimum load

Enter degrees F. This temperature is used in conjunction with the above question to determine a reset schedule for the chilled water temperature.

Chilled water flow

Enter gallons per minute. If you leave this line blank, the chilled water flow rate will be autosized.

Chilled water pump KW

Enter in KW. If you leave this line blank, the chilled water pump KW will be autosized.

The following questions are asked for double bundle chillers only:

Design heat recovery temperature

Enter degrees F. This value is the water temperature leaving the condenser of the double bundle chiller when in a heat recovery mode. If there is no calculated heating load on the double bundle chiller, it is assumed to be in a cooling mode.

Heat recovery backup

Enter the backup source for heating energy:

1—boiler
2—district heating

This question is asked when you have specified bundle double chillers as a heating source in the systems input. If the calculated heating load on the double bundle condenser is larger than the heat rejected by the cooling load, the additional heating load is added to the backup source.

Note: ASEAM2.1 assumes that the double bundle chiller operates only when there is a cooling load. Therefore, it will not false load itself to satisfy a heating load.

7.4.4 Cooling Tower Screen

On this screen you specify cooling tower parameters. Although most plant equipment types are specified in the systems input, cooling towers are automatically selected if you have a chiller or if they are specified as the cooling plant type for water source heat pump systems.

ASEAM2.1 assumes that cooling towers are used for all chillers (i.e., closed-loop fluid coolers or air-cooled condensers are not modeled by ASEAM2.1).

PITOWDAT

```
ASEAM2 PLANT INPUT
COOLING TOWER                                                PLANT FILE:
--------------------------------------------------------------------------------
Cooling Tower Heat Rejection Capacity
  Total heat rejection                                        _____  tons
    (or) Percent of design heat rejection load satisfied      ___    %

Tower Performance
  Number of tower cells (blank=autosized)                     _
  Fan KW per cell (blank=autosized)                           ___    KW
  Number of fan speeds (1 or 2)                               _
  Approach temperature                                        __     °F

Condenser Water Parameters
  Condenser water temperature at design load                  ___    °F
  Condenser water temperature at minimum load                 ___    °F
  Condenser water flow rate (blank=autosized)                 ___    gpm
  Condenser water pump KW (blank=autosized)                   ___    KW
```

Total heat rejection capacity
Enter in tons. Because ASEAM2.1 calculates the cooling tower heat rejection capacity for each bin from variables such as condenser water and wet-bulb temperatures, the capacity at ARI rating conditions should be entered. This capacity value is then adjusted for conditions other than ARI rating conditions.

Percent of design heat rejection load satisfied
Enter a percent. The sum of all system and chiller heat rejection requirements is used to determine the maximum load on the tower. If you enter 100% for this question, the tower would be perfectly sized (with no excess capacity).

Number of tower cells
Enter the number. With additional cells, the tower can better regulate the tower-leaving temperature. If you leave this line blank, the number of tower cells will be autosized based on DOE-2 algorithms.

Fan KW per cell

Enter KW. If you leave this line blank, the fan KW per cell will be autosized based on DOE-2 algorithms.

Number of fan speeds (1 or 2)

Enter 1 or 2 to specify the number of fan speeds. With a two-speed fan motor, the condenser water temperature can be lowered by both low- and high-speed fan operation and by natural convection (fans off).

Approach temperature

Enter degrees F. The tower approach temperature is the difference between the condenser-leaving water temperature and the outside air wet-bulb temperature. Since this value may change for each bin calculation, you should enter this value for design (ARI) conditions.

Condenser water temperature at design load

Enter degrees F.

Condenser water temperature at minimum load

Enter degrees F. This value and the above value are used to determine the condenser water reset schedule.

Condenser water flow rate

Enter gallons per minute. If you leave this line blank, the condenser water flow rate will be autosized.

Condenser water pump KW

Enter KW. If you leave this line blank, the pump KW will be autosized.

7.4.5 Domestic Hot Water Screen

On this screen you enter parameters used to calculate the energy consumption for domestic hot water.

PIDHWDAT

```
ASEAM2 PLANT INPUT:
DOMESTIC HOT WATER                                          PLANT FILE:
--------------------------------------------------------------------------
Domestic Hot Water Energy Source
  Domestic Hot Water Energy Source                                _
    (0=None  1=Electric  2=Nat Gas  3=Oil  4=Boiler  5=District)
      (if oil)  Oil Type (2 or 4 or 6)                            _
      (if gas)  Annual pilot consumption                          ___  therms
DHW Capacity and Usage
  Domestic Hot Water Heating Capacity (blank=autosized)           ____ KBTUH
    (if autosized) Peak hourly DHW usage                          ____ gal/hour
  Average hourly DHW usage - occupied cycle                       ____ gal/hour
  Average hourly DHW usage - unoccupied cycle                     ____ gal/hour
DHW Temperatures
  Domestic hot water supply temperature                           ___  °F
  DHW inlet temperature - design summer                           __   °F
  DHW inlet temperature - design winter                           __   °F
Circulating Pumps
  Circulating pump KW - occupied cycle                            ___  KW
  Circulating pump KW - unoccupied cycle                          ___  KW
DHW Efficiency and Losses
  Design DHW heating efficiency                                   ___   %
  DHW losses - occupied cycle                                     _____  BTUH
  DHW losses - unoccupied cycle                                   _____  BTUH
```

Domestic hot water energy source

Choose from the following domestic hot water energy sources:

0—none
1—electric
2—natural gas
3—oil
4—boiler
5—district

ASEAM2.1 assumes the existence of a separate DHW heater if you select option 1, 2, or 3. If either of the last two options is chosen, the domestic hot water load is added to any existing boiler or district heat load.

Oil type

Enter 2 or 4 or 6. If the domestic hot water energy source is oil, specify the type of fuel oil.

Annual pilot consumption

Enter therms. For a gas water heater, enter annual consumption of the pilot.

The next four questions specify the DHW capacity and usage:

Domestic hot water heating capacity

Enter KBTUH. Enter the domestic hot water heating capacity if it is known. Leave blank if you want autosizing.

Peak hourly DHW usage

Enter gallons per hour. This value is used to the DHW heater if you select autosizing.

Average hourly DHW usage (occupied cycle)

Enter gallons per hour. This value, along with usage during the unoccupied cycle (below), is used to specify the consumption load.

Average hourly DHW usage (unoccupied cycle)

Enter gallons per hour.

The next three questions pertain to domestic hot water temperatures:

Domestic hot water supply temperature

Enter degrees F. This is the domestic hot water heater discharge temperature, assumed to be constant throughout the year.

DHW inlet temperature (design summer)

Enter degrees F. This is the inlet water temperature at design summer outside temperature. Note that the inlet temperature is reset on outdoor air temperature (see also the following question).

DHW inlet temperature (design winter)

Enter degrees F. This is the inlet water temperature at design winter outside air temperature.

The next two questions pertain to the circulating pump:

Circulating pump KW (occupied cycle)

Enter KW. Enter any of the building's additional DHW pump power requirements for the occupied cycle.

Circulating pump KW (unoccupied cycle)

Enter KW. Note that in some cases, the circulating pump may be turned off in the unoccupied cycle, so a '0' value would be appropriate.

The following three questions pertain to domestic hot water heater efficiencies and losses:

Design DHW heating efficiency

Enter percent. The design efficiency of the DHW heater is adjusted for each bin according to efficiency equations found in the DOE program. Because ASEAM2.1

differentiates only between occupied and unoccupied cycles, average hourly usage and demand must be used. This results in relatively low efficiencies on a bin basis.

DHW losses (occupied cycle)
Enter BTUH. These are heat losses that may occur in the system during the occupied cycle, such as tank and pipe transmission losses. The losses are added to the usage load to determine the total load on the DHW plant.

DHW losses (unoccupied cycle)
Enter BTUH.

7.4.6 Boiler Screen

The boiler input screen appears if a boiler was specified during systems input as the energy source of either baseboard, preheat, heating, or humidification. It is also possible for the boiler to be the backup energy source for a double bundle chiller heat recovery system, the heat source for an absorption chiller, as well as the supplier of domestic hot water heating energy.

Regardless of the source of the heating requirements, all loads are added together to determine the total boiler load. When autosizing, it is possible that the boiler capacity is based on the absorption heat requirement rather than the maximum heating load demand.

PIBLRDAT

```
ASEAM2 PLANT INPUT
BOILER                                                  PLANT FILE:
---------------------------------------------------------------------------
Boiler Energy
  Boiler Energy Source                                  _       _
    (1=Electric   2=Nat Gas   3=Oil)
      (if oil)  Oil type (2 or 4 or 6)                  _       _
      (if gas)  Annual pilot consumption                ____    ____   therms
Boiler Heating Capacity
  Boiler heating capacity (per boiler)                  ______  ______ KBTUH
    (or) % max heating load satisfied (per boiler)      ___     ___    %
  Number of boilers with this capacity                  _       _
  Load management/operation                             _       _
    (1 = always on    2 = as needed)
Boiler Performance
  Boiler efficiency method (1=user entered   2=calc)    _       _
  Design boiler efficiency                              ____    ____   %
  (if calc) Combustion air temperature                  ___     ___    °F
  (if calc) Stack temperature                           ___     ___    °F
  (if calc) Air-Fuel ratio                              ____    ____   Lb/Lb
  Minimum part load operating ratio (% of capacity)     __      __     %
  Boiler pump KW (blank=autosized)                      ___     ___    KW
  Boiler losses - percent of capacity                   __      __     %
  Boiler losses - percent of load                       __      __     %
```

Boiler energy source

Choose from the following boiler energy sources:

1—electric
2—natural gas
3—oil

Select the boiler's energy source. If the fuel used for heating is not on the list, you are advised to select district heat as the heating source, and manually calculate the total fuel consumption from the total district heat requirement (which assumes 100% conversion efficiency).

Oil type

Enter 2 or 4 or 6. If the boiler energy source is oil, specify the type of fuel oil.

Annual pilot consumption

Enter therms. For a gas boiler, enter the annual consumption of the pilot. Note that these losses are not considered a heating load on the boiler, but are totaled at the end of the calculations.

Boiler heating capacity (per boiler)

Enter KBTUH. Enter the boiler design heating capacity (per boiler) in KBTUH here. This input is not required if the percent of maximum heating load satisfied is entered below. If multiple boilers are available in the heating plant, you should specify the heating capacity of *one* boiler and indicate there are multiple boilers available with this capacity.

Percent of maximum heating load satisfied (per boiler)

Enter the percent of the maximum heating load satisfied per boiler. A value of 100% indicates perfect sizing if there is only one boiler. This input is not required if the boiler heating capacity is entered above.

Number of boilers with this capacity

Enter the number of boilers with the capacity entered in the previous questions.

Load management or operation

Choose the method of boiler management or operation: 1, always on; 2, on as needed.

The first method simulates all boilers as "on" (regardless of load), possibly causing a low part-load operating efficiency at marginal boiler loads. The second method simulates additional boilers being activated if the total boiler load exceeds the capacity of one boiler.

Boiler efficiency method

Specify the method used to calculate boiler efficiency: 1, user-entered; 2, calculated.

The user-entered method uses the DOE-2 program algorithms, whereas the calculated method uses the BLAST algorithms. Electric boilers can only use the user-entered method. If you use the "calculated" efficiency method, you will enter several inputs below.

Design boiler efficiency

Enter percent. ASEAM2.1 uses the boiler algorithms from the DOE program manual. The actual bin efficiency is therefore calculated for each bin and is a function of many variables, one of which is the design efficiency. If you specify the "calculated" efficiency method above, this question is not asked.

The next three questions are asked if the boiler efficiency is to be calculated for a fossil fuel boiler:

Combustion air temperature
Enter degrees F.

Stack temperature
Enter degrees F.

Air-fuel ratio
Enter pounds of air per pound of fuel.

Minimum part-load operating ratio (percent of capacity)
Enter percent of capacity. The minimum part-load operating ratio is the smallest part-load ratio at which the boiler can operate continuously without cycling on and off.

Boiler pump KW
Enter KW. Enter the boiler hot water pump KW requirements. If you leave this line blank, the pump KW will be autosized and assume a pump exists. If you have a steam boiler, enter '0'.

Boiler losses—percent of capacity
Enter percent of capacity. These losses are totaled with the heating load on the boiler to determine total boiler load. Examples of such losses include stand-by heat losses for an idling boiler, steam trap losses, and piping heat loss.

Boiler losses—percent of load
Enter percent of load. These losses are calculated as a percentage of the heating load, not boiler capacity. These losses are totaled with the heating load on the boiler to determine total boiler load. Examples may include piping heat loss where the hot water temperature is reset on outside air.

This concludes the discussion of the plant input screens. You have now defined loads, systems, and plant for a building. You may proceed to the calculations by exiting from the Plant Input segment (remember to save your file) and entering the Specify Analyses segment from the Main Menu.

8 Energy Conservation Opportunity (ECO) Input

8 Energy Conservation Opportunity (ECO) Input

8.1 Introduction

Once a building has been operated for some time, the owners or operators may decide that it is worthwhile to consider retrofitting its structure, operating profile, or HVAC system to reduce energy consumption. Such measures are called Energy Conservation Opportunities (ECOs). ASEAM2.1 can model the effects of ECOs, both individually and in combination, on the building's overall energy consumption.

The determination of which ECOs to consider initially needs to be decided upon by you and the building owners and operators. Chapter 4 discusses some factors to be considered when selecting ECOs. Generally, you will model a number of ECOs individually and select from these a subset of cost-effective ECOs. Then you can model various combinations of ECOs to evaluate the economic feasibility of the entire package of ECOs.

There are many hand-calculation methods for determining the energy savings due from a particular ECO. These have the advantage of being quick and simple to perform. Hand-calculation methods, however, cannot account for the interactive effects of more than one ECO. For example, if you want to determine the combined energy savings resulting from increasing wall insulation, weatherstripping doors and windows, and reducing the thermostat setpoint, you would perform three separate calculations and then add the savings together. The result would not be accurate, however, because if the thermostat setpoint is reduced, the savings due to increased wall insulation are reduced because of the smaller indoor-outdoor temperature difference.

ECOs can be modifications of loads, systems, or plant parameters. The initial ECOs to be considered will probably be determined by a building energy audit or inspection of the building's energy bills. Lists of ECOs can be found in numerous publications. One excellent source is the "Architects and Engineers Guide to Energy Conservation in Existing Buildings." It is not the purpose of this manual to discuss possible ECOs and their applicability. Rather, once a list of potential ECOs has been determined, this section instructs the user how to model them with ASEAM2.1 to determine their projected energy savings.

ASEAM2.1 models ECOs by repeating simulation runs of a base-case building whose parameters are changed by varying ECO variables. You could perform this simulation by creating numerous input files, each basically the same but with a few values changed for the ECOs. To save disk space and user input time, ASEAM2.1 has an ECO input routine. First you define the base-case file completely. Next, the base-case file is referenced, and you define any number of ECOs, each of which modifies one or more input parameters. The changes are stored in files (much smaller than the complete input files) and are referenced from the "Specify Analyses" segment of the program.

Every ECO file name will have the form: AAAA###L.TEC

1. AAAA is a user-specified prefix.
2. ### is a number that identifies the type of ECO.
3. L is a letter that identifies the number of the type ### (above) ECO

(A is the first ECO of type ###, B the second, etc.).

4. TEC is the suffix that identifies the type of ECO:
   LEC—Loads ECO
   SEC—Systems ECO
   PEC—Plant ECO

You will need to use this file-naming convention in the Specify Analyses segment, when you are asked to identify which ECO files are to be used in the simulation.

8.1.1 Conventional ECO Modeling

When using any computer program to calculate the energy savings resulting from an ECO, the "normal" method of performing the analysis has several steps:

1. Define the base case input files and perform calculations with these files.

2. Change input variables in the base case input files to reflect the ECO and perform the calculations with these new sets of input files.

3. Manually determine the resultant energy savings by subtracting the ECO energy usage from the base case annual energy usage.

4. Perform Life-Cycle cost calculations if desired.

5. Repeat steps 2 through 4 for each ECO.

In the method described above, each ECO requires a separate input data file. If you desire to investigate all possible combinations of five individual loads ECOs, this would require 32 separate loads input files. Each individual loads input file would model either one ECO or any combination of up to five individual ECOs. ASEAM2.1 can model ECOs in this manner. Since each ECO or ECO combination is modeled in a separate input file, ASEAM2.1 refers to these type files as "batch" ECO files.

There are many limitations to this method:

- As described above, many complete input files are required.

- The calculation of the resultant energy savings must be performed manually by subtracting the ECO energy usage from the base case energy usage.

- Life-Cycle cost analysis is not integrated.

ASEAM2.1, on the other hand, requires less input time, automatically compares the ECO with the base case energy consumption, and integrates the LCC calculations.

8.1.2 ASEAM2.1 ECO Modeling

Simple ECOs

Many simple ECOs only require a minimal change to the base case input files (e.g. changing the wall U-factor for insulation, minimum outside air percent for systems, etc.). The ASEAM2.1 ECO Input Program was specifically designed for these simple ECOs. In the ECO Input Program, you first specify what input screen contain the input data that is to be changed for an ECO. For example, to model an ECO for adding wall insulation, you would want to change the U-Factor value in the "wall" screen of the base case loads input file. If you wanted to investigate both R-19 and R-27, you would specify two wall ECOs.

After you specify the number of ECOs for each ECO type (or input screen), ASEAM2.1 will first ask some general information about the ECO (ECO description, file name for storage). Then, ECO input screens appear for each ECO selected. These ECO input screens appear vary similar to the normal loads, systems, and plant input screens. Some of the normal input questions do not appear in the ECO screen (e.g. wall orientation, area, etc.). The base case information is shown on the input screen, and you may change any input value (or combination of input values) in the ECO input screen. You can only change the information in the base case file - you cannot add window sections, for example, since the area and window orientation would not be known. After you edit the values in the base case files, the new values are automatically stored in a small ECO file for each ECO type - not a complete new loads input file.

Note that ASEAM2.1 does not refer to ECOs by "names" - but rather by "types". That is, "Install Economizer Controls" or "Reduce Outside Air Intake" are never explicitly defined as ECOs by name. To model these ECOs, you must access the "Outside Air Controls" input screen for systems ECOs. To investigate different possible combinations of outside air controls (e.g. enthalpy versus dry bulb economizer, with different minimum percent outside air intake), you would indicate multiple "Outside Air Control" ECO types. For example, four "Outside Air Control" ECOs would be requested to simulate the following:

ECO #1	Install Enthalpy Economizer (same minimum %)
ECO #2	Install Dry Bulb Economizer with (75 deg switchover) (same minimum percent outside air)
ECO #3	Install Enthalpy Economizer (reduced minimum %)
ECO #4	Install Dry Bulb Economizer with (75 deg switchover) (reduced minimum percent outside air)

Complex ECOs

Many ECOs cannot be modeled as simple changes to a particular input screen. Examples would include changing the system or plant type, replacing window areas with walls, or adding daylighting. To model these more complex ECOs, you must use the normal loads, systems, and plant input programs to reflect the required changes in all input screens. Complete new loads, systems, and plant files (with different file names) must be saved. These ECOs are referred to as "batch" ECOs.

Complex ECOs cannot be modeled with the ECO input program since many different screens must be accessed for an ECO.

Before attempting to model an ECO, you must first decide whether the ECO input program can be used, or whether you must edit existing base case files with the normal loads, systems, and plant input programs ("batch" ECOs). The ECO input program should be used whenever possible. However, you can always use the "batch" ECO method.

The ECO input program can be used only if all the input changes required for an ECO are available on the ECO input screens. Therefore, you must first review the ECO input screens in sections 8.3 (Loads ECOs), 8.4 (Systems ECOs), and 8.5 (Plant ECOs). If all the inputs requiring changes can be found in these sections, you should use the ECO input program. If you cannot completely model an ECO by changing values in these ECO input screens, you must use "batch" ECO files.

Reset Schedule ECOs

Some specific ECOs cannot be modeled directly by ASEAM2.1. However, if the change in the zone load or plant load can be calculated, ASEAM2.1 can account for these load changes as a Reset Schedule ECO. Examples would include adding moveable insulation to windows at night or using heat recovery to reduce the boiler load. ASEAM2.1 includes two ECO input screens (Loads Reset Schedule #240 and Systems Reset Schedule #410) that allow you to change the loads on the systems and plant. You must first determine the change in BTUH load as a function of outside air temperature (i.e. a slope and intercept must be determined).

Example: Moveable Window Insulation at Night

Assume the following base case conditions:
    window area = 500 square feet
    U-Factor (same for occupied and unoccupied cycles) = .57
    Unoccupied cycle thermostat setpoint = 60 deg F.
    Design winter outside air temperature = 10 deg F.

Assume the following ECO conditions:
    U-Factor during the unoccupied cycle only = .10
    (all other values are the same as the base case)

Heat loss through windows at night = U * Area * (Toa - Tspace)

At design winter (10 deg F)
    Present heat loss = (.57)(500)(10-60) = -14,250 BTUH
    ECO heat loss = (.10)(500)(10-60) = -2,500 BTUH

At 60 deg F outside temperature, the heat losses in both cases would be zero since the temperature difference is zero.

Therefore, the change in load (ECO load minus base case load) for this ECO would be:

11,750 BTUH at 10 deg F (positive value)
0 BTUH at 60 deg F

The slope and intercept representing these two points is:
Slope = -235 BTUH/deg F (negative number)
Intercept = 14,100 BTUH (positive number)

The above two values (slope and intercept) would be entered for the slope adjustment and constant change respectfully in the Loads Reset Schedule ECO input screen (see section 8.3.15). Note that these values only "adjust" the loads up or down. Be sure to use positive adjustments for additional cooling loads (or reduced heating loads). DO NOT USE THE WRONG SIGNS FOR THESE VALUES.

The Reset Schedule ECOs allow you to use up to four different slope and intercept (constant) adjustment schedules per zone or system. Additionally, each schedule number can apply to different months and occupied or unoccupied cycle. Assuming the above two values were entered as schedule #1, they could be used only during the unoccupied cycle during the months of September through April, for example. Each zone or system has separate Reset Schedule ECO screens (the window area, for example, could be different between zones one and two).

Example - Heat Recovery

Assume a heat recovery device was installed as an ECO, and it reduced the boiler load during the months of October through April by 10,000 BTUH. In this case, the boiler load reduction is not dependent on the outside air temperature, and the slope adjustment would be entered as zero. The constant change input value would be entered as -10,000 (BTUH). Note that negative numbers represent load reductions and positive numbers indicate additional loads. You must use the System Reset Schedule (see section 8.4.12) for this ECO since it reduces the plant load. The Loads Reset Schedule ECO only adjusts the systems load.

8.1.3 ASEAM2.1 ECO Calculations

After you have created ECO files from the ECO input program or "batch" ECO files from the loads, systems, or plant input programs, you are ready to perform the energy calculations for these ECOs. If Life-Cycle cost analysis is desired, you should also create LCC input files to be used for each ECO or combination.

During the "Specify Analysis" segment (see Chapter 11) you define which files are to be used in the calculations. There are two calculation modes for ECOs: Single ECO Run Mode, and Multiple ECO Run Mode. In both modes, you begin by defining the base case input files to be used. Then separate input screens appear for the two modes:

Single ECO Run Mode - in this mode, you may enter only one new file name for the ECO calculations. This may be a file created by the ECO input program (e.g.

wall ECO), or it may be a completely different "batch" loads, systems or plant input file. Up to 40 different ECO calculations can be performed in this mode.

Multiple ECO Run Mode - in this mode you may enter several different ECOs files to be considered together for the calculations. That is, the combined effects of wall insulation, storm windows, economizer controls, increased chiller COP, etc. can be specified. If only one ECO is specified in this mode, the effect would be similar to the Single ECO Run Mode. Up to twenty different sets in ECO input files (combination runs) can be specified in this mode.

During the calculations, three "preprocessor" programs (for loads, systems, and plant) determine which input data is to be used for the calculations. Each preprocessor program first determines which loads, systems, or plant input file should be used and read into memory. This could be either the base case input files or batch ECO files. Next, if an ECO input file was specified (created in the ECO input program), the program reads the specified files and "substitutes" the new values for the base case values. Next, the Reset Schedule ECOs, if specified, are read in to adjust the loads on the systems or plant. Finally, the preprocessor passes the input values and loads to the correct calculation program. (Note: these preprocessor programs also make similar "substitutions" in the parametric run mode).

From the above discussion, you may note that only one complete input file (loads, systems, or plant) is read into memory at the beginning. Therefore, only one batch type loads, system or plant ECO file can be used for any ECO calculation. (If the second batch file of the same type was read into memory, it would completely overwrite the first file). In the multiple ECO run mode, you could specify different ECO files for each calculation segment (loads, systems, and plant). Secondly, only one ECO of a particular type (e.g. wall, outside air control, etc.) can be used in any ECO calculation. If a second wall ECO input file was read in, for example, the changed data from the first wall ECO would be lost. Therefore, if you want to model combinations of ECOs of the same type, you must specify multiple ECOs in the ECO input program. For example, if you wanted to consider both reducing the shading coefficient and weatherstripping the windows individually and in combination, you must specify three window type ECOs in the ECO input program. The first two ECOs would reflect the ECOs individually and the third would reflect the combination.

8.2 Entering ECO Data

The ECO input program is divided into loads, systems, and plant segments like the standard input routines. Before accessing the ECO input, first make sure that the base case files are on the data disk in drive B. From the ASEAM2.1 Main Menu, choose "Input Data" and then "ECO" from the pull-down menu:

ASEAM2.1 MAIN MENU

```
Input Data    Print Reports    Specify Analyses    Run Calcs    Exit DOS
 Loads
 Systems
 Plant
 FBLCC
 NBSLCC
 ECO
 Quick
 Weather
 Exit
```

The ASEAM2.1 ECO Input Menu will appear on the screen:

ASEAM2.1 ECO INPUT

```
Select ECOs (New Data)      Edit Existing ECOs      Exit
```

The ECOs that you will model will fall into the loads, systems, or plant category. You will enter these one category at a time. To enter new ECOs, choose the "Select ECOs" option. Use "Edit Existing ECOs" to change ECO data entered previously.

8.3 Loads ECOs

To begin with the loads ECOs, choose "Loads" from the pull-down menu. A directory of existing loads input files on the disk will be shown. Indicate the input file that is to be used as the base case file. If there are no loads input data files on the disk, an error message will be issued, and you should insert a diskette with loads input files in drive B.

The next screen asks you to specify the number of ECOs for each type. To do this, you must know how a given ECO will change the base-case building parameters. For example, adding wall insulation will change the wall U-factor and is therefore a wall ECO. Adding weatherstripping will change the leakage coefficient for doors and windows and is therefore both a window and a door ECO. Before using the ECO input routine, you should have a list of ECOs and the new input values for each ECO. From this list, enter the number of ECOs for each type on this screen.

```
LOADS ECO SELECTION
-------------------------------------------------------------------------------
                    Enter the number of analyses for each type

               100 - Wall                                _
               110 - Roof                                _
               120 - Window                              _
               130 - Door                                _
               140 - Infiltration                        _
               150 - Miscellaneous Conduction            _
               160 - Lighting                            _
               170 - Miscellaneous Electric              _
               180 - Miscellaneous Sensible              _
               190 - Daylighting                         _
               200 - Diversity Factors                   _
               210 - Occupancy Schedules                 _
               220 - Thermostat Setpoints                _
               230 - Building Schedules                  _

               240 - Special - User Entered              _
                     Loads Reset Schedule on Systems
```

For every ECO there is a screen of general data, which looks like this:

```
General ECO Data                                         Input File:SAMPLE
ECO Type - Type                  ECO No: ###   Case No: #
-------------------------------------------------------------------------------
Enter the description of the ECO below
Line 1   ____________________________________________________________
Line 2   ____________________________________________________________
Line 3   ____________________________________________________________
Line 4   ____________________________________________________________
Line 5   ____________________________________________________________


Four Character Filename Prefix                               ____
```

The ECO type, number, and case number will be listed at the top of the screen. Enter a description of the ECO (this description does not appear on any report - it is for your reference only) and a four character file name prefix. The complete file name, as explained in Section 8.1, will be the four-character prefix, the ECO number, and a letter designating the case of this ECO type. Keep note of these file names, because you will choose the ECOs by these names when you Specify Analysis.

The following screens pertain to the type of ECO. They look very much like the input screens for the same components (e.g., walls or windows). The difference is that only values which may be changed by ECOs are shown on the screen. For example, neither changing the wall area nor orientation are considered as ECOs, so the area and orientation data are omitted from the Wall ECO screens.

Any of the components that were originally input by zone will have one ECO screen for each zone. Thus, it is possible to model, for example, only the ECO of installing wall insulation in the north walls. The ECO input screens will initially display the base case data for all components. To enter the changes due to an ECO, edit the data just as you would normally. Once you have completed all the screens for the ECO (which may be just one screen, as in the case of operating hours, or one screen per zone, as in the case of a wall ECO), a file will automatically be written that contains the data for this ECO.

The ECO Input routine will go through all the ECOs that you identified on the first screen. All ECOs of one type will be completed before moving to the next type.

All types of ECOs are shown below. The screens contain data from a sample base case file. Note that an ECO screen will never appear without data unless the original base case file had no data. This may occur occasionally (for example, a core zone will not have any data entered for windows), but in general ECO screens will be shown with existing, base case data.

8.3.1 Wall ECOs #100 (1 screen per zone)

```
ASEAM2 ECO INPUT: ZONE  1 - South Exposure                 Input File:SAMPLE
WALL ECOS                          ECO No: 100   Case No: 1   ECO File:SAMP100A
-------------------------------------------------------------------------------
WALLS                              Wall 1     Wall 2     Wall 3     Wall 4
Name (Optional)                    South_____ NA________ NA________ NA________

U-Factor (BTUH/ft²-°)              .10__      _____      _____      _____
Wall Construction Group            D          _          _          _
Color Correction                   .83        ___        ___        ___

          Wall Construction Groups - see page F26.9 ('A' through 'G')
          Color Correction Codes     1=Dark   .83=Medium   .65=Light
```

8.3.2 Roof ECOs #110 (1 screen per zone)

```
ASEAM2 ECO INPUT: ZONE  1 - South Exposure                 Input File:SAMPLE
ROOF ECOS                          ECO No: 110   Case No: 1   ECO File:SAMP110A
-------------------------------------------------------------------------------
ROOFS                              Roof 1     Roof 2
Name (Optional)                    Roof 1____ NA________

U-Factor (BTUH/ft²-°)              .10__      _____
Roof Construction Code             6_         __
Color Correction                   .1__       ___

       Roof Construction Codes - see ASHRAE F26.8 T5 - numbers 1 thru 13
       Color Correction Codes   1 = Dark Colored or in an industrial area
                               .5 = permanently light colored or in rural area
```

8.3.3 Window ECOs #120 (1 screen per zone)

```
ASEAM2 ECO INPUT: ZONE  1 - South Exposure                 Input File:SAMPLE
WINDOW ECOS                        ECO No: 120   Case No: 1   ECO File:SAMP120A
-------------------------------------------------------------------------------
WINDOWS                              Window 1   Window 2   Window 3   Window 4
Name (optional)                      Window 1__ NA________ NA________ NA________

Shading coefficient                  .8_        ___        ___        ___
U-Factor (BTUH/ft²-°)                .57_       ____       ____       ____
Leakage coefficient                  4_         __         __         __
```

8.3.4 Door ECOs #130 (1 screen per zone)

```
ASEAM2 ECO INPUT: ZONE  1 - South Exposure                    Input File:SAMPLE
DOOR ECOS                               ECO No: 130   Case No: 1   ECO File:SAMP130A
--------------------------------------------------------------------------------
DOORS                                          Door 1        Door 2

Name (optional)                                NA________    NA________

U-Factor (BTUH/ft²-°)                          _____         _____
Leakage coefficient                            ___           ___
```

8.3.5 Infiltration ECOs #140 (1 screen per zone)

```
ASEAM2 ECO INPUT: ZONE  1 - South Exposure                    Input File:SAMPLE
INFILTRATION ECOS                       ECO No: 140   Case No: 1   ECO File:SAMP140A
--------------------------------------------------------------------------------
INFILTRATION

Occupied air change rate                            1___  Air changes per hour

Unoccupied air change rate                          1___  Air changes per hour

          These entries exclude infiltration by crack length method
```

8.3.6 Miscellaneous Conduction ECOs #150 (1 screen per zone)

```
ASEAM2 ECO INPUT: ZONE  1 - South Exposure                    Input File:SAMPLE
MISCELLANEOUS CONDUCTION                ECO No: 150   Case No: 1   ECO File:SAMP150A
--------------------------------------------------------------------------------
MISCELLANEOUS CONDUCTION                                 Type 1        Type 2

Name (Optional)                                          NA__________  NA__________

U-Factor (BTUH/ft²-°)                                    _____         _____
Reference temperature at design summer (°F)              _____         _____
Reference temperature at design winter (°F)              _____         _____
```

8.3.7 Lighting ECOs #160 (1 screen per zone)

```
ASEAM2 ECO INPUT: ZONE  1 - South Exposure                  Input File:SAMPLE
LIGHTING ECOS                     ECO No: 160    Case No: 1   ECO File:SAMP160A
-------------------------------------------------------------------------------
                                  Ltg Func 1 Ltg Func 2 Ltg Func 3 Ltg Func 4
Function name (optional)         LF 1______ NA________ NA________ NA________

Installed watts/ft²               2.25_      _____      _____      _____
 (times) Percent of zone area     100        ___        ___        ___
  (or) Total installed watts      ________   ________   ________   ________

Percent light heat to space (%)   100        ___        ___        ___
'A' classification                .55        ___        ___        ___
'B' classification                B          _          _          _

          A classification - .45, .55, .65, .75  (See ASHRAE F26.19 T15)
          B classification -  A, B, C, D         (See ASHRAE F26.19 T16)
```

8.3.8 Electrical Equipment ECOs #170 (1 screen per zone)

```
ASEAM2 ECO INPUT: ZONE  1 - South Exposure                  Input File:SAMPLE
EQUIPMENT ECOS                    ECO No: 170    Case No: 1   ECO File:SAMP170A
-------------------------------------------------------------------------------
ELECTRICAL EQUIPMENT                             Type 1         Type 2

Electric equipment name (optional)               Misc__________ NA____________

Installed watts/ft²                              .25__          _____
  (times) Percent of zone area                   100            ___
  (or) Total installed watts                     ________       ________

Hooded (Y/N)                                     N              _

                   All watts are converted to space heat gains
```

8.3.9 Miscellaneous Sensible Loads ECOs #180 (1 screen per zone)

```
ASEAM2 ECO INPUT: ZONE  1 - South Exposure                   Input File:SAMPLE
MISCELLANEOUS SENSIBLE LOADS       ECO No: 180   Case No: 1   ECO File:SAMP180A
-------------------------------------------------------------------------------
MISCELLANEOUS SENSIBLE LOADS                     Type 1         Type 2

Load source name (optional)                      NA__________   NA__________

Installed BTUH/ft²                               _____          _____
  (times) Percent of zone area                   ___            ___
  (or) Total installed BTUH                      _____          _____

Hooded (Y/N)                                     _              _

Enter Heat Gains as (+) and Heat Losses as (-)
```

8.3.10 Daylighting ECOs #190 (2 screens per zone)

```
ASEAM2 ECO INPUT: ZONE  1 - South Exposure                   Input File:SAMPLE
DAYLIGHTING ECOS                   ECO No: 190   Case No: 1   ECO File:SAMP190A
-------------------------------------------------------------------------------

                                   Ltg Func 1 Ltg Func 2 Ltg Func 3 Ltg Func 4
Function name (Optional)            NA_______  NA_______  NA_______  NA_______

Glass visible transmittance (%)     ___        ___        ___        ___
Wall reflectance (%)                ___        ___        ___        ___
Design footcandles for space        ___        ___        ___        ___
Control type ('D'im or 'S'tep)      _          _          _          _
```

```
ASEAM2 ECO INPUT: ZONE  1 - South Exposure                   Input File:SAMPLE
DAYLIGHTING ECOS (CONTROLS)        ECO No: 190   Case No: 1   ECO File:SAMP190A
-------------------------------------------------------------------------------

                                   Ltg Func 1 Ltg Func 2 Ltg Func 3 Ltg Func 4
Function name (optional)           NA_______  NA_______  NA_______  NA_______

For Dimming Control Only
  Minimum FC maintained by lights  ___        ___        ___        ___
  % of total power at min FC (%)   ___        ___        ___        ___

For Stepped Control Only
  Number of Steps (max=4)          _          _          _          _
    Step 1 artificial FC           ___        ___        ___        ___
    Step 1 lighting watts          ___        ___        ___        ___
    Step 2 artificial FC           ___        ___        ___        ___
    Step 2 lighting watts          ___        ___        ___        ___
    Step 3 artificial FC           ___        ___        ___        ___
    Step 3 lighting watts          ___        ___        ___        ___
    Step 4 artificial FC           ___        ___        ___        ___
    Step 4 lighting watts          ___        ___        ___        ___
```

8.3.11 Operating Use Profiles ECOs #200 (1 screen per zone)

```
ASEAM2 ECO INPUT: ZONE  1 - South Exposure                    Input File:SAMPLE
OPERATING USE PROFILES (DIVERSIT  ECO No: 200   Case No: 1   ECO File:SAMP200A
------------------------------------------------------------------------------
                                               OCCUPIED  UNOCCUPIED MONTHLY DIV FC
                                                PERIOD     PERIOD    TABLE # (1-4)
People:
           Average % of full occupancy          100_       0___       1___

Lights:
           Average % of installed capacity      100_       0___       1___
           Average % of installed capacity      ____       ____       ____
           Average % of installed capacity      ____       ____       ____
           Average % of installed capacity      ____       ____       ____

Electric Equipment:
           Average % of installed capacity      100_       0___       1___
           Average % of installed capacity      ____       ____       ____

Miscellaneous Sensible Loads:
           Average % of installed capacity      ____       ____       ____
           Average % of installed capacity      ____       ____       ____
```

8.3.12 Occupancy Schedule ECOs #210 (1 screen only)

```
ASEAM2 ECO INPUT                                              Input File:SAMPLE
OCCUPANCY SCHEDULES ECOS          ECO No: 210   Case No: 1   ECO File:SAMP210A
------------------------------------------------------------------------------
    Enter the typical OCCUPIED schedule - Use military time (5:30 pm = 1730)

            Values should be in 'hundreds' of hours  - 8 am = 800

              If UNOCCUPIED for entire day - use   0  to  0
              If OCCUPIED for entire day   - use   0  to  2400

                    Day of Week

                    Weekdays .... from   800_  to   1800
                    Saturdays ... from   0___  to   0___
                    Sundays ..... from   0___  to   0___
```

8.3.13 Thermostat ECOs #220 (1 screen per zone)

```
ASEAM2 ECO INPUT: ZONE  1 - South Exposure                  Input File:SAMPLE
THERMOSTAT ECOS                  ECO No: 220   Case No: 1   ECO File:SAMP220A
------------------------------------------------------------------------------

Zone label                       South Exposure__________________________

Thermostat Set Point Temperatures
  Summer occupied temperature                                  78__  °F
  Winter occupied temperature                                  68__  °F
  Winter unoccupied temperature                                60__  °F
```

8.3.14 Operating Schedule ECOs #230 (1 screen only)

```
PROJECT DATA SCREEN 2
OPERATING SCHEDULE ECOS          ECO No: 230   Case No: 1   ECO File:SAMP230A
------------------------------------------------------------------------------

Operating Schedules:
  Typical weekday occupancy starting hour                      8_
  Typical weekday operating hours per day                      10
    (Use only 8, 10, 12, 14, 16)

Summer thermostat schedule beginning month number              5_
Summer thermostat schedule ending month number                 10
```

8.3.15 Special Loads Reset Schedule ECOs #240 (1 screen per zone)

This screen, unlike all the others, does not correspond to any screen in the standard input set. It is used for ECOs that cannot be modeled directly by ASEAM2.1. Any ECO that ASEAM2.1 cannot handle can nonetheless be simulated providing that you can estimate how it will change the building load profile. You must estimate how the ECO will affect the building load, and this data can be input to the program, thereby changing the load that is passed on to the system calculations. See Section 8.1.2 for an example.

Be careful when redefining the load curve. The changes made in the slope and the intercept will adjust the ASEAM2.1 load calculations.

```
ASEAM2 ECO INPUT: ZONE  1 - South Exposure                    Input File:SAMPLE
LOADS RESET SCHEDULE                 ECO No: 240   Case No: 1   ECO File:SAMP240A
---------------------------------------------------------------------------------
Enter Loads Reset Schedule in BTUH
Schedule #1    Slope Adjustment  ________  Constant Change  ________
Schedule #2    Slope Adjustment  ________  Constant Change  ________
Schedule #3    Slope Adjustment  ________  Constant Change  ________
Schedule #4    Slope Adjustment  ________  Constant Change  ________

Applicable Months - Enter Schedule # (or 'blank')
          Occupied Schedule #        Unoccupied Schedule #
January              _                          _
February             _                          _
March                _                          _
April                _                          _
May                  _                          _
June                 _                          _
July                 _                          _
August               _                          _
September            _                          _
October              _                          _
November             _                          _
December             _                          _
```

8.4 Systems ECOs

Systems ECOs are input in the same way as loads ECOs. Enter the systems ECO input by choosing "Systems" from the ECO Menu. Next, indicate which existing systems input file is to be used for the base-case file. If there are no systems input files on the disk, an error message will be issued; insert the disk with the correct input file in drive B and try again. Remember that the loads, systems, and plant base-case data files must all be on the same data disk.

The first screen will ask you how many ECOs of each type you will model.

```
SYSTEMS ECO SELECTION

-------------------------------------------------------------------------------
                   Enter the number of analyses for each type

                      300 - Heating                    _
                      310 - Cooling                    _
                      320 - Preheat                    _
                      330 - Humidification             _
                      340 - Baseboard                  _
                      350 - Fan                        _
                      360 - Outside Air Control        _
                      370 - Furnace                    _
                      380 - Heat Pump Cooling          _
                      390 - Heat Pump Heating          _
                      400 - Direct Expansion           _

                      410 - Special - User Entered     _
                            Plant Loads Reset Schedule
```

The different types of ECOs are shown below. The screens show data from a sample base-case file. If the data fields are blank, this indicates that no data were entered for this item in the base-case file.

8.4.1 Heating ECOs #300 (1 screen per system)

```
ASEAM2 ECO INPUT: SYSTEM  1 - 1                             Input File:SAMPLE
HEATING                           ECO No: 300   Case No: 1   ECO File:SAMP300A
-------------------------------------------------------------------------------
Heating Availability
  Outside temperature above which heating is off              120 °F
  Heating available beginning month #                         9_
  Heating available ending month #                            5_

Heating Discharge Conditions
  Design heating coil discharge temperature                   120 °F

(Dual Duct System Only)
  Discriminator Control (Y/N)                                 _
  Outside temperature at maximum hot deck temperature         ___ °F
    Maximum hot deck temperature                              ___ °F
  Outside temperature at minimum hot deck temperature         ___ °F
    Minimum hot deck temperature                              ___ °F
```

8.4.2 Cooling ECOs #310 (1 screen per system)

```
ASEAM2 ECO INPUT: SYSTEM  1 - 1                             Input File:SAMPLE
COOLING                           ECO No: 310   Case No: 1   ECO File:SAMP310A
-------------------------------------------------------------------------------
Cooling Availability
  Outside temperature below which cooling is off              55_ °F
  Cooling available beginning month #                         5_
  Cooling available ending month #                            10

Cooling Discharge Conditions
  Design cooling coil discharge temperature                   55  °F
  Discriminator control (Y/N)                                 N
  Maximum cooling coil discharge temperature                  __  °F
```

8.4.3 Preheat ECOs # 320 (1 screen per system)

```
ASEAM2 ECO INPUT: SYSTEM  1 - 1                             Input File:SAMPLE
PREHEAT                           ECO No: 320   Case No: 1   ECO File:SAMP320A
-------------------------------------------------------------------------------
Preheat Availability
  Outside temperature above which preheat is off              50_ °F
  Preheat available beginning month #                         1_
  Preheat available ending month #                            12

Preheat Discharge Conditions
  Design preheat coil discharge temperature                   50_ °F
```

8.4.4 Humidification ECOs # 330 (1 screen per system)

```
ASEAM2 ECO INPUT: SYSTEM  1 - 1                              Input File:SAMPLE
HUMIDIFICATION                    ECO No: 330   Case No: 1   ECO File:SAMP330A
------------------------------------------------------------------------------
Humidification Availability
  Outside temperature above which humidification is off      50_ °F
  Humidification available beginning month #                9_
  Humidification available ending month #                    5_
  Humidification available during unoccupied cycle (Y/N)     N

Humidification Discharge Conditions
  Minimum relative humidity maintained (% RH)                30  % RH
```

8.4.5 Baseboard ECOs #340 (1 screen per system)

```
ASEAM2 ECO INPUT: SYSTEM  1 - 1                              Input File:SAMPLE
BASEBOARD                         ECO No: 340   Case No: 1   ECO File:SAMP340A
------------------------------------------------------------------------------
Baseboard Availability
  Outside temperature above which baseboard is off             45_ °F
  Baseboard available beginning month #                        10
  Baseboard available ending month #                           4_

Baseboard Control and Capacity
  Baseboard control type                                       1
    (1 = thermostatic   2 = reset by outside temperature)

Percent of design heating load satisfied at design winter      100 %
Percent of design heating load satisfied at balance temp       ___ %
```

8.4.6 Fan ECOs #350 (1 screen per system)

```
ASEAM2 ECO INPUT: SYSTEM  1 - 1                              Input File:SAMPLE
FAN                                ECO No: 350   Case No: 1   ECO File:SAMP350A
-------------------------------------------------------------------------------
Supply Fans
  Total supply fan power required (blank=default)                 ___  KW
    (or) Supply fan power per 1000 CFM                            ____ KW/1000 CFM
  Supply fan temperature rise (blank=default)                     ____ °F

Return Fans
  Total return fan power required (blank=default)                 ___  KW
    (or) Return fan power per 1000 CFM                            ____ KW/1000 CFM
  Return fan temperature rise (blank=default)                     ____ °F

  (VAV) Minimum percent of design air volume when heating         50_  %
  (VAV) Air volume control method                                 1
   (1=Variable Speed   2=Discharge Dampers   3=Inlet Vanes)

Fan Control Methods  (See Codes Below)
  Occupied cycle fan control method                               _
  Unoccupied cycle fan control method                             2
-------------------------------------------------------------------------------
                              Fan Control Methods
                    1=On Continuously     2=Cycles with load
```

8.4.7 Outside Air Control #360 ECOs (1 screen per system)

```
ASEAM2 ECO INPUT: SYSTEM  1 - 1                              Input File:SAMPLE
OUTSIDE AIR CONTROLS               ECO No: 360   Case No: 1   ECO File:SAMP360A
-------------------------------------------------------------------------------
Occupied Cycle Only
  Outside air damper control method (see codes below)        3
  Minimum percent outside air intake                         10_ %
  Dry bulb switchover temperature                            70_ °F

Unoccupied Cycle Only
  Outside air damper control method (see codes below)        2
  Minimum percent outside air intake                         10_ %
  Dry bulb switchover temperature                            ___ °F

                      Outside Air Damper Control Methods
     1=No Outside Air     2=Fixed Dampers      3=Dry Bulb      4=Enthalpy
                                              (Economizer)    (Economizer)
```

8.4.8 Furnace ECOs #370 (1 screen per system)

```
ASEAM2 ECO INPUT: SYSTEM  1 - 1                           Input File:SAMPLE
FURNACE                          ECO No: 370   Case No: 1   ECO File:SAMP370A
-----------------------------------------------------------------------------
Furnace Heat Output
  Furnace capacity (blank=autosize)                         ______ KBTUH
    (if autosized) Percent of design load satisfied         120    %

Furnace Efficiency
  Furnace efficiency at design load                         75_    %

Furnace Losses
  Losses as percent of design load (at design load)         0__    %
  Losses as percent of design load (at no load)             0__    %
  Pilot gas annual consumption                              70_    therms
```

8.4.9 Heat Pump Cooling ECOs #380 (1 screen per system)

```
ASEAM2 ECO INPUT: SYSTEM  1 - 1                           Input File:SAMPLE
HEAT PUMP COOLING                ECO No: 380   Case No: 1   ECO File:SAMP380A
-----------------------------------------------------------------------------
Cooling Performance
  Design coefficient of performance                               3___

Water Source Heat Pump Only
  Outside temperature at minimum fluid loop temperature           30_  °F
    Minimum fluid loop temperature                                60_  °F
  Outside temperature at maximum fluid loop temperature           80_  °F
    Maximum fluid loop temperature                                85_  °F
```

8.4.10 Heat Pump Heating ECOs #390 (1 screen per system)

```
ASEAM2 ECO INPUT: SYSTEM  1 - 1                           Input File:SAMPLE
HEAT PUMP HEATING                ECO No: 390   Case No: 1   ECO File:SAMP390A
-----------------------------------------------------------------------------
Outside temperature below which backup heating is on              35_  °F

Heating Performance
  Design heating coefficient of performance                       4___
```

8.4.11 Direct Expansion ECOs #400 (1 screen per system)

```
ASEAM2 ECO INPUT: SYSTEM  1 - 3                                  Input File:SAMP
DX COOLING                          ECO No: 400   Case No: 1   ECO File:SAMP400A
--------------------------------------------------------------------------------
Cooling Performance
  Design coefficient of performance                                  3___
  Minimum unloading ratio (% of capacity)                            25_    %
  Minimum hot gas bypass ratio (% of capacity)                       25_    %

DX Condenser
  Condenser fan KW (blank=default)                                   ___    KW
  Outside temperature below which condenser fan is off               45_    °F
```

8.4.12 Special System Reset Schedule ECOs #410 (1 screen per system)

This screen is like the Loads Reset Schedule ECO screen, discussed above. Its purpose is to adjust the slope and intercept of the systems load curve, which is passed on to the plant calculations when the ECO cannot be modeled directly by ASEAM2.1. See section 8.12 for an example.

```
ASEAM2 ECO INPUT: SYSTEM  1 - 1                                  Input File:SAMPLE
SYSTEM RESET SCHEDULE               ECO No: 410   Case No: 1   ECO File:SAMP410A
--------------------------------------------------------------------------------
Type of Plant Load to Adjust                                            NA
  1=Centrifugal   2=Absorption     3=DB Chiller    4=Reciprocating
  5=Dist Cooling  6=Cooling Tower  7=DB Heat Recv  8=Elec Res HTG
  9=Boiler       10=Dist Heating

Enter Plant Loads Reset Schedule in BTUH
Schedule #1    Slope Adjustment ________ Constant Change ________
Schedule #2    Slope Adjustment ________ Constant Change ________
Schedule #3    Slope Adjustment ________ Constant Change ________
Schedule #4    Slope Adjustment ________ Constant Change ________

Applicable Months - Enter Schedule # (or 'blank')
Month       Occup   Unocc       Month      Occup   Unocc
January       _       _         July         _       _
February      _       _         August       _       _
March         _       _         September    _       _
April         _       _         October      _       _
May           _       _         November     _       _
June          _       _         December     _       _
```

8.5 Plant ECOs

Plant ECOs are input just like Loads ECOs. To access the Plant ECO Input routine, select "Plant" from the ECO Input Menu. Next, indicate the Plant Input file that is to be used as the base case file.

The following screen will ask how many of each of the different types of plant ECOs you would like to model.

```
PLANT ECO SELECTION

--------------------------------------------------------------------------------
                     Enter the number of analyses for each type

                  500 - Energy Costs & Conversions              _
                  510 - Miscellaneous Energy Consumption        _
                  520 - Centrifugal Chiller                     _
                  530 - Absorption Chiller                      _
                  540 - Double Bundle Chiller                   _
                  550 - Reciprocating Chiller                   _
                  560 - Cooling Tower                           _
                  570 - Domestic Hot Water                      _
                  580 - Boiler                                  _
```

The different types of ECOs are shown below. These screens show initial data values from a sample base-case file. Note that some of the screens have no data values entered; these components were not initially modeled.

8.5.1 Energy Costs/Conversions ECOs #500

```
ASEAM2 ECO INPUT: PLANT - Energy Costs                      Input File:SAMPLE
ENERGY COSTS/CONVERSIONS          ECO No: 500    Case No: 1   ECO File:SAMP500A
--------------------------------------------------------------------------------
Fuel Type          Energy          Unit Cost
                    Units           $ / Unit
--------------------------------------------------------------------------------
Electricity          KWH             .075_
Natural Gas        Therms            .50__
#2 Oil             Gallons           _____
#4 Oil             Gallons           _____
#6 Oil             Gallons           _____
Dist Heating         MBTU            _____
Dist Cooling         MBTU            _____
```

8.5.2 Miscellaneous Energy Consumption ECOs #510

```
ASEAM2 ECO INPUT: PLANT - Misc Energy Consumption          Input File:SAMPLE
MISCELLANEOUS ENERGY CONSUMPTION   ECO No: 510   Case No: 1   ECO File:SAMP510A
--------------------------------------------------------------------------------

Label for Miscellaneous                    Fuel Units         Annual Consumption
Energy Consumption                      (See Codes Below)      in Energy Units
--------------------------------------------------------------------------------
 Exterior Lighting________                  3                   5000____
 Kitchen Range____________                  1                   10______
 _________________________                  _                   ________
 _________________________                  _                   ________
 _________________________                  _                   ________

--------------------------------------------------------------------------------
                         Fuel Code      Fuel Type       Energy Units
                         ---------      ---------       ------------
                             1          Natural Gas       therms
                             2          Oil               gallons
                             3          Electricity       KWH
                             4          Dist Heating      MBTU
                             5          Dist Cooling      MBTU
```

8.5.3 Centrifugal Chiller ECOs #520

```
ASEAM2 ECO INPUT: PLANT - Centrifugal                      Input File:SAMPLE
CENTRIFUGAL CHILLER              ECO No: 520   Case No: 1   ECO File:SAMP520A
--------------------------------------------------------------------------------
                                                        Type 1    Type 2
Cooling Performance
  Design coefficient of performance                     ____      ____
  Minimum unloading ratio (% of capacity)               __        __       %
  Minimum part load ratio (% of capacity)               __        __       %
  Load management/operating method                      _         _
    (1 = always on   2 = as needed)

Chilled Water Parameters
  Chilled water temperature at design load              ___       ___      °F
  Chilled water temperature at minimum load             ____      ____     °F
  Chilled water flow (blank=autosized)                  ____      ____     gpm
  Chilled water pump kw (blank=autosized)               ____      ____     KW
```

8.5.4 Absorption Chiller ECOs #530

```
ASEAM2 ECO INPUT: PLANT - Absorption                          Input File:DEMO
ABSORPTION CHILLER                  ECO No: 530   Case No: 1    ECO File:DEMO530A
--------------------------------------------------------------------------------
                                                         Type 1    Type 2

Cooling Performance
  Design coefficient of performance                      ____      ____
  Minimum part load ratio (% of capacity)                __        __       %

  Load management/operating method                       _         _
    (1 = always on    2 = as needed)

Chilled Water Parameters
  Chilled water temperature at design load               ___       ___      °F
  Chilled water temperature at minimum load              ____      ____     °F
  Chilled water flow (blank=autosized)                   ____      ____     gpm
  Chilled water pump kw (blank=autosized)                ____      ____     KW
```

8.5.5 Double Bundle Chiller ECOs #540

```
ASEAM2 ECO INPUT: PLANT - DB Chiller                          Input File:SAMPLE
DOUBLE BUNDLE CHILLER               ECO No: 540   Case No: 1   ECO File:SAMP540A
--------------------------------------------------------------------------------
                                                         Type 1    Type 2
Cooling Performance
  Design coefficient of performance                      ____      ____
  Minimum unloading ratio (% of cap - clg mode)          __        __       %
  Minimum unloading ratio (% of cap - htg mode)          __        __       %
  Minimum part load ratio (% of capacity)                __        __       %
  Load management/operating method                       _         _
    (1 = always on    2 = as needed)
Chilled Water Parameters
  Chilled water temperature at design load               ____      ____     °F
  Chilled water temperature at minimum load              ____      ____     °F
  Chilled water flow (blank=autosized)                   ____      ____     gpm
  Chilled water pump kw (blank=autosized)                ___       ___      KW

Heat Recovery Parameters
  Design heat recovery temperature                       ___       ___      °F
```

8.5.6 Reciprocating Chiller ECOs #550

```
ASEAM2 ECO INPUT: PLANT - Reciprocating                  Input File:SAMPLE
RECIPROCATING CHILLER            ECO No: 550   Case No: 1   ECO File:SAMP550A
--------------------------------------------------------------------------------
                                                     Type 1    Type 2
Cooling Performance
  Design coefficient of performance                  3.5_      ____
  Minimum unloading ratio (% of capacity)            25        __        %
  Minimum part load ratio (% of capacity)            25        _         %
  Load management/operating method                   2         _
    (1 = always on    2 = as needed)

Chilled Water Parameters
  Chilled water temperature at design load           50__      ____      °F
  Chilled water temperature at minimum load          44__      ____      °F
  Chilled water flow (blank=autosized)               ____      ____      gpm
  Chilled water pump KW (blank=autosized)            ___       ___       KW
```

8.5.7 Cooling Tower ECOs #560

```
ASEAM2 ECO INPUT: PLANT - Cooling Tower                   Input File:SAMPLE
COOLING TOWER                    ECO No: 560   Case No: 1   ECO File:SAMP560A
--------------------------------------------------------------------------------
Tower Performance
  Fan KW per cell (blank=autosized)                              ___   KW
  Number of fan speeds (1 or 2)                                  2
  Approach temperature                                           10    °F

Condenser Water Parameters
  Condenser water temperature at design load                     95_   °F
  Condenser water temperature at minimum load                    85_   °F
  Condenser water flow rate (blank=autosized)                    ___   gpm
  Condenser water pump KW (blank=autosized)                      ___   KW
```

8.5.8 Domestic Hot Water ECOs #570

```
ASEAM2 ECO INPUT: PLANT - Domestic Hot Water                     Input File:SAMPLE
DOMESTIC HOT WATER                       ECO No: 570   Case No: 1  ECO File:SAMP570A
-----------------------------------------------------------------------------------
Annual pilot consumption (if gas)                                  70_     therms

  Average hourly DHW usage - occupied cycle                        10__    gal/hou
  Average hourly DHW usage - unoccupied cycle                      1___    gal/hou

DHW Temperatures
  Domestic hot water supply temperature                            140     °F
  DHW inlet temperature - design summer                            60      °F
  DHW inlet temperature - design winter                            50      °F
Circulating Pumps
  Circulating pump KW - occupied cycle                             0__     KW
  Circulating pump KW - unoccupied cycle                           0__     KW
DHW Efficiency and Losses
  Design DHW heating efficiency                                    70_     %
  DHW losses - occupied cycle                                      150___  BTUH
  DHW losses - unoccupied cycle                                    0_____  BTUH
```

8.5.9 Boiler ECOs #580

```
ASEAM2 ECO INPUT: PLANT
                                                         Input File:BLRE580A
BOILER                                 ECO No: 580   Case No: 1   ECO File:BLRE580A
-----------------------------------------------------------------------------------
Annual pilot consumption (if gas)                      70__     ____    therms

  Load management/operation                            2
    (1 = always on     2 = as needed)                           _

Boiler Performance
  Design boiler efficiency                             78__     ____    %
  Combustion air temperature                           ___      ___     °F
  Stack temperature                                    ___      ___     °F
  Air-Fuel ratio                                       ____     ____    Lb/Lb
  Minimum part load operating ratio (% of capacity)    25       __      %
  Boiler pump KW (blank=autosized)                     ___      ___     KW
  Boiler losses - percent of capacity                  1_       __      %
  Boiler losses - percent of load                      1_       __      %
```

8.6 ECO Input Hints

When you enter a four-character file-name prefix for the ECO files, it is helpful to use a name that will define the ECO. Although the second four characters also define the type of ECO, you have to look up these numbers to determine which ECOs they refer to.

If you input the ECO data in more than one sitting, be sure to use different file-name prefixes for the ECOs. Whenever the ECO Input program is accessed, the first file saved is assumed to be A and the second file B, and so on. For example, if you enter three wall ECOs in the first sitting, with the file-name prefix "WALL," the program will create three ECO files: "WALL100A.LEC", "WALL100B.LEC", and "WALL100C.LEC". If you subsequently reenter the ECO Input program to create a fourth wall ECO and use the name "WALL" again, the new ECO file will be called "WALL100A.LEC" and will overwrite the first ECO file.

This concludes the presentation of the ECO Input program. Create ECO Input files for all ECOs that you will model. The files will be on the data disk in drive B.

You are now ready to perform the calculations. Enter the Specify Analysis program and enter the base-case files and ECO modifications to be analyzed. Refer to Chapter 11 for instructions on the Specify Analysis procedure.

STATION	ST	CLM	VSN	VSEW	VSS	CDD50	CDD65	CDH80	HDD50	HDD65
ADAK	AK	24	280	652	434	124	0	0	3,562	8,913
ANNETTE	AK	19	285	739	482	756	12	0	2,545	7,277
BETHEL	AK	30	252	789	453	312	0	0	8,285	13,449
BIG DELTA	AK	30	249	989	527	777	16	25	9,355	14,069
FAIRBANKS	AK	30	241	919	492	922	19	8	9,841	14,414
GULKANA	AK	30	257	943	522	498	4	6	8,865	13,846
HOMER	AK	29	272	926	538	236	0	0	5,301	10,540
JUNEAU	AK	25	254	642	410	348	0	0	4,223	9,350
KINGSALMON	AK	30	270	860	499	330	4	6	6,843	11,992
KODIAK	AK	26	276	852	509	360	6	0	3,775	8,896
McGRATH	AK	30	246	841	467	578	3	0	9,967	14,868
NOME	AK	30	242	871	478	119	0	0	9,061	14,418
SUMMIT	AK	30	247	893	488	155	0	0	9,210	14,530
YAKUTAT	AK	25	247	650	402	248	0	0	4,486	9,714
BIRMINGHAM	AL	7	464	908	789	5,182	1,825	6,272	765	2,882
MOBILE	AL	9	486	919	816	6,478	2,419	7,479	164	1,580
MONTGOMERY	AL	9	462	981	823	5,821	2,116	8,473	491	2,261
FORT SMITH	AR	18	462	1,005	842	5,307	2,077	10,413	1,149	3,394
LITTLEROCK	AR	9	465	981	831	5,351	2,055	8,450	912	3,091
PHOENIX	AZ	12	488	1,310	1,116	7,830	3,647	34,521	90	1,382
PRESCOTT	AZ	15	473	1,334	1,090	3,385	895	3,973	1,477	4,462
TUCSON	AZ	10	500	1,280	1,112	6,822	2,769	19,657	178	1,601
WINSLOW	AZ	15	471	1,338	1,092	3,708	1,141	7,347	1,695	4,603
YUMA	AZ	12	493	1,330	1,151	8,921	4,186	37,892	43	782
ARCATA	CA	4	407	926	724	1,038	1	0	582	5,020
BAKERSFIEL	CA	9	474	1,211	1,053	5,879	2,294	15,447	305	2,194
CHINA LAKE	CA	10	468	1,312	1,091	6,222	2,782	26,739	409	2,444
DAGGETT	CA	10	475	1,309	1,102	6,516	2,720	22,302	237	1,916
EL TORO	CA	5	486	1,163	977	4,764	834	2,391	32	1,577
FRESNO	CA	7	459	1,199	1,029	5,070	1,803	13,085	492	2,700
LONG BEACH	CA	5	482	1,144	956	4,947	900	1,616	54	1,483
LOSANGELES	CA	5	482	1,146	962	4,456	472	136	3	1,494
MT. SHASTA	CA	21	419	1,153	909	2,395	556	2,073	1,947	5,583
OAKLAND	CA	4	453	1,102	909	2,792	82	23	157	2,922
POINT MUGU	CA	4	477	1,131	936	3,435	145	70	8	2,193
RED BLUFF	CA	7	428	1,177	951	5,110	1,930	14,404	589	2,884
SACRAMENTO	CA	7	444	1,185	987	4,274	1,171	7,315	381	2,753
SAN DIEGO	CA	5	490	1,121	950	4,865	662	383	2	1,275
SAN FRANCI	CA	4	454	1,146	941	2,496	73	204	186	3,238
SANTA MARI	CA	4	476	1,128	950	2,663	92	513	138	3,041
SUNNYVILLE	CA	4	456	1,145	947	3,112	204	421	142	2,708

STATION	ST	CLM	VSN	VSEW	VSS	CDD50	CDD65	CDH80	HDD50	HDD65
COLO SPRGS	CO	21	435	1,321	976	2,557	491	2,075	2,587	5,996
DENVER	CO	21	428	1,321	971	2,611	567	2,934	2,652	6,083
EAGLE	CO	27	432	1,296	976	1,480	90	1,008	4,232	8,317
GRAND JUNC	CO	23	420	1,115	843	3,611	1,221	6,147	2,616	5,701
PUEBLO	CO	21	442	1,309	992	3,384	971	5,899	2,223	5,285
HARTFORD	CT	20	384	834	646	2,857	706	2,197	2,953	6,277
GUANTANAMO	CU	2	612	1,018	1,045	11,071	5,596	18,452	0	0
WASHINGTON	DC	21	419	905	724	3,734	1,083	3,592	2,004	4,828
WILMINGTON	DE	21	414	921	726	3,602	1,078	2,188	2,133	5,084
APALACHICO	FL	9	508	971	887	6,967	2,695	8,289	163	1,366
DAYTONA	FL	9	503	953	860	7,404	2,635	5,252	81	787
JACKSONVIL	FL	9	495	943	849	7,045	2,721	7,488	206	1,357
MIAMI	FL	11	527	936	874	9,338	4,045	9,166	3	185
ORLANDO	FL	11	511	974	881	8,288	3,312	9,757	33	532
TALLAHASSE	FL	9	495	944	845	6,462	2,401	7,323	307	1,721
TAMPA	FL	9	518	974	890	7,985	3,047	8,905	37	575
W. PALM BE	FL	11	519	906	846	9,203	3,904	10,324	8	177
ATLANTA	GA	7	467	930	807	4,837	1,566	3,799	866	3,070
AUGUSTA	GA	7	468	933	803	5,458	1,904	6,904	664	2,584
MACON	GA	9	476	939	822	5,769	2,111	8,097	514	2,330
SAVANNAH	GA	9	474	926	805	6,112	2,194	6,308	410	1,967
BARBERS PT	HI	1	592	965	978	9,314	3,842	3,617	0	3
HILO	HI	1	557	805	817	8,494	3,019	1,112	0	0
HONOLULU	HI	1	588	932	953	9,625	4,150	4,537	0	0
LIHUE	HI	1	567	893	895	9,219	3,746	1,912	0	0
BURLINGTON	IA	21	419	1,030	802	3,393	1,002	2,598	3,009	6,094
DES MOINES	IA	26	413	1,027	788	3,116	812	2,383	3,275	6,447
MASON CITY	IA	27	400	1,053	783	2,708	658	1,882	4,311	7,735
SIOUX CITY	IA	26	406	1,064	794	3,326	993	3,488	3,608	6,750
BOISE	ID	21	399	1,228	916	2,828	744	4,512	2,276	5,667
LEWISTON	ID	21	370	988	729	2,709	645	4,121	2,015	5,426
POCATELLO	ID	26	405	1,262	935	2,330	526	3,293	3,404	7,075
CHICAGO	IL	21	402	936	729	3,339	1,015	3,190	3,000	6,151
MOLINE	IL	21	405	959	736	3,204	894	2,808	3,085	6,250
SPRINGFIEL	IL	23	422	962	768	3,675	1,158	4,038	2,490	5,448
EVANSVILLE	IN	23	426	890	736	4,063	1,265	4,288	1,948	4,625
FORT WAYNE	IN	20	395	826	664	3,096	743	1,629	3,023	6,145

STATION	ST	CLM	VSN	VSEW	VSS	CDD50	CDD65	CDH80	HDD50	HDD65
INDIANAPOL	IN	21	407	851	692	3,430	951	2,263	2,624	5,620
SOUTH BEND	IN	21	396	857	690	2,917	684	1,840	3,038	6,280
DODGE CITY	KS	23	450	1,196	942	4,008	1,384	7,186	2,280	5,131
GOODLAND	KS	21	434	1,228	935	3,047	905	5,147	2,757	6,090
TOPEKA	KS	23	434	1,068	837	4,120	1,388	5,212	2,458	5,201
COVINGTON	KY	19	408	843	687	3,656	1,057	2,638	2,154	5,030
LEXINGTON	KY	23	425	872	729	3,904	1,157	2,853	1,921	4,649
LOUISVILLE	KY	23	424	883	727	4,144	1,357	4,716	1,851	4,539
BATONROUGE	LA	9	488	889	806	6,682	2,543	8,814	237	1,573
LK CHARLES	LA	9	489	864	795	6,849	2,615	7,883	214	1,455
NEW ORLEAN	LA	9	497	923	838	6,840	2,578	7,380	179	1,392
SHREVEPORT	LA	9	484	954	843	6,022	2,365	10,039	447	2,265
BOSTON	MA	21	387	849	659	2,810	695	1,601	2,416	5,775
BALTIMORE	MD	21	419	932	739	3,683	1,134	3,825	2,020	4,946
PATUXENT	MD	17	429	943	758	4,180	1,289	2,966	1,418	4,002
BANGOR	ME	27	378	950	693	1,853	243	454	4,132	7,998
CARIBOU	ME	28	357	922	649	1,410	121	203	5,297	9,483
PORTLAND	ME	26	376	856	643	1,946	245	399	3,531	7,305
ALPENA	MI	27	371	862	661	1,928	335	894	4,282	8,164
DETROIT	MI	21	390	858	676	3,199	922	2,238	2,799	5,997
FLINT	MI	24	379	811	641	2,502	473	921	3,471	6,917
GRAND RAPI	MI	26	438	1,303	1,003	2,680	590	1,461	3,392	6,777
SAULT SAIN	MI	28	359	858	640	1,399	119	246	5,087	9,282
TRAVERSE C	MI	24	369	818	642	2,193	438	1,124	3,934	7,654
DULUTH	MN	28	355	886	633	1,511	157	258	5,797	9,918
INTL FALLS	MN	28	351	962	669	1,473	119	167	6,414	10,535
MINNEAPOLI	MN	27	380	972	709	2,751	773	2,509	4,563	8,060
ROCHESTER	MN	27	383	927	691	2,360	442	590	4,544	8,100
COLUMBIA	MO	23	431	972	790	3,940	1,234	4,242	2,225	4,994
SPRINGFIEL	MO	23	446	982	812	4,115	1,311	4,170	1,839	4,509
ST. LOUIS	MO	23	432	983	797	4,193	1,467	5,379	2,111	4,860
JACKSON	MS	9	481	942	833	5,927	2,330	8,789	546	2,424
MERIDIAN	MS	9	480	905	811	5,723	2,148	9,508	546	2,446
BILLINGS	MT	26	380	1,160	814	2,544	598	2,695	3,627	7,156
CUTBANK	MT	27	357	1,150	768	1,368	117	702	4,718	8,941
DILLON	MT	27	386	1,187	838	1,564	159	784	4,140	8,210
GLASGOW	MT	28	361	1,115	752	2,272	543	2,642	5,082	8,828

STATION	ST	CLM	VSN	VSEW	VSS	CDD50	CDD65	CDH80	HDD50	HDD65
GREAT FALL	MT	26	366	1,133	776	2,199	450	1,886	3,728	7,454
HELENA	MT	26	372	1,098	771	1,911	328	1,771	3,926	7,817
LEWISTOWN	MT	27	368	1,084	753	1,629	216	1,270	4,027	8,089
MILES CITY	MT	27	374	1,156	800	2,694	773	4,364	4,435	7,989
MISSOULA	MT	26	363	957	704	1,629	221	1,513	3,492	7,560
ASHEVILLE	NC	15	449	946	782	3,442	763	1,298	1,407	4,203
CAPE HATTE	NC	7	460	972	819	4,978	1,613	2,039	635	2,745
CHARLESTON	NC	17	456	968	809	4,698	1,549	4,299	1,086	3,412
CHERRY PT.	NC	7	461	996	826	5,277	1,788	3,614	569	2,556
GREENSBORO	NC	17	449	994	810	4,274	1,298	3,642	1,261	3,760
RALEIGH	NC	17	445	935	774	4,485	1,389	3,697	1,131	3,509
BISMARK	ND	28	371	1,114	766	2,175	496	2,067	5,196	8,992
FARGO	ND	28	371	1,077	751	2,388	573	2,288	5,582	9,242
MINOT	ND	28	358	1,059	724	2,064	431	1,570	5,336	9,178
GRAND ISL.	NE	26	390	872	688	3,309	996	4,580	3,315	6,477
N. PLATTTE	NE	26	419	1,183	880	2,731	715	3,468	3,447	6,905
OMAHA	NE	21	414	1,066	806	3,618	1,130	3,883	2,981	5,968
SCOTTSBLUF	NE	26	413	1,168	861	2,603	693	3,745	3,335	6,900
CONCORD	NH	24	375	824	630	2,254	463	1,865	3,742	7,425
LAKEHURST	NJ	21	407	917	712	3,299	915	3,019	2,174	5,265
NEWARK	NJ	21	406	912	710	3,556	1,009	2,487	2,027	4,956
ALBUQUERQU	NM	17	469	1,361	1,105	3,942	1,257	5,705	1,633	4,423
CLAYTON	NM	21	457	1,310	1,019	3,122	685	2,093	2,138	5,176
ROSWELL	NM	17	490	1,280	1,081	4,536	1,539	11,135	1,008	3,486
TRUTH OR C	NM	17	488	1,326	1,113	4,457	1,500	6,882	1,074	3,592
TUCUMCARI	NM	17	470	1,300	1,046	4,451	1,554	8,424	1,344	3,922
ELKO	NV	26	420	1,332	1,000	1,997	355	4,065	3,345	7,178
ELY	NV	26	432	1,350	1,014	1,650	157	1,317	3,683	7,666
LAS VEGAS	NV	10	456	1,417	1,136	6,567	3,043	26,408	449	2,399
LOVELOCK	NV	21	418	1,452	1,094	2,813	745	6,659	2,438	5,845
RENO	NV	21	428	1,401	1,068	2,180	365	4,059	2,181	5,841
TONOPAH	NV	21	427	1,502	1,130	2,742	611	3,777	2,308	5,652
WINNEMUCCA	NV	21	418	1,350	1,014	2,264	486	6,366	2,774	6,471
YUCCA	NV	15	450	1,399	1,112	3,378	1,041	11,568	1,664	4,802
ALBANY	NY	26	395	942	719	2,812	619	1,308	3,488	6,770
BINGHAMTON	NY	24	370	733	592	2,373	410	672	3,885	7,397
BUFFALO	NY	24	371	746	609	2,476	509	779	3,213	6,721
MASSENA	NY	27	380	942	708	2,026	365	913	4,583	8,397
N.Y. (CP)	NY	19	392	817	650	3,273	834	911	1,986	5,022
N.Y. (LAG)	NY	19	392	817	650	3,273	834	911	1,986	5,022

STATION	ST	CLM	VSN	VSEW	VSS	CDD50	CDD65	CDH80	HDD50	HDD65
ROCHESTER	NY	24	374	771	622	2,557	595	1,642	3,482	6,995
SYRACUSE	NY	24	371	764	611	2,579	513	926	3,448	6,856
AKRON	OH	20	396	812	664	2,845	661	1,100	2,881	6,172
COLUMBUS	OH	19	401	819	671	3,195	789	2,268	2,424	5,493
DAYTON	OH	21	408	855	696	3,367	868	1,346	2,573	5,549
TOLEDO	OH	21	393	853	676	2,791	698	1,794	3,132	6,514
YOUNGSTOWN	OH	20	383	760	624	2,593	546	1,128	3,129	6,557
OKLHMA CTY	OK	17	465	1,053	875	4,901	1,834	8,878	1,417	3,825
TULSA	OK	18	453	991	820	5,244	2,072	10,065	1,429	3,732
ASTORIA	OR	13	350	782	588	1,357	29	145	1,080	5,226
MEDFORD	OR	15	405	1,005	814	2,681	568	4,081	1,531	4,893
NORTH BEND	OR	4	392	977	740	1,429	2	0	629	4,678
PORTLAND	OR	13	364	841	647	2,321	272	1,086	1,151	4,577
REDMOND	OR	21	395	1,127	835	1,573	228	2,390	2,535	6,665
SALEM	OR	15	373	874	680	1,849	172	1,224	1,128	4,926
ALLENTOWN	PA	21	401	864	682	3,105	698	1,146	2,692	5,760
AVOCA	PA	20	389	811	646	2,823	652	1,547	2,931	6,236
ERIE	PA	20	384	792	646	2,527	472	378	3,006	6,426
HARRISBURG	PA	21	404	864	687	3,518	992	2,860	2,302	5,251
PHILADELPH	PA	21	408	889	701	3,661	1,065	3,172	2,044	4,923
PITTSBURGH	PA	20	392	780	642	2,989	648	1,040	2,773	5,907
KOROR ISL.	PN	2	662	827	890	11,435	5,960	14,548	0	0
KWAJALEIN	PN	2	678	888	961	11,635	6,160	16,217	0	0
WAKE ISL.	PN	2	609	977	1,002	10,869	5,394	10,167	0	0
SAN JUAN	PR	2	608	931	963	10,648	5,173	11,563	0	0
PROVIDENCE	RI	21	393	874	677	2,756	693	1,284	2,610	6,022
CHARLESTON	SC	9	467	925	796	5,722	2,005	5,249	435	2,194
COLUMBIA	SC	9	467	953	816	5,613	2,110	8,541	694	2,666
GREENVILLE	SC	7	459	971	814	4,563	1,400	3,494	907	3,220
HURON	SD	27	390	1,044	769	2,718	774	3,739	4,820	8,351
PIERRE	SD	27	392	1,147	822	3,079	934	5,262	4,028	7,358
RAPID CITY	SD	26	394	1,142	819	2,581	663	3,477	3,672	7,229
SIOUX FALL	SD	27	394	1,078	778	2,811	779	3,029	4,240	7,683
CHATTANOOG	TN	17	444	869	738	4,652	1,541	5,079	1,232	3,595
KNOXVILLE	TN	17	446	898	762	4,455	1,514	3,840	1,283	3,818
MEMPHIS	TN	18	460	935	806	5,319	2,069	7,807	1,034	3,259
NASHVILLE	TN	17	443	863	749	4,583	1,552	5,078	1,165	3,609

STATION	ST	CLM	VSN	VSEW	VSS	CDD50	CDD65	CDH80	HDD50	HDD65
ABILENE	TX	9	494	1,066	924	5,968	2,416	13,206	792	2,714
AMARILLO	TX	17	471	1,253	1,013	4,113	1,377	6,763	1,592	4,331
AUSTIN	TX	9	503	972	877	6,873	2,862	14,093	271	1,735
BROWNSVILL	TX	11	547	908	908	8,531	3,664	12,218	35	642
CORPUS CHR	TX	11	529	946	906	8,200	3,508	13,109	106	889
DEL RIO	TX	9	511	1,008	903	7,376	3,112	14,870	186	1,397
EL PASO	TX	9	503	1,306	1,133	5,617	2,225	13,224	522	2,605
FORT WORTH	TX	9	485	994	875	6,174	2,448	13,682	605	2,354
HOUSTON	TX	9	490	883	805	7,215	2,891	10,569	195	1,346
KINGSVILLE	TX	11	527	922	881	8,302	3,652	15,512	49	874
LAREDO	TX	12	532	936	900	8,827	4,130	25,225	65	842
LUBBOCK	TX	17	488	1,267	1,070	4,754	1,749	9,827	1,173	3,643
LUFKIN	TX	9	492	942	848	6,667	2,668	11,737	370	1,846
MIDLAND	TX	9	504	1,247	1,079	5,695	2,159	11,177	634	2,573
PORTARTHUR	TX	9	497	900	824	6,888	2,662	8,837	167	1,416
SAN ANGELO	TX	9	503	1,076	944	6,522	2,619	14,621	538	2,110
SAN ANTONI	TX	9	510	955	878	7,170	3,013	13,841	261	1,579
SHERMAN	TX	9	476	996	862	5,844	2,378	12,065	699	2,708
WACO	TX	9	495	972	874	6,676	2,879	15,658	488	2,166
WICHITA FA	TX	9	480	1,077	911	5,708	2,299	14,487	984	3,049
BRYCE	UT	27	445	1,386	1,063	899	4	69	4,709	9,288
CEDAR CITY	UT	21	447	1,342	1,054	2,802	624	3,119	2,592	5,888
SALT LAKE	UT	21	422	1,266	975	3,011	941	7,030	2,570	5,975
NORFOLK	VA	17	443	964	792	4,636	1,586	4,554	1,185	3,609
RICHMOND	VA	17	430	923	745	4,225	1,323	4,021	1,322	3,895
ROANOKE	VA	17	433	946	763	3,986	1,183	3,306	1,520	4,192
BURLINGTON	VT	27	382	925	698	2,118	365	490	4,211	7,932
OLYMPIA	WA	13	351	819	619	1,550	79	466	1,546	5,550
SEATTLE	WA	13	350	828	621	1,683	106	256	1,382	5,281
SPOKANE	WA	21	363	1,064	758	2,094	363	1,595	2,983	6,727
WHIDBEY IS	WA	15	344	878	630	1,403	22	7	1,179	5,274
YAKIMA	WA	21	373	1,091	790	2,370	449	3,285	2,323	5,877
EAU CLAIRE	WI	27	376	923	683	2,545	603	1,898	4,751	8,285
GREENBAY	WI	27	380	947	696	2,172	426	957	4,310	8,039
LA CROSSE	WI	26	386	937	701	2,786	716	2,121	3,838	7,243
MADISON	WI	27	391	955	717	2,559	542	1,329	4,009	7,466
MILWAUKEE	WI	26	396	941	724	2,427	487	1,013	3,586	7,121
CHARLOTTE	WV	19	409	798	667	3,712	1,008	3,054	1,816	4,587
CASPER	WY	26	403	1,343	961	2,177	495	2,699	3,824	7,617
CHEYENNE	WY	26	416	1,267	906	1,963	271	1,040	3,435	7,218
ROCK SPRIN	WY	27	411	1,395	1,012	1,698	207	702	4,407	8,391
SHERIDAN	WY	26	387	1,133	806	2,074	360	2,105	3,605	7,366

10 Life-Cycle Cost (LCC) Programs

10 LIFE-CYCLE COST (LCC) PROGRAMS

10.1 Introduction

ASEAM2.1's Life-Cycle Cost Programs (FBLCC and NBSLCC) were originally developed by the National Bureau of Standards as independent software programs. The two LCC programs have been integrated into ASEAM2.1 for LCC analysis.

This chapter describes the types of LCC analyses available, the individual LCC subprograms, how each program can be used, and the input data requirements for each program.

The following two NBS reference should be obtained for additional information:

- Stephen Petersen, "A User's Guide to The Federal Building Life-Cycle Cost (FBLCC) Computer Program", (NBS Technical Note 1222)

- Rosalie T. Ruegy and Stephen R. Petersen, "Comprehensive Guide for Least-Cost Energy Decisions", (NBS Special Publication 709)

10.1.1 Types of LCC Programs

ASEAM2.1 has two LCC programs:

FBLCC: Federal Building Life-Cycle Cost Program
NBSLCC: National Bureau of Standards Life-Cycle Cost Program

The FBLCC program is designed *only* for federal buildings. This program consists of several subprograms that are used for data entry, calculations, printing reports, and comparing different LCC results. FBLCC does not include many of the typical private sector LCC input requirements associated with tax status, depreciation, mortgage, and the like.

The FBLCC program can use either of two methodologies for LCC calculations:

1. Energy Conservation or Renewable Energy Projects (NBS 135)
2. Non-Energy-Related Projects (OMB Circular A-94)

The NBSLCC program is a general purpose LCC program that should be used *only* for nonfederal buildings. Like the FBLCC, the NBSLCC program also consists of several subprograms that are used for data entry, calculations, printing reports, and comparing LCC results. This program, on the other hand, has input requirements associated with tax status, depreciation, mortgage, etc. Although the program will compute LCC for "not for profit" projects, do not use this program for federal buildings.

10.1.2 ASEAM2.1 Comparisons with Original Programs

The original FBLCC and NBSLCC programs were modified for use with ASEAM2.1. Primarily, the input programs were changed to adhere to ASEAM2.1 data entry routines, menu bars, etc. There are no computational changes, however, to the original programs, and the LCC results are identical regardless of the program (ASEAM2.1 or original) used. The printed output reports as well as the various program variable names used for the calculations are also identical. The source code for the subprograms was changed and restructured so that ASEAM2.1 type menu bars could be used.

10.2 LCC Subprograms

FBLCC and NBSLCC both consist of five subprograms that are linked together through "Exit" menus. The purpose of each subprogram is described below. To differentiate between the two LCC programs, the first letter of the subprogram file names is different: "F" for FBLCC and "P" for NBSLCC. In other words, "FLCCDATA" is the subprogram that performs data entry for the FBLCC program, and "PLCCDATA" contains data entry routines for the NBSLCC program.

> *Warning*: Input data requirements, calculation procedures, and output differ with each LCC program. Input data files therefore cannot be interchanged. Do not attempt to use input files created by the FBLCC program for NBSLCC calculations. If you do so inadvertently, you will receive an error message that the files are not compatible.
>
> When exiting from any ASEAM2.1 subprogram to the LCC programs, you will access either the FLCCDATA or PLCCDATA input data entry subprograms. You must then use the "Exit" menu from these programs to access other subprograms (calculations, reports, etc.).

10.2.1 LCCDATA (FLCCDATA for FBLCC version, PLCCDATA for NBSLCC version)

These subprograms contain the input data entry routines for the other LCC programs. Like ASEAM2.1, input data files (file-name extension '.BCF'—Building Characteristic Files) are created and edited in these subprograms. Therefore, you must first use these programs to create input data files before performing LCC calculations.

10.2.2 LCCMAIN (FLCCMAIN for FBLCC version, PLCCMAIN for NBSLCC version)

The LCCMAIN subprograms perform LCC calculations using input data files created by LCCDATA subprograms. After the calculations are performed, a brief summary of the results is displayed on the screen. You can save these calculations results to a file for printing with the PRNTLCC subprograms (file-name extension 'LCC').

10.2.3 PRNTBCF (FPRNTBCF for FBLCC version, PPRNTBCF for NBSLCC version)

These subprograms print a formatted output of the building characteristics files created by the LCCDATA subprograms. These subprograms are similar to the data echo reports in ASEAM2.1: first retrieve the file to be printed, and then "print" the report to either the screen, printer, or file.

10.2.4 PRNTLCC (FPRNTLCC for FBLCC version, PPRNTLCC for NBSLCC version)

These subprograms print a formatted output of the LCC calculations created by LCCMAIN subprograms. These subprograms are similar to the PRNTBCF subprograms: first retrieve the file to be printed, and then "print" the report to either the screen, printer, or file.

10.2.5 COMPARE (FCOMPARE for FBLCC version, PCOMPARE for NBSLCC version)

These subprograms are used to compare two LCC calculation results. The LCCMAIN subprograms are first used to perform the calculations for both sets of input data, and then 'LCC' output files must be stored for each LCC analysis. The program then accesses these files and prints a comparison and savings analysis. Several LCC "indicators" (Benefit-Cost Ratio, Savings to Investment Ratio, etc.) are calculated and displayed in the report.

10.3 Use of LCC Programs

10.3.1 Using LCC Programs without ASEAM2.1

Both versions of the LCC programs (FBLCC and NBSLCC) can be used independently of ASEAM2.1. You may prefer to perform all the energy calculations first, and then enter the calculated energy consumption values from the ASEAM2.1 analyses into the LCCDATA subprograms. After the input files are created, you would then perform the LCC calculations (LCCMAIN) and print the calculation reports (PRNTLCC) and data echo reports (PRNTBCF).

10.3.2 Using LCC Programs with ASEAM2.1

Both LCC programs have been integrated into the ASEAM2.1 calculations. LCC input files created by LCCDATA subprograms may be specified when you "Specify Analysis." After each ASEAM2.1 energy calculation is performed, the resultant annual energy consumption values are automatically substituted into the LCC input files, and the LCC calculations are then performed with these values (not the original energy values in your LCC input file).

> *Important*: Since both of these LCC programs have been integrated, you may need to copy some files onto the calculation disk before performing any integrated energy-LCC calculations. There are *two* ASEAM2.1 programs (one for each LCC type) that integrate the energy results and LCC calculations. Unfortunately, both cannot be stored on the calculation disk. If you have received original ASEAM2.1 diskettes, the FBLCC version is presently used.

After the normal ASEAM2.1 energy calculations are performed and reported, ASEAM2.1 will automatically execute a program named AS2ECON if an LCC input file is specified for the run. To ensure that the correct type of LCC analysis is performed (FBLCC or NBSLCC), you must ensure that the correct version of AS2ECON is used in the calculation:

To use the FBLCC calculations, follow these steps:

1. Put the FBLCC Executable diskette in one drive and the ASEAM2.1 Calculation diskette in the other.

2. Copy the FBLCC diskette file AS2FECON.EXE onto the ASEAM2.1 Calculation disk using the file name AS2ECON.EXE. For example, using floppy disks (with the FBLCC executable diskette in drive B and the Calculation diskette in drive A):

   'copy b:as2fecon.exe a:as2econ.exe' (CR) (for floppy based ASEAM2.1)
   'copy b:as2fecon.exe^C:\aseam2\as2econ.exe' (CR) (for hard disk ASEAM2.1)

3. Ensure that you use only the FBLCC input program to create LCC input files. The files created by the NBSLCC input program are not compatible and will cause ASEAM2.1 to abort during the calculations.

To use the NBSLCC calculations, follow these steps:

1. Put the NBSLCC Executable diskette in one drive and the ASEAM2.1 Calculation diskette in the other.

2. Copy the NBSLCC diskette file AS2PECON.EXE onto the Calculation diskette using the file name AS2ECON.EXE. For example, using floppy disks (with the NBSLCC executable diskette in drive B and the Calculation diskette in drive A):

   'copy b:as2pecon.exe a:as2econ.exe' (CR) (for floppy based ASEAM2.1)
   'copy b:as2pecon.exe^C:\aseam2\as2econ.exe' (CR) (for hard disk ASEAM2.1)

3. Ensure that you use only the NBSLCC input program to create LCC input files. The files created by the FBLCC input program are not compatible and will cause ASEAM2.1 to abort during the calculations.

When integrating LCC calculations with ASEAM2.1 energy calculations, the output you receive from the LCC analysis depends on the type of ASEAM2.1 calculation mode you are using:

Single and Batch Run Modes. If you specify an LCC input file for these calculation run modes, the PRNTLCC report will be generated at the completion of each ASEAM2.1/LCC analysis. The report will always appear on the screen. If a printer is available, the report will also be printed. You may also specify to save this report as a text ASCII file on your data diskette. The file name for this report is 'xxxxLCCO', where 'xxxx' is the four-character file-name prefix you assign. Separate LCC input files must be specified for each run.

Parametric Run Mode. At the completion of each ASEAM2.1/LCC analysis the PRNTLCC report is displayed only on the screen, because there is no hard-copy report in the parametric run mode. Since both the parametric and ECO run modes are used to "compare" different runs, the LCC analysis actually is performed twice: once with base-case data, and once for the parametric or ECO case. The results of these two LCC analyses are then compared and displayed on the screen only. For the parametric run mode only, the LCC results are stored in a LOTUS-compatible output file for each run, complete with financial indicators such as benefit-cost ratio, savings to investment ratio, etc. The file name used to save these results is 'xxxxPRLC.prn', where 'xxxx' is the four-character file-name prefix you assign. Only one LCC input file is required for the base-case information.

Single and Multiple ECO Run Modes. Like the parametric run mode, two LCC analyses are performed: one for the base case and one for the ECO case. The LCC output results are automatically stored in an ASCII text file at the completion of each run. The file name used to save these results is 'xxxxSECO.#' for single ECO runs and 'xxxxMECO.#' for multiple ECO runs, where 'xxxx' is the four-character file-name prefix you assign and '#' is the run number: '1' for base case, '2' for the first ECO, '3' for the second ECO, etc. If a printer is available, these reports will also be printed. Note that for the ECO cases (run number '2' and up), the text report also includes an LCC comparison of the base case and ECO case. Separate LCC input files must be specified for each ECO run.

10.4 Entering LCC Input Data

10.4.1 Entering New Data

To create a new LCC input file, you must first access one of the LCC programs (FBLCC or NBSLCC) from the "Exit" menu of any program or from the Main Menu program. The procedure for doing this is discussed in detail in Chapter 3. Once within this program, you should choose the "Enter New Data" command from the main input bar menu (shown below).

FBLCC BUILDING CHARACTERISTICS INPUT PROGRAM

```
Get BCF File     Save BCF File     Edit BCF Data     Enter New Data     Exit
```

All of the input screens will then appear sequentially in the order shown below in sections 10.5 (FBLCC) or 10.6 (NBSLCC). Note that many input screens are "conditional," that is, they will appear only if previously entered data dictates.

10.4.2 Editing Existing Data

To modify an existing LCC input file stored on the data diskette, you first need to access the LCC input program and then retrieve the existing data with the "Get BCF File" command. The procedure for doing this is discussed in detail in Chapter 3. Briefly, you should use the following steps:

1. Access the LCC program from the "Exit" menu of any program or from the Main Menu program.

2. Choose "Get BCF File" from the input menu.

3. Choose the file (on drive B) you wish to edit from the list. (This will copy the LCC input data from the diskette into memory.)

4. Choose "Edit BCF Data."

When editing an existing file, you have a choice of which data to edit. You may edit all data or only a particular subset in which you are interested.

After you choose "Edit BCF Data," you will first select the LCC components (input screens) to edit. Move the highlighted box using the right and left cursor control keys, and then press CR to select your option.

10.4.3 Input Screen Menus

Shown below are fully expanded menus for both the FBLCC input program (FLCCDATA) and the NBSLCC input program (PLCCDATA). The second menu bar appears after selecting "Edit BCF Data." The third menu bar and the vertical pull-down menu bar appear after selecting "Capital Components."

FBLCC BUILDING CHARACTERISTICS INPUT PROGRAM

Get BCF File	Save BCF File	Edit BCF Data	Enter New Data	Exit

All Data	Project	Capital Components	O&M	Energy	Exit

All Data	Component Data	Cost Phasing	Replacements	Exit

All Components
Component 1
Component 2
Component 3
Component 4
Component 5
Component 6
Exit

NBSLCC INPUT

Get BCF File	Save BCF File	Edit BCF Data	Enter New Data	Exit

All Data	Project	Capital Components	Mortgage	O&M	Energy	Exit

All	Component Data	Cost Phasing	Replacements	Depreciation	Exit

All Components
Component 1
Component 2
Component 3
Component 4
Component 5
Component 6
Exit

10.4.4 Exiting to Other LCC Subprograms

Once you have created or edited your LCC input files and saved them, you may wish either to print these input files or to perform the LCC calculations with them. To access other LCC subprograms, select "Exit" from the main input menu bar and use the up and down cursor keys to highlight your selection. Select the subprogram by using CR when the desired subprogram is highlighted.

Note that *both* the FBLCC and NBSLCC input programs create '.BCF' input data files. These input data files must not be interchanged, however, between the two LCC programs because their file structure and contents are different. Error messages will appear if you attempt to use a '.BCF' file with the incorrect LCC version.

Shown below is the "Exit" menu from the FBLCC input program FLCCDATA:

EXIT TO OTHER FBLCC PROGRAMS

```
Print Building Characteristics Data (FPRNTBCF)
Perform Calculations (FLCCMAIN)
Print Calculation Results (FPRNTLCC)
Print Comparative Analysis (FCOMPARE)
ASEAM2 Menu
DOS
Previous Menu (Shown Above)
```

10.5 FBLCC Input Screens

The input screens for the FBLCC program are shown below in the order in which they will appear. Three of these input screens—Operational and Maintenance Cost Data, Energy Cost Data, and Energy Escalation Data—will also appear in the NBSLCC input program.

A discussion of each input question can be found in the FBLCC User's Guide, pages 35-45. The help key (F9) will direct you to the correct page in this manual.

10.5.1 Project Information

```
FBLCC LCC INPUT  -
PROJECT INFORMATION                                            LCC FILE:
--------------------------------------------------------------------------------
Section 1. Project Title:                                          ____________
-------------------------


Section 2.  Basic LCC Analysis Assumptions:
-------------------------------------------

LCC Analysis Type                                                  _
  1 = Energy Conservation or Renewable Energy Projects (NBS 135)
  2 = Non-Energy Related Projects (OMB Circular A-94)

Study Period (Years)                                               __
Occupancy Year (e.g. 1987)                                         ____
DOE Region (1-11)                                                  __
Building Type                                                      _
  1 = Residental  2 = Commercial  3 = Industrial
```

10.5.2 Capital Component Data

```
FBLCC LCC INPUT  -
CAPITAL COMPONENTS DATA                                        LCC FILE:
--------------------------------------------------------------------------------
Capital Component Data (Use F4 to Delete THIS Component)       Item # 1

Component Name (or 'NA')                                       __________
Initial Cost of Component (dollars)                            _______
Initial Conservation-Related Cost                              _______
Expected Component Life (Years) - Use '999' for Land           ___
Average Escalation Rate During Planning/Construction Period    ___
Average Escalation Rate During Occupancy                       ___
Resale Value Factor (Percent of Initial Cost)                  ___
```

10.5.3 Cost Phasing

```
FBLCC INPUT
COST PHASING SCHEDULE BY YEAR OF PLANNING/CONSTRUCTION PERIOD AND AT OCCUPANCY
--------------------------------------------------------------------------------

Capital Component # 1  -

Enter Percentage of Cost for Each Year

Planning/Construction Year 1    ( 1987 )        ___
Planning/Construction Year 2    ( 1988 )        ___
Planning/Construction Year 3    ( 1989 )        ___
At Occupancy                    ( 1990 )        100
```

10.5.4 Replacement Data

```
FBLCC LCC INPUT  -
REPLACEMENTS TO CAPITAL COMPONENTS                          LCC FILE:
--------------------------------------------------------------------------------

Capital Component # 1  -

                                             Replacements to Capital Component
                                                 1      2      3      4
                                              ------- ------- ------- -------
Year of Replacement (from occupancy or 'NA')  __      __      __      __
Init Cost of Replacement (Unadjusted)         _______ _______ _______ _______
Expected Replacement Life (years)             __      __      __      __
Resale Value (% of replacement cost)          ____    ____    ____    ____
```

10.5.5 Operational and Maintenance Data

```
FBLCC LCC INPUT  -
OPERATING AND MAINTENANCE COSTS                              LCC FILE:
-------------------------------------------------------------------------------
Annually Recurring Costs
 Annual Recurring Cost (Base-Year Dollars)                               ________
 Average Annual Rate of Increase (%)                                     _____
Non-Annually Recurring Costs
 Number of Non-Annually Recurring Costs                                  __
 Average Annual Rate of Increase (%)                                     _____

              Non-Annually Recurring Costs (Base Year Dollars)
             (Note: Years begin with Occupancy; e.g. 1,2,...50)
-------------------------------------------------------------------------------
No Year  Amt      No Year  Amt      No Year  Amt      No Year  Amt      No Year  Amt
 1  __  ______    11  __  ______    21  __  ______    31  __  ______    41  __  ______
 2  __  ______    12  __  ______    22  __  ______    32  __  ______    42  __  ______
 3  __  ______    13  __  ______    23  __  ______    33  __  ______    43  __  ______
 4  __  ______    14  __  ______    24  __  ______    34  __  ______    44  __  ______
 5  __  ______    15  __  ______    25  __  ______    35  __  ______    45  __  ______
 6  __  ______    16  __  ______    26  __  ______    36  __  ______    46  __  ______
 7  __  ______    17  __  ______    27  __  ______    37  __  ______    47  __  ______
 8  __  ______    18  __  ______    28  __  ______    38  __  ______    48  __  ______
 9  __  ______    19  __  ______    29  __  ______    39  __  ______    49  __  ______
10  __  ______    20  __  ______    30  __  ______    40  __  ______    50  __  ______
```

10.5.6 Energy Cost Data

```
FBLCC LCC INPUT  -
ENERGY COST DATA                                              LCC FILE:
--------------------------------------------------------------------------------
Number of Energy Types                                                   _
Cumulative General Inflation from Mid-1985 to Date (%)                   _____

                                                          Energy Type
                                                      1         2         3
                                                  --------- --------- ---------
Energy Type Code                                  _         _         _
 1=Electricity       2=Distillate Fuel Oil
 3=Residual Fuel Oil         4=Natural Gas
 5=Liquified Petroleum Gas (LPG)  6 = Coal

Annual Consumption (MBTU)                         ________  ________  ________
Price per MBTU (Use F8 for DOE default)           ______    ______    ______
Demand (or other) Charge                          ______    ______    ______
Average Annual Rate of Increase (%)               _____     _____     _____
  During Plan/Construction
Price Escalation Method                           _         _         _
 1 = User Entered
 2 = Defaulted
```

10.5.7 Energy Escalation Data

```
FBLCC LCC INPUT  -
ENERGY ESCALATION                                        LCC FILE:
--------------------------------------------------------------------------------
Fuel Type 1   -  Electricity

Number of Discrete
Time Intervals   __

 # Dur Annual    # Dur Annual    # Dur Annual    # Dur Annual    # Dur Annual
   Yrs Rate %      Yrs Rate %      Yrs Rate %      Yrs Rate %      Yrs Rate %
 ------------    ------------    ------------    ------------    ------------
 1 __  ______   11 __  ______   21 __  ______   31 __  ______   41 __  ______
 2 __  ______   12 __  ______   22 __  ______   32 __  ______   42 __  ______
 3 __  ______   13 __  ______   23 __  ______   33 __  ______   43 __  ______
 4 __  ______   14 __  ______   24 __  ______   34 __  ______   44 __  ______
 5 __  ______   15 __  ______   25 __  ______   35 __  ______   45 __  ______
 6 __  ______   16 __  ______   26 __  ______   36 __  ______   46 __  ______
 7 __  ______   17 __  ______   27 __  ______   37 __  ______   47 __  ______
 8 __  ______   18 __  ______   28 __  ______   38 __  ______   48 __  ______
 9 __  ______   19 __  ______   29 __  ______   39 __  ______   49 __  ______
10 __  ______   20 __  ______   30 __  ______   40 __  ______   50 __  ______
```

10.6 NBSLCC Input Screens

The input screens for the NBSLCC program are shown below in the order in which they will appear. Three of these input screens—Operational and Maintenance Cost Data, Energy Cost Data, and Energy Escalation Data—also appear in the FBLCC input program.

10.6.1 Project Information

```
NBSLCC INPUT -                                                       fiprojdt
LCC PROJECT DATA                                                LCC FILE:
-----------------------------------------------------------------------------
  Project Title                                                  ___________
  Study Period                                                   __    years
  Construction Period                                            __    years
  Project Starting Date (e.g. 1987)                              ____
  Base Date for Discounting (e.g.1987)                           ____
  Tax Status Code (see reference manual page 138)                ____
    (1=for profit  2=priv resid  3=non-profit)
  Nominal ('1') or Real Rates ('2' - Includes Inflation)         2___
  General Inflation Rate (%/Year Average over Study Period)      ____  %
  Discount Rate                                                  ____  %
  Marginal Federal Income Tax Rate                               ____  %
  Marginal State Income Tax Rate                                 ____  %
  Property Tax Rate                                              ____  %
  Capital Gains Adjustment Factor                                ____  %
  Depreciation Recapture Code (see reference manual page 140)    _
    (0=none  1=capital gain  2=ordinary income  3=straight line)
  Depreciation Basis Adjustment Factor                           ____  %
  Sales Tax Rate                                                 ____  %
  DOE Region (for Default Energy Prices)                         __
  Building Type (1=Residential  2=Commercial  3=Industrial)       _
```

10.6.2 Capital Component Data

```
NBSLCC INPUT -
CAPITAL COMPONENTS DATA FOR:                                  LCC FILE:
---------------------------------------------------------------------------------
Capital Component Data (Use F4 to Delete this Component)      Item # 1
Component Name (or 'NA')                                      __________
Initial Cost of Component (dollars)                           _______
Percent Subject to Sales Tax                                  _____
Expected Component Life (Years - Use '999' for Land)          ___
Depreciation Method Code                                      _
  0 = no depreciation calculated
  1 = straight line
  2 = declining balance (accelerated)
  3 = sum of years digits
  4 = depreciation table (user entered)
Depreciation Life (years)                                     __
Depreciation Acceleration Rate (%) (Code 2 only)              ___
Depreciation Salvage Value (Percent of Initial Cost)          ___
Additional First Year Depreciation Factor                     ___
Average Escalation Rate During Planning/Construction Period   ___
Average Escalation Rate During Occupancy                      ___
Property Tax Assessment Factor (%)                            ___
Tax Credit Rate (Percent of Initial Cost)                     ___
Resale Value Factor (Percent of Initial Cost)                 ___
```

10.6.3 Cost Phasing

```
NBSLCC INPUT
COST PHASING SCHEDULE BY YEAR OF PLANNING/CONSTRUCTION PERIOD AND AT OCCUPANCY
---------------------------------------------------------------------------------

Capital Component # 1  -

Enter Percentage of Cost for Each Year

Planning/Construction Year 1    ( 1989 )        ___
Planning/Construction Year 2    ( 1990 )        ___
Planning/Construction Year 3    ( 1991 )        ___
Planning/Construction Year 4    ( 1992 )        ___
Planning/Construction Year 5    ( 1993 )        ___
At Occupancy                    ( 1994 )        100
```

10.6.4 Replacement Data

NBSLCC INPUT -
REPLACEMENTS TO CAPITAL COMPONENTS — LCC FILE:

Capital Component # 1 -

	Replacements to Capital Component			
	1	2	3	4
Year of Replacement (or 'NA') (from occupancy year e.g. '2')	____	____	____	____
Init Cost of Replacement (Unadjusted)	________	________	________	________
Percent Subject to Sales Tax	____	____	____	____
Expected Replacement Life (years)	__	__	__	__
Depr Salv Val Factor (% of repl cost)	____	____	____	____
Depreciation Life (years)	__	__	__	__
Resale Value (% of replacement cost)	____	____	____	____
Property Tax Assessment Factor (%)	____	____	____	____

10.6.5 Mortgage Data

NBSLCC INPUT -
MORTGAGE LOAN — LCC FILE:

	Constrt Loan	Permanent Loans			
		1	2	3	4
% of Total Cost Borrowed (or 'NA')	_____	_____	_____	_____	_____
Loan Type Code 1=fully amortized (equal payments) 2=interest only (principal at end) 3=interest and principal at end	_	_	_	_	_
Annual Interest Rate (%)	_____	_____	_____	_____	_____
Life of Loan (years)	__	__	__	__	__
Number of Payments per Year	__	__	__	__	__
Points Paid (% of loan amount)	_____	_____	_____	_____	_____

10.6.6 Depreciation Data

```
NBSLCC INPUT -

Year (Use F6 to Copy Last Capital Component Depreciation Table)
Capital Component # 1  -
  1                              ______
  2                              ______
  3                              ______
  4                              ______
  5                              ______
  6                              ______
  7                              ______
  8                              ______
  9                              ______
 10                              ______
 11                              ______
 12                              ______
 13                              ______
 14                              ______
 15                              ______
```

10.6.7 Operational and Maintenance Data

```
NBSLCC INPUT -
OPERATING AND MAINTENANCE COSTS                              LCC FILE:
------------------------------------------------------------------------------
Annually Recurring Costs
 Annual Recurring Cost (Base-Year Dollars)                            ________
 Average Annual Rate of Increase (%)                                  _____
Non-Annually Recurring Costs
 Number of Non-Annually Recurring Costs                               __
 Average Annual Rate of Increase (%)                                  _____

               Non-Annually Recurring Costs (Base Year Dollars)
              (Note: Years begin with Occupancy; e.g. 1,2,...50)
------------------------------------------------------------------------------
No Year  Amt     No Year  Amt     No Year  Amt     No Year  Amt     No Year  Amt
 1  __ ______    11  __ ______    21  __ ______    31  __ ______    41  __ ______
 2  __ ______    12  __ ______    22  __ ______    32  __ ______    42  __ ______
 3  __ ______    13  __ ______    23  __ ______    33  __ ______    43  __ ______
 4  __ ______    14  __ ______    24  __ ______    34  __ ______    44  __ ______
 5  __ ______    15  __ ______    25  __ ______    35  __ ______    45  __ ______
 6  __ ______    16  __ ______    26  __ ______    36  __ ______    46  __ ______
 7  __ ______    17  __ ______    27  __ ______    37  __ ______    47  __ ______
 8  __ ______    18  __ ______    28  __ ______    38  __ ______    48  __ ______
 9  __ ______    19  __ ______    29  __ ______    39  __ ______    49  __ ______
10  __ ______    20  __ ______    30  __ ______    40  __ ______    50  __ ______
```

10.6.8 Energy Cost Data

```
NBSLCC INPUT -
ENERGY COST DATA                                          LCC FILE:
--------------------------------------------------------------------------------
Number of Energy Types                                                  _
Cumulative General Inflation from Mid-1985 to Date (%)                  _____

                                                        Energy Type
                                                     1         2         3
                                                 --------- --------- ---------
Energy Type Code                                 _         _         _
 1=Electricity       2=Distillate Fuel Oil
 3=Residual Fuel Oil         4=Natural Gas
 5=Liquified Petroleum Gas (LPG)  6 = Coal

Annual Consumption (MBTU)                        ________  ________  ________
Price per MBTU (Use F8 for DOE default)          ______    ______    ______
Demand (or other) Charge                         ______    ______    ______
Average Annual Rate of Increase (%)              _____     _____     _____
  During Plan/Construction
Price Escalation Method                          _         _         _
 1 = User Entered
 2 = Defaulted
```

10.6.9 Energy Escalation Data

```
NBSLCC INPUT -
ENERGY ESCALATION                                           LCC FILE:
-------------------------------------------------------------------------------
Fuel Type 1   -  Electricity

Number of Discrete
Time Intervals    __

 # Dur Annual    # Dur Annual    # Dur Annual    # Dur Annual    # Dur Annual
   Yrs Rate %      Yrs Rate %      Yrs Rate %      Yrs Rate %      Yrs Rate %
 ------------    ------------    ------------    ------------    ------------
 1 __ ______    11 __ ______    21 __ ______    31 __ ______    41 __ ______
 2 __ ______    12 __ ______    22 __ ______    32 __ ______    42 __ ______
 3 __ ______    13 __ ______    23 __ ______    33 __ ______    43 __ ______
 4 __ ______    14 __ ______    24 __ ______    34 __ ______    44 __ ______
 5 __ ______    15 __ ______    25 __ ______    35 __ ______    45 __ ______
 6 __ ______    16 __ ______    26 __ ______    36 __ ______    46 __ ______
 7 __ ______    17 __ ______    27 __ ______    37 __ ______    47 __ ______
 8 __ ______    18 __ ______    28 __ ______    38 __ ______    48 __ ______
 9 __ ______    19 __ ______    29 __ ______    39 __ ______    49 __ ______
10 __ ______    20 __ ______    30 __ ______    40 __ ______    50 __ ______
```

11 Specify Analysis

11 SPECIFY ANALYSIS

11.1 Introduction

After all the input data files have been created and you have copied the weather and solar files for your location onto your data diskette, you next specify the analyses. This step tells ASEAM2.1 which files are to be used in the calculations and which method of calculation is to be used. The algorithms used are the same in all cases, but the input screens and output reports vary. You may specify one or many sets of calculations to be performed.

To access the Specify Analyses segment of ASEAM2.1, select "Specify Analyses" from the Main Menu or "Main Menu—Specify Analyses—Run Calcs" from any exit menu. The data disk should be in drive B *before* you select "Specify Analyses" because the filenames on the data disk are read to generate a list of acceptable input files to use.

ASEAM2.1 can perform calculations in five different modes:

1. Single Run Mode
2. Batch Run Mode
3. Parametric Run Mode
4. Single ECO Run Mode
5. Multiple ECO Run Mode

Each of these modes and their relative advantages and disadvantages are discussed in Section 11.2. Refer to Section 11.3 for instructions on how to complete the input screens for all modes.

11.2 Modes of Calculation: Descriptions, Advantages, Disadvantages

The five modes of calculation have several features in common. All require that the pertinent input data, weather, and solar files be on the data disk in drive B. This includes Loads, Systems, Plant, Economic, and ECO input files, if analyses are to be done for these segments. In addition, the data disk must have sufficient space for the output reports that will be created while the calculations are being performed. (Note: If the data disk fills up in the middle of a run, ASEAM2.1 will issue a message that the disk is full (error #61) and will abort. The calculations must be restarted.)

ASEAM2.1 can run unattended in any mode. Once you have specified the analyses and the calculations have begun, all specified calculations will be performed. The program automatically moves from one analysis to the next. You could "stack up" many runs, start the calculations, go home, and come back the next morning to look at the output files. If you have specified that a printer is available, some reports will be printed, depending on the calculation mode. All specified output reports will also be stored in files. (Note: Again, make sure that you have sufficient disk space for all outputs specified.)

Samples of the output reports can be found in Chapter 12. Refer to the table in Section 2.4 for a listing of the types of reports for each calculation mode.

11.2.1 Single Run Mode

The Single Run Mode is the most basic ASEAM2.1 calculation mode. In this mode, you specify which calculations are to be done (Loads only; Systems and Plant only; Plant only; or Loads, Systems, and Plant), the input data files to be used, and the output reports to be generated. If an LCC input file is specified, an LCC report also will be generated.

The Single Run and batch run modes provides the widest variety of output reports. You can select from among 39 output reports. These include the BEPS report, peak loads report, and numerous hourly loads reports and systems and plant bin reports. Most of the reports are LOTUS-compatible. See Chapter 12 for a discussion of output reports and formats. You do not have the option of specifying these reports in the Parametric and ECO Modes. If you require detailed information on hourly or bin calculations, the Single or Batch Run Mode is recommended.

11.2.2 Batch Run Mode

The Batch Run Mode is several Single Runs linked together. You specify the input files and output reports for up to 20 individual runs. The program performs the calculations in sequence and automatically moves from one analysis to the next.

The advantages and disadvantages of the Batch Run Mode are the same as those for the Single Run Mode.

11.2.3 Parametric Run Mode

The Parametric Run Mode permits you to easily change selected variables in the input data files without having to create new data files. You specify which variables are to be changed and the new values (either as a percentage of their original value or as a replacement value). Complete Loads, Systems, and Plant calculations are performed for all runs. In addition, if an LCC input file is specified, ASEAM2.1 will perform an LCC analysis and store the results.

WARNING: A major limitation to the parametric processor is that any changed input variable applies to all zones or systems. Thus, if you change the wall U-factor for example, this value is changed in all zones. Another limitation is that there is no error checking on the input values you enter.

The output report from the parametric processor consists of several files of annual values for output parameters that you specify. Thus, you determine which output variables you are interested in, and these are written to an output file. Monthly energy consumption of peak loads and LCC output files are also available, if specified.

The Parametric Run Mode is very useful for considering design alternatives. Input parameters can be changed very quickly. You can examine several different values for one parameter. The cumulative effects of changes in parameters also are easily studied. For example, you could specify wall insulations of R-5, R-10, and R-20 and thermostat setpoints of 74 and 68 degrees. The parametric processor would calculate all possible combinations of these inputs.

If you require hourly or bin output, you must use either the Single or Batch Run Mode. The Parametric Run Mode can have any output variable you specify in the output report, but only on an annual basis.

11.2.4 Single ECO Run Mode

The Single ECO Run Mode is used to examine the impact of a single ECO (Energy Conservation Opportunity) on existing buildings. Like the Parametric Run Mode, the ECO Run Mode makes modifications to an existing set of input files so that you do not need to create complete new input data files.

ECO files must be created in advance by using the ECO Input program (see Chapter 8). You may also use different complete loads, systems, or plant input files in the analysis. These files must be on the data disk in drive B. You select those files (either ECO files or complete input files) to be used to modify the base-case files.

The outputs from the ECO run are the monthly energy consumption, BEPS and LCC reports (optional). These reports are stored for both the base case and the modified (with ECO) case. After each ECO analysis, the two annual energy end-use summaries are compared, and an LCC comparison may also be generated if specified. This is very useful if you want to see how much energy or money a given ECO will save.

If you require more specific output than the BEPS report, you should use either Single or Batch modes of calculation. If you want to look at the cumulative effects of many ECOs, use the Multiple ECO Run Mode.

11.2.5 Multiple ECO Run Mode

The Multiple ECO Run Mode is used to model the cumulative effects of more than one ECO. It is like the Single ECO Run Mode except that more than one ECO file is used to modify the original input files. All ECO files must be on the data disk in drive B.

The output from the Multiple ECO Run Mode is the same as that from the Single ECO Run Mode.

11.3 Specify Analyses: Screens

Each mode of calculation has its own set of input screens. The screens for each mode are described below.

After you select "Specify Analyses," the file names stored on the data disk will be read. When you are asked to select input files to be used in the analyses, your entry will be compared against valid file names from this list. You can use the default key (F8) to select from the available files. Therefore, make sure that the data disk is in place *before* you "Specify Analyses." If you need to change disks because the correct files were not on the disk, you will need to Exit and then reenter the Specify Analyses program.

After you complete all the Specify Analyses screens, the Main Menu will appear. You must start the calculations by selecting "Run Calcs." The data from Specify Analyses are saved in a file when you select Run Calcs from the Main Menu, *not* when you exit from Specify Analyses. Therefore, you should always select Run Calcs after completing a Specify Analyses segment. Run Calcs will always use the Specify Analyses instructions immediately preceding it.

11.3.1 Configuration Screen

The first screen that appears after you select Specify Analyses is a configuration screen. Here you specify whether you have a printer and what mode of calculation you will use. If you have a printer, the monthly energy consumption, BEPS report and Peak Loads reports (if specified) will automatically be printed in Single or Batch Run Modes. If you do not have a printer, they will be stored in files, if so specified.

You also specify a name for the runfile. The runfile contains all the data specified on the following screens. You should *always* use the F8 default key to retrieve existing runfiles or create new ones. The runfile is named so that later you can access it without having to enter all the Specify Analysis data again. The program identifies the runfile type (calculation mode) by extension, so you can use the same file name for different types of calculation modes. Do not specify the extensions. The program automatically uses the following extensions:

.SRC—Single Run Calculation
.BRC—Batch Run Calculation
.PRC—Parametric Run Calculations
.ERC—Single ECO Run Calculations
.MRC—Multiple ECO Run Calculations

```
ANALYSIS SPECIFICATIONS

--------------------------------------------------------------------------------
Hardware Specifications
  Printer Available (Y/N)                                          _

Calculation Mode                                                   _
  S = Single Run    B = Batch Mode    P = Parametric Mode
  E = ECO Runs (Single ECO)    M = Multiple ECO Runs (Combination)
                                                                   ________
Runfile for Analysis (Use F8 for Listing)
```

Select the calculation mode. The mode selected here determines which screens follow.

Select a runfile name by pressing F8 and selecting from the list of files displayed at the bottom of the screen. If you have not previously defined a runfile, or wish to create a new runfile, select "New File" from the list of runfiles, and enter a valid file name.

11.3.2 Single-Run Mode

There are three screens for the Single Run Mode. On the first screen, shown below, you specify the input files to be used for the analysis. Whenever you are to specify a input data file, press the F8 key, and then use the cursor control keys to select a file from the list. Also select the weather files to be used.

In all the calculation modes, the first two entries allow you to specify a title for this analysis, which will be printed on many reports.

The Single Run and Batch Run modes are the only modes that allow you to start the calculations from other parts of the program. For example, if you are investigating changes in chiller parameters, you may decide to start the analysis with the plant calculations, eliminating the unnecessary loads and systems calculations. *Note, however, that the intermediate results of the most recent ASEAM2.1 loads and systems analysis (before the one being specified) will be used.*

```
ANALYSES SPECIFICATIONS
Analysis Number  1
------------------------------------------------------------------------------
Report Output Titles
Line 1 ('999' to end)    ______________________________________________________
Line 2                   ______________________________________________________

Analysis Type                                                          _
  1=All  2=Loads Only   3=Systems & Plant   4=Plant Only

Input Files for Analysis (Use F8 for Listing)
  Load Input File                                                      ________
  System Input File                                                    ________
  Plant Input File                                                     ________
  LCC Input File (if appl)                                             ________

Weather Files
  Type of bin weather data                                             _
    1=ASHRAE   2=Battelle   3=DOD

  Weather station filename (Use F8 for Listing)                        ________
  Solar station filename (Use F8 for Listing)                          ________
```

ASEAM2.1 will not allow you to enter either invalid file names or those not stored on your data disk. If you wish to use input files that are not listed by using the F8 key, you should press the F10 key to abort and return to the menu. All of the input data files for all analyses *must* be on the data disk when you specify analysis.

The following two screens are used to select which output reports are to be generated. Remember that there must be sufficient space on the data disk for all output reports. The first of these screens is for Loads reports and the second is for Systems and Plant reports. Refer to Chapter 12 for samples of these reports.

Identify the output file name with a four-character prefix. This prefix is your only way to identify the output report. Enter only valid file-name characters (consult your DOS manual if necessary). The last four letters of the output file name and the file name extension are automatically inserted by ASEAM2.1. The extensions for many output files are .PRN so that they can be imported directly into LOTUS. If, for example, you specify a 'Y' for the 'LB' report, and you have three zones, three new output files will be created and stored on the data disk during the loads calculations. In the following examples, 'xxxx' is the four-character prefix you specified; 'LB' is the report type; and '01', '02', etc. are the zone numbers:

xxxxLB01.PRN
xxxxLB02.PRN
xxxxLB03.PRN

Three of the reports you may specify below are not standard LOTUS-compatible files:

1. 'LA' is a peak loads data file containing numbers.
2. 'BEPS' is the building energy end-use data file.

   Note: These two reports contain only numbers that are associated with peak-load components or end-use components. Therefore, these two reports must be formatted with the Miscellaneous Output Reports command from the Main Menu—Print Reports.

3. 'LCCO' is an ASCII text file output that can be read by a word processor.

```
OUTPUT SPECIFICATIONS (LOADS OUTPUTS - SCREEN 1)
Analysis Number  1
-----------------------------------------------------------------------------
Output File Name Prefix (4 Characters)                ____


Select Loads Outputs - Enter 'Y' or 'N' ('blank' = 'N')

    LA - Peak Loads Summary        _   LM - Divrs Equipment                  _
    LB - Peak Total                _   LN - Daylighting (Overcast - Max)     _
    LC - Diversified Total         _   LO - Daylighting (Overcast - Mid)     _
    LD - Peak Opaque CLTD          _   LP - Daylighting (Overcast - Min)     _
    LE - Peak Glass Solar          _   LQ - Daylighting (Clear    - Max)     _
    LF - Peak Lighting             _   LR - Daylighting (Clear    - Mid)     _
    LG - Divrs Lighting            _   LS - Daylighting (Clear    - Min)     _
    LH - Peak Plenum               _   LT - Wall CLTD                        _
    LI - Divrs Plenum              _   LU - Roof CLTD                        _
    LJ - Peak People               _   LV - Direct Solar on Glass            _
    LK - Divrs People              _   LW - Shaded Solar on Glass            _
    LL - Peak Equipment            _
```

```
OUTPUT SPECIFICATIONS (SCREEN 2)
Analysis Number  1
--------------------------------------------------------------------------------
Enter 'Y' or 'N'  ('blank' = 'N') for each Output Report
Systems Outputs ('.PRN' - Bin)
  SA - System Loads (Zone Loads on System)                          _
  SB - System Energy Requirements (System Loads on Plant)           _
  SC - System Psychrometrics (Central Systems)                      _
  SD - System Psychrometrics (Unitary Systems)                      _
Plant Outputs ('.PRN' - Bin)
  SLDS - Plant Loads (Composite System Loads on Plant)              _
  PDHW - Domestic Hot Water                                         _
  PCEN - Centrifugal Chiller                                        _
  PABS - Absorption Chiller                                         _
  PDBC - Double Bundle Chiller                                      _
  PREC - Reciprocating Chiller                                      _
  PDBH - Double Bundle Heating                                      _
  PBLR - Boiler                                                     _
  PTOW - Cooling Tower                                              _
Energy End Use
  BEPS - Building Energy End Use Report                             _
Life Cycle Costs
  LCCO - Life Cycle Costs Report                                    _
```

11.3.3 Batch Run Mode

The Batch Run Mode screens are exactly the same as those for Single Run Mode. The same three screens will keep appearing, in sequence, so that as many as 20 runs can be "stacked up." Again, all the input files must be on the data disk. To terminate the input sequence, enter '999' for the report output title on the first line of the first screen.

Note that the four-character prefix must be unique for each run; otherwise a later run's output files will overwrite an earlier run's output files.

11.3.4 Parametric Run Mode

On the first screen of the Parametric Run Mode, shown below, you specify the base-case data files and weather files. These are the files that will be used originally; any modifications will be to the variables in these files.

You also choose the method of changing the input variables: either all possible combinations of variables or single changes. Choosing "all possible combinations" means that calculations will be performed for every combination of each value for each parametric input variable. Single changes will perform the calculation once for each value of each parametric variable (all other parametric variables remain unchanged).

Always be aware of how many runs you are requesting, especially if you designate "all possible combinations." On the following screens you will specify both the number of variables to be changed or investigated and the number of iterations for each variable. If four different variables were selected, and there were 3, 4, 5, and 6 iterations on the respective variables, the following number of ASEAM2.1 runs would be investigated:

Run singularly: 3 + 4 + 5 + 6 = 18 (plus one for base case)

All possible combinations: 3 * 4 * 5 * 6 = 360 (plus one for base case)

```
PARAMETRIC ANALYSES SPECIFICATIONS
------------------------------------------------------------------------------

Parametric Input Files for Analysis (Use F8 for Listing)
  Load Input File                                                   ________
  System Input File                                                 ________
  Plant Input File                                                  ________
  Base Case LCC File (if appl)                                      ________

Weather Files
  Type of bin weather data                                          _
    1=ASHRAE   2=Battelle   3=DOD

  Weather station filename (Use F8 for Listing)                     ________
  Solar station filename (Use F8 for Listing)                       ________

  Method of Changing Input Variables                                _
    1 = All Possible Combinations
    2 = Run Singularly
```

On the next screen, you select the variables to be included in the output reports. For each parameter selected (such as annual electricity consumption), the annual value will be shown for every parametric input combination.

In the output report, the results of each run will be stored on one line, and each number in the line (column) will contain a different parametric output variable. Note that output variables numbers 30 to 35 generates separate parametric output files for monthly energy consumption and peak loads. First, enter the total number of columns in the output report. Then enter which variables are to appear in which columns. Refer to the list below for parametric output variables.

```
PARAMETRIC OUTPUT SPECIFICATIONS

------------------------------------------------------------------------------
      Enter Parametric Output Variable Numbers for each Output Column
                  (See Reference Manual for Listing)

Number of Parametric Output Columns                                       __

  Output Variable - Col #1   __       Output Variable - Col #11     __
  Output Variable - Col #2   __       Output Variable - Col #12     __
  Output Variable - Col #3   __       Output Variable - Col #13     __
  Output Variable - Col #4   __       Output Variable - Col #14     __
  Output Variable - Col #5   __       Output Variable - Col #15     __
  Output Variable - Col #6   __       Output Variable - Col #16     __
  Output Variable - Col #7   __       Output Variable - Col #17     __
  Output Variable - Col #8   __       Output Variable - Col #18     __
  Output Variable - Col #9   __       Output Variable - Col #19     __
  Output Variable - Col #10  __       Output Variable - Col #20     __
```

Table 11.1 Parametric Output Variables

OUTPUT VARIABLE NUMBER	VARIABLE TYPE	DESCRIPTION OF VARIABLE	UNITS
1	Heating Energy	Electric Resistance	KWH
2	Heating Energy	Heat Pump	KWH
3	Heating Energy	Gas Boiler	therms
4	Heating Energy	Oil Boiler	gal
5	Heating Energy	Electric Boiler	KWH
6	Heating Energy	District Heating	MBTU
7	Heating Energy	Gas Furnace	therms
8	Heating Energy	Oil Furnace	gal
9	Heating Energy	Electric Furnace	KWH
10	Cooling Energy	Direct Expansion	KWH
11	Cooling Energy	Centrifugal Chiller	KWH
12	Cooling Energy	Absorption Chiller	KWH
13	Cooling Energy	District Cooling	MBTU
14	Cooling Energy	Double Bundle Chiller	KWH
15	Cooling Energy	Reciprocating Chiller	KWH
16	Cooling Energy	Window A/C Units	KWH
17	Cooling Energy	Heat Pump	KWH
18	DHW Energy	Domestic HW Heater	therms
19	DHW Energy	Domestic HW Heater	gal
20	DHW Energy	Domestic HW Heater	KWH
21	DHW Energy	Domestic HW Heater	MBTU
22	Building Misc.	Lights	KWH
23	Building Misc.	Equipment	KWH
24	Building Misc.	Miscellaneous	KWH
25	System Misc.	Fans	KWH
26	Not Assigned		
27	Plant Misc.	Cooling Tower	KWH
28	Plant Misc.	Pumping	KWH
29	Not Assigned		
30	Not Assigned		
31	Not Assigned		
32	Not Assigned		
33	Not Assigned		
34	Not Assigned		
35	Peak Loads Report	(See Note Below)	
36	Not Assigned		
37	Not Assigned		
38	Not Assigned		
39	Not Assigned		
40		Total Gas Consumption	therms

Table 11.1—*Continued*

41		Total Oil Consumption	gal
42		Total Electrical Cons	KWH
43		Total District Heating	MBTU
44		Total District Cooling	MBTU
45	Not Assigned		
46	Not Assigned		
47	Not Assigned		
48	Not Assigned		
49	Not Assigned		
50		Total Energy Cost	$
51	Not Assigned		
52	Not Assigned		
53	Not Assigned		
54	Not Assigned		
55		Total Site Energy	MBTU
56	Not Assigned		
57	Not Assigned		
58	Not Assigned		
59	Not Assigned		
60		Total Source Energy	MBTU

Note: Output variable numbers 30 to 35 generate separate parametric output files for monthly energy consumption and zone peak loads. These files can be imported into LOTUS (see Chapter 12).

On the following screen, enter the number of the parametric variable to be changed. Refer to the list (below) of parametric input variables. Also enter the method of change, either a decimal percent change or a new value. (Note: Some input values, such as changing the weather file or orientation, only accept new values.)

Then enter the number of values (up to 10) for this parameter. Finally, enter the values desired and the cost for each. An entry of '999' should be used if the value of the variable in the base case file is not to be changed.

```
PARAMETRIC VARIABLE SPECIFICATIONS
Parametric Variable Number  1
--------------------------------------------------------------------------------
Parametric Variable Number  (Enter '0' to end)                               __
  (See Reference Manual for Listing)

Method of Parametric Change (1 or 2)                                         _
  1 - Decimal Percent Change (0-1)
  2 - New Value Entered

Number of Values for this Variable                                           __

  Changed Value #1  ________         $ Cost for Change ________
  Changed Value #2  ________         $ Cost for Change ________
  Changed Value #3  ________         $ Cost for Change ________
  Changed Value #4  ________         $ Cost for Change ________
  Changed Value #5  ________         $ Cost for Change ________
  Changed Value #6  ________         $ Cost for Change ________
  Changed Value #7  ________         $ Cost for Change ________
  Changed Value #8  ________         $ Cost for Change ________
  Changed Value #9  ________         $ Cost for Change ________
  Changed Value #10 ________         $ Cost for Change ________
                      (USE '999' FOR NO CHANGE IN VALUE)
```

The above screen can be repeated up to 20 times. When you have entered all values for all parameters, enter a '0' for the Parametric Variable number and you will be returned to the Main Menu.

Warning: The maximum number of runs you could specify is 20 variables with 10 values each. This comprises ten to the twentieth runs, which would take several years to run! If you choose to perform runs for all combinations of variables, keep track of how many total runs this is. You may want to "time" a typical run first. If, for example, each run takes 5 minutes, about 180 runs could be performed between 5 p.m. and 8 a.m. (12 runs/hour times 15 hours). Note that the results are stored at the end of each calculation, and you can stop the calculations (using the F2 key) to investigate the completed runs.

Table 11.2 Parametric Input Variable List

Input Variable Number	Variable Type	Description of Variable	Notes Number	Entry Type	Remarks
1	Loads	Orientation Adjustment	1	N2	See Notes
2	Loads	Weather Data Type	2	N2	See Notes
3	Loads	Weather Data Filename	3	C	See Notes
4	Loads	Solar Data Filename	3	C	See Notes
5	Loads	Starting Hour for Occupancy	4	N2	(1 to 24)
6	Loads	Occupied Hours/Day	5	N2	See Notes
7	Loads	Summer Stat Start Month #		N2	(1 to 12)
8	Loads	Summer Stat Ending Month #		N2	(1 to 12)
9		NOT ASSIGNED			
10		NOT ASSIGNED			
11	Loads	Summer Stat Setpoint		N	(deg F)
12	Loads	Winter Stat Setpoint (OCC)		N	(deg F)
13	Loads	Winter Stat Setpoint (UNOCC)		N	(deg F)
14		NOT ASSIGNED			
15	Loads	Wall U-Factor		N	
16		NOT ASSIGNED			
17	Loads	Roof U-Factor		N	
18		NOT ASSIGNED			
19	Loads	Window U-Factor		N	
20	Loads	Window Shading Coef		N	(0 to 1)
21	Loads	Window Leak Coefficient		N	
22	Loads	Window Shading Model #	6	N2	(1,2,3)
23		NOT ASSIGNED			
24	Loads	Daylighting Glass Transmittance	6	N	(to 100)
25	Loads	Daylighting Wall Reflectance	6	N	(to 100)
26	Loads	Daylighting Present FC	6	N	
27	Loads	Daylighting Design FC	6	N	
28	Loads	Daylighting Sensor Location	6	N2	1
29	Loads	Daylighting Control Type	6	C	D or S
30		NOT ASSIGNED			
31		NOT ASSIGNED			
32	Loads	Daylighting Min FC Maintained	6	N	
33	Loads	Daylighting Min % Power at Min FC	6	N	(to 100)
34		NOT ASSIGNED			
35		NOT ASSIGNED			
36	Loads	Div Factor - People (OCC)	7	N	(to 100)
37	Loads	Div Factor - Lights 1 (OCC)	7	N	(to 100)
38	Loads	Div Factor - Lights 2 (OCC)	7	N	(to 100)
39	Loads	Div Factor - Lights 3 (OCC)	7	N	(to 100)
40	Loads	Div Factor - Lights 4 (OCC)	7	N	(to 100)
41	Loads	Div Factor - Equip 1 (OCC)	7	N	(to 100)
42	Loads	Div Factor - Equip 2 (OCC)	7	N	(to 100)
43	Loads	Div Factor - Misc Sens 1 (OCC)	7	N	(to 100)
44	Loads	Div Factor - Misc Sens 2 (OCC)	7	N	(to 100)

Table 11.2—*Continued*

45	Loads	Div Factor - People (UNOCC)	7	N	(to 100)
46	Loads	Div Factor - Lights 1 (UNOCC)	7	N	(to 100)
47	Loads	Div Factor - Lights 2 (UNOCC)	7	N	(to 100)
48	Loads	Div Factor - Lights 3 (UNOCC)	7	N	(to 100)
49	Loads	Div Factor - Lights 4 (UNOCC)	7	N	(to 100)
50	Loads	Div Factor - Equip 1 (UNOCC)	7	N	(to 100)
51	Loads	Div Factor - Equip 2 (UNOCC)	7	N	(to 100)
52	Loads	Div Factor - Misc Sens 1 (UNOCC)	7	N	(to 100)
53	Loads	Div Factor - Misc Sens 2 (UNOCC)	7	N	(to 100)
54		NOT ASSIGNED			
55	Loads	Door U-Factor		N	
56	Loads	Door Leak Coef		N	
57		NOT ASSIGNED			
58	Loads	Occupied Air Change Rate	8	N	See Notes
59	Loads	Unoccupied Air Change Rate	8	N	See Notes
60		NOT ASSIGNED			
61	Loads	Misc Cond U-Factor		N	
62	Loads	Misc Cond Ref Temp at Des Sum		N	(deg F)
63	Loads	Misc Cond Ref Temp at Des Win		N	(deg F)
64		NOT ASSIGNED			
65	Loads	Lighting - Total Watts		N	
66	Loads	Lighting - Watts/ft2		N	
67	Loads	Lighting - Percent Heat to Space		N	(to 100)
68		NOT ASSIGNED			
69	Loads	Number of People		N	
70	Loads	Square Feet per person		N	
71		NOT ASSIGNED			
72	Loads	Misc Elect - Total Watts		N	
73	Loads	Misc Elect - Watts/ft2		N	
74		NOT ASSIGNED			
75	Loads	Misc Sensible - Total BTUH	9	N	
76	Loads	Misc Sensible - BTUH/ft2		N	
77		NOT ASSIGNED			
78	Loads	Ext Shading - Overhang depth	10	N	See Notes
79	Loads	Ext Shading - Recess depth	11	N	See Notes
80		NOT ASSIGNED			
81		NOT ASSIGNED			
82		NOT ASSIGNED			
83		NOT ASSIGNED			
84		NOT ASSIGNED			
85	Systems	TOA Heating Off		N	(deg F)
86	Systems	Maximum Heating Temp		N	(deg F)
87	Systems	Discriminator Control-HTG (DDMZ)	12	C	Y or N
88	Systems	TOA at Maximum Hot Deck Temp (DDMZ)		N	(deg F)
89	Systems	Maximum Hot Deck Temp (DDMZ)		N	(deg F)
90	Systems	TOA at Minimum Hot Deck Temp (DDMZ)		N	(deg F)
91	Systems	Minimum Hot Deck Temp (DDMZ)		N	(deg F)
92		NOT ASSIGNED			

93	Systems	TOA Cooling On		N	(deg F)
94	Systems	Minimum Supply Temp CLG	13	N	See Notes
95	Systems	Discriminator Control - Cooling	12	C	Y or N
96	Systems	Max Cooling Supply Temp (Disc)	14	N	(deg F)
97		NOT ASSIGNED			
98	Systems	TOA Preheat Off		N	(deg F)
99	Systems	Design Preheat Discharge Temp		N	(deg F)
100		NOT ASSIGNED			
101	Systems	TOA Humidification Off (OCC)		N	(deg F)
102	Systems	Winter Relative Humidity (%)		N	(to 100)
103		NOT ASSIGNED			
104	Systems	TOA Baseboard Off		N	(deg F)
105	Systems	Baseboard Control Method	15	N2	See Notes
106	Systems	Percent Load Satisfied - Des Win		N	(to 100)
107	Systems	Percent Load Satisfied - Min Load		N	(to 100)
108		NOT ASSIGNED			
109	Systems	Total Supply Fan KW	16	N	
110	Systems	Supply Fan KW/1000 CFM		N	
111	Systems	Supply Fan Heat		N	(deg F)
112	Systems	Total Return Fan KW	16	N	
113	Systems	Return Fan KW/1000 CFM		N	
114	Systems	Return Fan Heat		N	(deg F)
115	Systems	Minimum Percent Flow (VAV)		N	(to 100)
116	Systems	Fan Control Method (VAV)	17	N2	See Notes
117	Systems	Fan Operating Method (OCC)	18	N2	See Notes
118	Systems	Fan Operating Method (UNOCC)	19	N2	See Notes
119		NOT ASSIGNED			
120	Systems	Outside Air Control Method (OCC)	20	N2	See Notes
121	Systems	Min Percent Outside Air (OCC)		N	(to 100)
122	Systems	Dry Bulb Switchover Temp (OCC)		N	(deg F)
123	Systems	Outside Air Control Method (UNOCC)	20	N	See Notes
124	Systems	Min Percent Outside Air (UNOCC)		N	(to 100)
125	Systems	Dry Bulb Switchover Temp (UNOCC)		N	(deg F)
126		NOT ASSIGNED			
127		NOT ASSIGNED			
128	Systems	Furnace Capacity (KBTUH)	21	N	
129	Systems	Furnace % Load Satisfied (auto)	22	N	(to 100)
130	Systems	Furnace Efficiency (%)		N	(to 100)
131	Systems	Furnace Off Loss - % at Des Win		N	(to 100)
132	Systems	Furnace Off Loss - % at Min Load		N	(to 100)
133	Systems	Furnace Pilot Consumption (therms)		N	annual #
134		NOT ASSIGNED			
135		NOT ASSIGNED			
136	Systems	HP/WAC - % Total Load Satisfied	22	N	(to 100)
137	Systems	HP/WAC - % Sensible Load Satisfied	22	N	(to 100)
138	Systems	HP/WAC - COP Cooling		N	
139	Systems	WSHP - TOA at Min Fluid Temp		N	(deg F)
140	Systems	WSHP - Min Fluid Temp		N	(deg F)

141	Systems	WSHP - TOA at Max Fluid Temp		N	(deg F)
142	Systems	WSHP - Max Fluid Temp		N	(deg F)
143		NOT ASSIGNED			
144		NOT ASSIGNED			
145	Systems	HP - % Heating Load Satisfied	22	N	(to 100)
146	Systems	HP - TOA Heat Pump HTG Off (AAHP)	23	N	(deg F)
147	Systems	HP - % Load Satisfied - Backup HTG	22	N	(to 100)
148	Systems	HP - COP (Heating)		N	
149		NOT ASSIGNED			
150	Systems	Percent Design Air Flow (Central)	22	N	(to 100)
151	Systems	Percent Design Zonal Fan KW (Unit)	22	N	(to 100)
152		NOT ASSIGNED			
153	Systems	DX - % Total CLG Load Satisfied	22	N	(to 100)
154	Systems	DX - COP		N	
155	Systems	DX - Minimum Unloading Ratio		N	(to 100)
156	Systems	DX - Min Hot Gas Bypass Ratio		N	(to 100)
157	Systems	DX - Condenser Fan KW		N	
158	Systems	DX - TOA Condenser Fan Off		N	(deg F)
159	Plant	DHW Capacity		N	(KBTUH)
160	Plant	DHW Occupied Cycle Average Usage		N	(Gal/Hr)
161	Plant	DHW Unoccupied Cycle Average Usage		N	(Gal/Hr)
162	Plant	DHW Efficiency (percent)		N	(to 100)
163	Plant	DHW Occupied Cycle Losses		N	(BTUH)
164	Plant	DHW Unoccupied Cycle Losses		N	(BTUH)
165	Plant	Chiller Cooling Capacity (tons)	24	N	
166	Plant	Chiller % Max Load Satisfied	25	N	(to 100)
167	Plant	Chiller COP		N	
168	Plant	Chiller Unloading Ratio		N	(to 100)
169	Plant	Chiller Min Part Load Ratio		N	(to 100)
170	Plant	Chiller Unloading Ratio (Heating-DB)		N	(to 100)
171	Plant	Chiller Design Heat Rec Temp (DB)		N	(deg F)
172		NOT ASSIGNED			
173		NOT ASSIGNED			
174		NOT ASSIGNED			
175	Plant	Cooling Tower - % Load Satisfied	25	N	(to 100)
176	Plant	Cooling Tower - Number Cells		N2	
177	Plant	Cooling Tower - # Fan Speeds		N2	
178		NOT ASSIGNED			
179		NOT ASSIGNED			
180	Plant	Boiler - Heat Capacity (KBTUH)	24	N	
181	Plant	Boiler - % Heat Load Satisfied	25	N	(to 100)
182	Plant	Boiler - Efficiency		N	(to 100)
183	Plant	Boiler - Combustion Air Temp		N	(deg F)
184	Plant	Boiler - Stack Temp		N	(deg F)
185	Plant	Boiler - Air-Fuel Ratio		N	
186	Plant	Boiler - Min Unloading Ratio		N	(to 100)
187		NOT ASSIGNED			
188		NOT ASSIGNED			

189	NOT ASSIGNED
190	NOT ASSIGNED
191	NOT ASSIGNED
192	NOT ASSIGNED
193	NOT ASSIGNED
194	NOT ASSIGNED
195	NOT ASSIGNED
196	NOT ASSIGNED
197	NOT ASSIGNED
198	NOT ASSIGNED
199	NOT ASSIGNED
200	NOT ASSIGNED

Notes

Entry Type - 'N' represents a numeric input
'N2' represents a numeric input using the 'new value' method for changing
'C' represents a character input

There are no error checks for valid input values.

1. *Orientation Adjustment*: Enter a number from 1 to 7 that corresponds to the amount of clockwise rotation in increments of 45 degrees. For example, if you enter "2" (indicating a 90 degree rotation), all south orientations entered in the base input file will become west orientations for the calculations. If no rotation is desired, enter either 0 or 8.

2. *Weather Data Type*: Enter one of the following:
   1—ASHRAE Bin Weather (file name extension '.awd')
   2—Battelle Bin Weather (file name extension '.bwd')
   3—DOD Bin Weather (file name extension '.dwd')

3. *Bin and Solar Weather File Names*: Enter the eight-character weather file name. These data files must also be stored on your data disk. See also note 2 above.

4. *Starting Hour for Occupancy*: Enter a number value from 1 to 24

5. *Occupied Hours/Day*: Enter one of the following: 8, 10, 12, 14, or 16. Any other entry is invalid.

6. *Daylighting*: Note that all three daylighting functions will be changed by this entry.

   The sensor location should be one of the following:
   1—Max location (closest to window)
   2—Mid location
   3—Min location (farthest from window)

   The daylighting control type should be entered as either 'D' for dimming or 'S' for stepped control. Capital letters should be used.

7. *Diversity Factors*: Diversity factors of *all* zones will be changed. This entry should be in percent (e.g., 70, not .7).

8. *Infiltration Air Change Rate*: Because the parametric processor changes all zones to this value, you may want to select the first method (multiply base value by percent) for changing this variable. By using this method, the interior zones (assuming no infiltration) would not be changed.

9. *Miscellaneous Loads*: The BTUH value is positive for heat gains and negative for heat losses.

10. *Overhang depth*: Make this entry in inches. See note 11 below. All three exterior shading models will be changed.

11. *Recess depth*: Make this entry in inches. This will change three base-case entries simultaneously—the left, right, *and* overhang depth.

12. *Discriminator Control*: Enter either 'Y' or 'N'. Capital letters must be used.

13. *Minimum Supply Temperature*: If you have selected 'autosizing' for the system air flow, changing this value may change the system sizing.

14. *Maximum Cooling Supply Temperature*: Used only if discriminator control is used in the cooling mode.

15. *Baseboard Control Method*: Enter one of the following:

    1—Thermostatic control
    2—Baseboard heating reset by outside air temperature

16. *Fan KW*: This entry has precedence over the 'KW/1000 CFM' entry.

17. *Fan Control Method (VAV)*: Use one of the following:
    1—Variable Speed
    2—Discharge Dampers
    3—Inlet Vanes

    Any other entry is invalid.

18. *Fan Operating Method (Occupied Cycle only)*: This entry applies only to "zonal" systems (systems that normally cycle day and night). It does not affect the central systems such as CVRH, DDMZ, VAV, HV, SZRH. Use one of the following:
    1—On Continuously
    2—Cycles with Load

19. *Fan Operating Method (Unoccupied Cycle only)*: This entry applies to all systems. Use the 1 or 2 code described in note 18 above.

20. *Outside Air Control Method*: Use one of the following codes:
    1—No Outside Air
    2—Fixed Percent Outside Air
    3—Dry-Bulb Economizer
    4—Enthalpy Economizer

21. *Entered Capacity*: This entry has precedence over the autosizing option.

22. *Autosizing*: Only used if autosizing is selected.

23. *TOA Heat Pump Heating Off (for Air-to-Air Heat Pump only)*: When the outside air temperature is below this value, backup heating is used.

24. *Plant Capacity*: Enter value per unit (e.g., if two chillers or boilers are specified in the base file, enter the capacity of each chiller or boiler, not the combined capacity).

25. *Plant Capacity (autosizing)*: Enter percent of maximum load per unit (e.g., if two chillers or boilers are specified in the base file, enter the percent capacity of each chiller or boiler, not the combined capacity).

11.3.5 Single ECO Run Mode

The first screen for Single ECO Run Mode defines the base-case files. These are the files to which all ECOs will be compared. An output file name for the base case is also entered. At the end of each calculation, an ASCII text file will be created to store the results.

The example below shows the form of the file name for your output results. In the example, 'xxxx' is the four-character file-name prefix you specify; 'SECO' is automatically added by ASEAM2.1 (Single ECO); and '.y' is the ECO run number, where 'y' is '1' for the base case, '2' for the first ECO run, '3' for the second ECO run, etc.

xxxxSECO.y

where
'XXXX' is the four character filename prefix you specify
'SECO' is automatically added by ASEAM2.1 (Single ECO)
' .Y ' is the ECO run number where 'Y' is
'1' for the base case
'2' for the first ECO run
'3' for the second ECO run, etc.

```
ANALYSES SPECIFICATIONS
Base Case Information
--------------------------------------------------------------------------------
Base Case Definition Output Titles
Line 1    _________________________________________________________________
Line 2    _________________________________________________________________

Base Case Input Files for Analysis (Use F8 for Listing)
  Load Input File                                                     ________
  System Input File                                                   ________
  Plant Input File                                                    ________
  LCC Input File                                                      ________

Weather Files
  Type of bin weather data                                            _
    1=ASHRAE   2=Battelle   3=DOD

  Weather station filename (Use F8 for Listing)                       ________
  Solar station filename (Use F8 for Listing)                         ________

  File Name for Output (4 characters)                                 ____
```

The following screen defines one ECO. You specify the type of ECO (Loads, Loads Batch, Systems, Systems Batch, Plant, or Plant Batch) to be modeled. Note that 'Batch' refers to complete input files created with the input programs. Use the F8 key to display a list of the files for this ECO type, and choose one from the list. Note that the ECO files must have been created previously using the ECO input program and stored on the data disk. You also enter the type of economic analysis to be performed, the cost of the ECO, and, if appropriate, the LCC input file name. Finally, you select the four-letter prefix of the output file name. This four character matrix should be descriptive of the ECO (e.g. wall, lite, etc.).

This screen will be repeated for as many as 40 ECOs. After you have input data for each ECO, enter '999' for the ECO description on the first line of the screen, and you will be returned to the Main Menu, ready to Run Calcs.

The calculations will be performed once for each ECO specified. Each ECO will be compared to the base-case file. No multiple ECOs are considered.

```
ANALYSES SPECIFICATIONS
ECO Number 1
------------------------------------------------------------------------------------
ECO Description
Line 1 ('999' to end)      ______________________________________________________
Line 2                     ______________________________________________________

ECO Type                                                                         _
  1=Loads ECO         2=Systems ECO        3=Plant ECO
  4=Loads (Batch)     5=Systems (Batch)    6=Plant (Batch)

ECO Files for Analysis (Use F8 for Listing)
  Load ECO File      ________        Loads Input File      ________
  System ECO File    ________        Systems Input File    ________
  Plant ECO File     ________        Plant Input File      ________

Economic Analysis                                                                _
    0=None (Energy Only)   1=Simplified (SPB)   2=Detailed LCC

Cost of ECO Alteration (Dollars)                                          ________
LCC Input File                                                            ________

File Name for Output (4 characters)                                       ____
```

11.3.6 Multiple ECO Run Mode

The first screen for the Multiple ECO Run Mode is the same as that for the Single ECO Run Mode. Specify the base-case files and weather files to be used. Press the F8 key to access a list of input files; use the cursor control keys to highlight the file you want, and then press CR. The results of the calculations with these files will be used as the basis for comparisons with the ECO modified files.

```
ANALYSES SPECIFICATIONS
Base Case Information
-----------------------------------------------------------------------------------
Base Case Definition Output Titles
Line 1    ________________________________________________________________
Line 2    ________________________________________________________________

Base Case Input Files for Analysis (Use F8 for Listing)
  Load Input File                                                        ________
  System Input File                                                      ________
  Plant Input File                                                       ________
  LCC Input File                                                         ________

Weather Files
  Type of bin weather data                                               _
    1=ASHRAE   2=Battelle   3=DOD

  Weather station filename (Use F8 for Listing)                          ________
  Solar station filename (Use F8 for Listing)                            ________

  File Name for Output (4 characters)                                    ____
```

The next two Multiple ECO Run Mode screens define the ECOs to be modeled together in one run, allowing for calculation of the cumulative effects of more than one ECO.

These two screens will be repeated until data has been entered for all runs to be performed (up to 20). When you have completed the data input for all ECOs, enter '999' as the Combined ECO description, and you will be returned to the Main Menu, ready to Run Calcs.

The first of these screens defines the batch ECOs to be modeled. "Batch" ECOs are complete loads, systems, or plant input files that are used to model ECO's. If no batch ECOs are to be modeled, enter only the ECO description, economic analysis method, the LCC input file if required, and the output file name four-character prefix. The example below shows the form for the file name for your output results. In the example, 'xxxx' is the four-character file- name prefix you specify; 'MECO' is automatically added by ASEAM2.1 (Multiple ECO); and 'y' is the ECO run number, where 'y' is '1' for the base case, '2' for the first ECO run, '3' for the second ECO run, etc.

xxxxMECO.y

where

'XXXX'	is the four character filename prefix you specify
'MECO'	is automatically added by ASEAM2.1 (Multiple ECO)
'.Y'	is the ECO run number where 'Y' is
	'1' for the base case
	'2' for the first ECO run
	'3' for the second ECO run, etc.

```
MULTIPLE ECO SPECIFICATIONS
Combination ECO Number 1
--------------------------------------------------------------------------------
Combined ECO Description (for ALL)
Line 1 ('999' to end)          ______________________________________________
Line 2                         ______________________________________________

ECO Batch Files for Analysis (If Applicable)
  Load Input File     (Use F8 for Listing)                              ________
  System Input File   (Use F8 for Listing)                              ________
  Plant Input File    (Use F8 for Listing)                              ________

Economic Analysis                                                       _
    0=None (Energy Only)   1=Simplified (SPB)   2=Detailed LCC

Cost of ECO Alteration (Dollars)                                        ________

LCC Input File for ECO                                                  ________

File Name for Output (4 characters)                                     ____
```

On the following screen, you specify all ECOs that are to be considered together in one run. First, enter the number of Loads, Systems, and Plant ECOs. Next, using the F8 key to access the ECO files of each type on disk, specify which ECOs are to be modeled. Up to 12 ECOs of each type may be modeled. Note that two ECOs of the same type (e.g., two wall ECOs) cannot be modeled simultaneously.

```
MULTIPLE ECO FILE SPECIFICATIONS
Combination ECO Number 1
--------------------------------------------------------------------------------
ECO Files
  Number of Loads ECO                                                      __
  Number of Systems ECO                                                    __
  Number of Plant ECO                                                      __

USE F8 FOR LISTING

Loads ECO  1  ________    Systems ECO  1  ________    Plant ECO  1  ________
Loads ECO  2  ________    Systems ECO  2  ________    Plant ECO  2  ________
Loads ECO  3  ________    Systems ECO  3  ________    Plant ECO  3  ________
Loads ECO  4  ________    Systems ECO  4  ________    Plant ECO  4  ________
Loads ECO  5  ________    Systems ECO  5  ________    Plant ECO  5  ________
Loads ECO  6  ________    Systems ECO  6  ________    Plant ECO  6  ________
Loads ECO  7  ________    Systems ECO  7  ________    Plant ECO  7  ________
Loads ECO  8  ________    Systems ECO  8  ________    Plant ECO  8  ________
Loads ECO  9  ________    Systems ECO  9  ________    Plant ECO  9  ________
Loads ECO 10  ________    Systems ECO 10  ________    Plant ECO 10  ________
Loads ECO 11  ________    Systems ECO 11  ________    Plant ECO 11  ________
Loads ECO 12  ________    Systems ECO 12  ________    Plant ECO 12  ________
```

11.4 Run Calcs

When the specify analyses data input for all calculations has been entered, you will be returned to the Main Menu. In Single Run Mode, this occurs automatically after you have completed the data entry for the run. In all other modes, you indicate that you have finished specifying analyses by entering '999' for the run description, or 'O' for the parametric input variables number.

To begin the calculations, use the cursor control keys to highlight "Run Calcs" on the Main Menu and press CR. If you are running ASEAM2.1 from floppy disks, you will be prompted to insert the Calculation diskette in drive A.

Run Calcs first writes the Specify Analyses data to a file. These data will be available to retrieve later, should you wish to rerun these calculations or modify the runfile. Note that the runfile is *not* written when you exit from Specify Analyses. Therefore, if you have completed the Specify Analyses program but do not want to run the calculations immediately, select the Run Calcs command, wait until the calculations have begun, and then break the program (using the F2 key). This ensures that the runfile will be written to disk, and that you will not have to reenter all the Specify Analyses data.

The calculations always use the latest version of Specify Analyses. You cannot begin ASEAM2.1 with the Run Calcs command. If you have previously completed the Specify Analyses program, select Specify Analyses again, retrieve the runfile you want to use, and move through the screens until the ASEAM2.1 Main Menu appears. Enter the Run Calcs command and the calculations will commence.

ASEAM2.1 can run unattended in any mode. The only limitation to the number of runs is disk space. Especially in Single and Batch Run Modes, make sure that the output files specified will all fit on the data disk. If the data disk fills up, ASEAM2.1 will abort, printing error #61 occurred (disk full).

While ASEAM2.1 is performing the calculations, you can view them either in graphic or tabular form on the screen. This slows the calculations down greatly, so you should use this feature only when you are actually looking at the screen (i.e., do not turn on the screen graphics and then let the program run unattended). Runtime screen displays are discussed in Chapter 12.

All output reports specified are saved on the data disk. The reports and their formats are described in Chapter 12.

12 Output Reports

12 OUTPUT REPORTS

12.1 Introduction

ASEAM2.1 is capable of creating many different output reports. Run-time reports and graphic displays are available while the calculations are being performed. These reports may be directed to the printer or to the screen, but cannot be stored in a file and accessed later. There are also numerous reports that are written to files, and you need not be at the computer during the calculations to obtain them.

This chapter describes various types of output reports, the data they contain, the file-naming conventions, and how to get the data into useful form. Not all output reports are available from all calculation modes. Refer to Section 12.2.1, 12.2.2, and 12.2.3 for a listing of output reports created by different calculation methods.

Note: Make sure, when specifying the analyses, that all of the output reports you want are available with the type of calculation you are performing and that the reports have been specified, if required. Once the runs have been made, there is no way to backtrack and obtain additional output data that was not specified originally. You must first specify the additional outputs and then rerun the calculations.

12.2 Types of Output

ASEAM2.1 can produce many different kinds of output reports. Outlined in the sections below are the various output reports that can be specified or produced for the different calculation modes. Also refer to Chapter 11 for a discussion of the various outputs created by the calculation modes.

12.2.1 Single and Batch Run Modes

Single and Batch Run Modes can create up to 39 reports that detail heating and cooling loads, system psychrometrics, energy consumptions, and the like by zone or by system. Most of these reports can be imported into a spreadsheet package (such as LOTUS) for further calculations or graphical presentation, or into a three-dimensional graphics package.

Output reports are available for both peak and diversified loads. Note that peak loads correspond to full occupancy, full solar, all lights and equipment on, etc. Diversified loads take into account the fraction percent sunshine (from the weather file), occupancy, lighting, and equipment schedules (entered as diversity factors in the Loads input segment of the program). All loads type report values are in BTUH, except for daylighting reports, which use footcandles on the work plane. The following output reports are available for single run and batch run modes:

LOADS REPORTS: For each zone (the 24 hourly values for reports LB through LW are written to file by month)

LA—Peak Loads Summary (This report is *not* LOTUS compatible. It generates the load by components at the time the zone peak load occurs. Use the Miscellaneous Output Reports from the main menu to access these reports).

LB—Peak Total Load (sum of all time-dependent peak load components excluding temperature-dependent loads such as conduction and infiltration)

LC—Diversified Total Load (sum of all time-dependent diversified load components excluding temperature-dependent loads such as conduction and infiltration)

LD—Peak Opaque CLTD Load (sum of wall and roof CLTD)

LE—Peak Glass Solar Load

LF—Peak Lighting Load

LG—Diversified Lighting Load

LH—Peak Plenum Load

LI—Diversified Plenum Load

LJ—Peak People Load

LK—Diversified People Load

LL—Peak Equipment Load

LM—Diversified Equipment Load

LN—Daylighting Footcandles on Work plane, Function 1, Overcast Sky

LO—Daylighting Footcandles on Work plane, Function 2, Overcast Sky

LP—Daylighting Footcandles on Work plane, Function 3, Overcast Sky

LQ—Daylighting Footcandles on Work plane, Function 1, Clear Sky

LR—Daylighting Footcandles on Work plane, Function 2, Clear Sky

LS—Daylighting Footcandles on Work plane, Function 3, Clear Sky

LT—Wall CLTD Load

LU—Roof CLTD Load

LV—Direct Solar on Glass (considers only effect of external shading, *not* orientation)

LW—Shaded Solar on Glass (considers only effect of external shading, *not* orientation)

(Note Reports LB through LW can be viewed in three dimensions with the program AS23DIMG)

SYSTEMS REPORTS: For each system (the values are written to file by cycle, by month, and by bin)

SA—System Loads (Zone Diversified Loads on System)

SB—System Energy Requirements (System Loads on Plant)

SC—System Psychrometrics (Central Systems)

SD—System Psychrometrics (Unitary Systems)

PLANT REPORTS: For each plant component (values are written to file by cycle, by month, and by bin)

SLDS—Plant Loads (Composite System Loads on Plant)

PDHW—Domestic Hot Water

PCEN—Centrifugal Chiller

PABS—Absorption Chiller

PDBC—Double Bundle Chiller

PREC—Reciprocating Chiller

PDBH—Double Bundle Heating

PBLR—Boiler

PTOW—Cooling Tower

BEPS report—building end-use summary (this report is *not* LOTUS-compatible)

MCON — Monthly energy consumption by fuel type.

Note: All reports *except* the Peak Loads Summary (LA) and the Building Energy End-Use Summary (BEPS) are suitable for importing into LOTUS. If you indicated that a printer was available, and asked for either of these reports, they will automatically be printed when the run calculations are finished. To access these two data type output file, refer to Section 12.4.2.

The report file names of LOTUS-compatible output files will appear as xxxxLLyy.PRN, xxxxSSzz.PRN, or xxxxPPPP.PRN:

1. 'xxxx' is the file-name prefix you specified in "Specify Analysis"
2. 'LL' is the loads report type (LB through LW)
3. 'yy' is the zone number for loads report
4. 'SS' is the systems report type (SA through SD)

5. 'ZZ' is the system number for systems report
6. 'PPPP' is the plant report type (SLDS, PDHW, etc.)

The files from these reports are also saved on disk. To create legible reports from these files, follow the directions in Section 12.4.1.

12.2.2 Parametric Run Mode

If you are running ASEAM2.1 in the parametric processing mode, the output files are more limited. Refer to Chapter 11 for a discussion of how to specify the outputs included in the report.

The Parametric Run Mode creates a maximum of nine output files. The first two are always created:

xxxxPRIN.PRN (contains the input variables)
xxxxPROU.PRN (contains the output variables and results)

The following seven files are created only if you requested them in "Specify Analysis":

xxxxPRMG.PRN (monthly gas consumption, parametric input variable #30)
xxxxPRMO.PRN (monthly oil consumption, parametric input variable #31)
xxxxPRME.PRN (monthly electricity consumption, parametric input variable #32)
xxxxPRMH.PRN (monthly district heating consumption, parametric input variable #33)
xxxxPRMC.PRN (monthly district cooling consumption, parametric input variable #34)
xxxxPRPL.PRN (peak loads summaries, parametric input variable #35)
xxxxPRLC.PRN (LCC summaries; if a base case LCC file is specified)

To create legible reports from these LOTUS compatible files, follow the directions in Section 12.4.1.

12.2.3 Single and Multiple ECO Run Modes

If you are running ASEAM2.1 in the Single or Multiple ECO Run mode, the output reports are ASCII text files only, which compare the base case with the ECO case(s). The file names used are xxxxSECO.Z (Single ECO Run Mode) and xxxxMECO.Z (Multiple ECO Run Mode), where Z is the run number (1 is the first, or base case, run; 2 compares the base case run and ECO #1, etc.).

These reports are already in text file mode. The file is legible when you "type" it or retrieve the file with a word processor. Follow the directions in Section 12.4.3.

12.3 Run-Time Graphics and Reports

Run-time graphic displays and reports differ from other output reports in that you must be at the computer while the program is calculating to obtain them. These displays occur while the calculations are being performed regardless of the calculation mode. They show the calculations being performed, typically hour by hour for loads and bin by bin for systems and plant. If you want to see what is happening on a particular hour of a particular month, these data are available, but you must turn on the display when the calculations reach that month.

The run-time outputs are quite voluminous. They may be directed to a printer or to the screen, but not to a file. Viewing or printing the displays slows down the calculations considerably, so you should turn the displays off when you are not watching them.

Run-time outputs are accessed by using the function keys while ASEAM2.1 is performing the calculations. You can tell where you are in the calculations from the message on the screen (e.g., Calculating Loads, Zone 3, May). Below this message a function key menu appears. The keys have the following functions:

F1—turns on the function key menu. This stops any present screen display.

F2—stops the program. The screen will display a question asking if you want to stop the program. If this key was pressed by mistake, respond accordingly and the program will continue.

F3—turns on screen display of calculations (loads only)

F4—turns off screen display of calculations (loads only)

F5—turns on screen graphics display of calculations

F6—turns off screen graphics display of calculations

F7—turns on printer output

F8—turns off printer output

F9—increases graphic screen delay by 1 second. If you want to "freeze" the screen, the CTRL-NUMLOCK keys should be pressed at the same time. Press any key to resume the screen display update.

F10—decreases graphic screen delay by 1 second

12.4 Accessing Output Reports

The three types of output reports (LOTUS-compatible data files, non-LOTUS-compatible data files, and text files) are accessed differently. Obviously, you can "type" any of these files, but, except for the text files, the result will be basically unintelligible strings of numbers.

ASEAM2.1 includes ways to present the data in a more useful and understandable manner in Section 12.4.1 through 12.4.3.

The following table lists all of the possible output reports, the calculation run modes that generate the reports, and the file type.

Output File Type

REPORT	LOTUS-COMPAT.	ASM3DIMG-COMPAT.	TEXT	DATA	AVAILABILITY (CALCULATION MODES) S	B	P	E	M
SYSTEMS									
1 xxxxSAyy.PRN	S	S	-	-	S	S	-	-	-
2 xxxxSByy.PRN	S	S	-	-	S	S	-	-	-
3 xxxxSCyy.PRN	S	S	-	-	S	S	-	-	-
4 xxxxSDyy.PRN	S	S	-	-	S	S	-	-	-
PLANT									
1 xxxxSLDS.PRN	S	S	-	-	S	S	-	-	-
2 xxxxPDHW.PRN	S	S	-	-	S	S	-	-	-
3 xxxxPCEN.PRN	S	S	-	-	S	S	-	-	-
4 xxxxPABS.PRN	S	S	-	-	S	S	-	-	-
5 xxxxPDBC.PRN	S	S	-	-	S	S	-	-	-
6 xxxxPREC.PRN	S	S	-	-	S	S	-	-	-
7 xxxxPDBH.PRN	S	S	-	-	S	S	-	-	-
8 xxxxPBLR.PRN	S	S	-	-	S	S	-	-	-
9 xxxxPTOW.PRN	S	S	-	-	S	S	-	-	-
ENERGY CONSUMPTION									
1 xxxxMCON.PRN	S	S	-	-	S	S	-	-	-
2 xxxxBEPS.ASO	-	-	-	S	S	S	-	-	-
PARAMETRIC									
1 xxxxPRIN.PRN	D	-	-	-	-	-	D	-	-
2 xxxxPROU.PRN	D	-	-	-	-	-	D	-	-
3 xxxxPRPL.PRN	S	-	-	-	-	-	S	-	-
4 xxxxPRLC.PRN	S	-	-	-	-	-	S	-	-
5 xxxxPRMG.PRN	S	-	-	-	-	-	S	-	-
6 xxxxPRMO.PRN	S	-	-	-	-	-	S	-	-
7 xxxxPRME.PRN	S	-	-	-	-	-	S	-	-
8 xxxxPRMH.PRN	S	-	-	-	-	-	S	-	-
9 xxxxPRMC.PRN	S	-	-	-	-	-	S	-	-
LCC									
1 xxxxLCCO.LCO	-	-	S	-	S	S	-	-	-
ECO									
1 xxxxSECO.Z	-	-	D	-	-	-	-	D	-
2 xxxxMECO.Z	-	-	D	-	-	-	-	-	D

Output File Type (cont)

REPORT	LOTUS-COMPAT.	ASM3DIMG-COMPAT.	TEXT	DATA	AVAILABILITY (CALCULATION MODES) S	B	P	E	M
LOADS									
1 xxxxLAyy.PRN	-	-	-	S	S	S	-	-	-
2 xxxxLByy.PRN	S	S	-	-	S	S	-	-	-
3 xxxxLCyy.PRN	S	S	-	-	S	S	-	-	-
4 xxxxLDyy.PRN	S	S	-	-	S	S	-	-	-
5 xxxxLEyy.PRN	S	S	-	-	S	S	-	-	-
6 xxxxLFyy.PRN	S	S	-	-	S	S	-	-	-
7 xxxxLGyy.PRN	S	S	-	-	S	S	-	-	-
8 xxxxLHyy.PRN	S	S	-	-	S	S	-	-	-
9 xxxxLIyy.PRN	S	S	-	-	S	S	-	-	-
10 xxxxLJyy.PRN	S	S	-	-	S	S	-	-	-
11 xxxxLKyy.PRN	S	S	-	-	S	S	-	-	-
12 xxxxLLyy.PRN	S	S	-	-	S	S	-	-	-
13 xxxxLMyy.PRN	S	S	-	-	S	S	-	-	-
14 xxxxLNyy.PRN	S	S	-	-	S	S	-	-	-
15 xxxxLOyy.PRN	S	S	-	-	S	S	-	-	-
16 xxxxLPyy.PRN	S	S	-	-	S	S	-	-	-
17 xxxxLQyy.PRN	S	S	-	-	S	S	-	-	-
18 xxxxLRyy.PRN	S	S	-	-	S	S	-	-	-
19 xxxxLSyy.PRN	S	S	-	-	S	S	-	-	-
20 xxxxLTyy.PRN	S	S	-	-	S	S	-	-	-
21 xxxxLUyy.PRN	S	S	-	-	S	S	-	-	-
22 xxxxLVyy.PRN	S	S	-	-	S	S	-	-	-
23 xxxxLWyy.PRN	S	S	-	-	S	S	-	-	-

where 'S' indicates this report may (or may not) be specified
'D' indicates this report is defaulted - it always is produced

Availability (Calculation Mode) Codes
- 'S' Single Run Mode
- 'B' Batch Run Mode
- 'P' Parametric Run Mode
- 'E' Single ECO Run Mode
- 'M' Multiple ECO Run Mode

12.4.1 LOTUS-Compatible Reports

All output reports from the Single and Batch Run Modes are written in standard ASCII files and may be imported into many spreadsheet or word processing packages *except* for the Peak Loads (xxxxLAyy.PRN) and BEPS (xxxxBEPS.ASO) reports. All output reports from the Parametric Run mode are also LOTUS-compatible. This section explains how to use LOTUS to format these reports.

To format Peak Loads and BEPS reports, refer to Section 12.4.2. The output reports from Single and Multiple ECO Run modes and from the LCC program are text files. Refer to Section 12.4.3 for instructions.

ASEAM2.1 includes a LOTUS worksheet template file consisting of many "macros" for formatting LOTUS-compatible output files. This file is named "AS2TEMPL.WKS" and is located on Source Disk #4. To use this template, enter LOTUS and, on the blank worksheet, use the "/File Retrieve" command to load in "AS2TEMPL". This file contains macro's for formatting ASEAM2.1 output reports. Instructions are included in the file and will be visible when the file is imported into LOTUS.

First, determine the output report file to be displayed (see menu below). Second, position the cursor to the right of the instructions, separated by at least one blank column and five blank rows. If you are importing more than one file, import the others below or to the right of each other, separated by at least five blank rows (for headings) and one blank column. Third, press the appropriate key (see below) to format your report. If your report file is not on your data diskette, press "Ctrl-Break" to stop the macro.

Macro Definitions

Loads Reports

Alt-a	all loads reports

Systems Reports

Alt-b	systems SA report (zone loads on systems)
Alt-c	systems SB report (system energy requirements)
Alt-d	systems SC report (system psychrometrics central systems)
Alt-e	systems SD report (system psychrometrics unitary systems)

Plant Reports

Alt-f	plant SLDS report (system loads on plant)
Alt-g	plant PDHW report (plant domestic hot water)
Alt-h	plant PCEN report (centrifugal or recipricating chiller)
Alt-i	plant PABS report (absorption chiller)
Alt-j	plant PBDC report (double bundle chiller cooling)
Alt-k	plant PBDH report (double bundle chiller heating)
Alt-l	plant PBLR report (boiler)
Alt-m	plant PTOW report (cooling tower)

Parametric Reports

Alt-p	parametric output reports

Monthly Energy Consumption

Alt — x	monthly energy consumption by fuel type

12.4.2 Data Files - BEPS and Peak Load Summaries

The BEPS and Peak Load summaries (if specified) will automatically be printed if you indicated that you have a printer installed. The data for these files will also be written to files on the data disk for later use. Printed output of these files is suppressed in the parametric run mode.

The BEPS and Peak Loads summaries are stored in data files that are not LOTUS-compatible (i.e., you cannot import these files into a spreadsheet). To generate useful reports from these files, ASEAM2.1 includes report generator programs.

The report generator program is used after the calculations are complete. The file names on the data disk will be in the form xxxxBEPS.ASO (BEPS file) and xxxxLAyy.PRN (Peak Loads file), where 'xxxx' is your specified file-name prefix, 'yy' is the zone number for the report, and '00' is the whole building peak loads summary.

You can enter the report generator program from the Main Menu or from the "exit" choices of any program. If you access this program from the Main Menu (shown below), select "Print Reports" from the horizontal bar and then "Misc Output" from the pull-down menu.

ASEAM2.1 MAIN MENU

```
Input Data   Print Reports   Specify Analyses   Run Calcs   Exit DOS
             Loads Echo
             Systems Echo
             Plant Echo
             FBLCC
             NBSLCC
             Weather Echo
             Misc Output
             Exit
```

The ASEAM2.1 Reports Program Menu will then appear on the screen. Select "Select/Print Report File" and press CR. Select the type of output report to be generated. The "Combined BEPS" report is used when you want to combine several BEPS reports. For example, if a building was so complex that it had to be modeled by two separate ASEAM2.1 runs (e.g., if the building model required more than 10 zones), you would combine the two "halves" of the building to obtain the total annual energy consumption.

ASEAM2.1 REPORTS PROGRAM

```
Select/Print Report File    Exit
Peak Loads Report
BEPS Report
Combined BEPS
Exit
```

Next, specify the output device for the output report. The output report may be printed to the screen, to a printer, or to a file. You will be asked to provide a two-line title, which will appear at the top of the output report. If the report is to be written to a file, you will also be asked for the file name. Do not include a drive specification; the file will automatically be written to drive B.

ASEAM2.1 OUTPUT DEVICE

```
Screen        Printer        File        Exit
```

12.4.3 Text Files

The outputs of the LCC and ECO calculations are text files. You can view these files using the "type" command from DOS (e.g., "type b:xxxxLCCO.LCO" (CR)). The files are standard ASCII files, so they may also be retrieved and edited with a word processor.

12.4.4 AS23DIMG (Loads Graphics)

Loads reports LB through LW contain hourly load profiles for each month for various load categories (e.g. solar, lighting, total, etc.). All report values are in BTUH except for the daylighting reports LN through LS which are in footcandles.

The program AS23DIMG presents these hourly profiles in a three-dimensional graph. This program is included on Source Diskette #4. To use this program, however, you must exit from ASEAM2.1 - it cannot be reached from any of the Exit menus. Once you have the DOS prompt, insert this diskette into drive A and type 'AS23DIMG', followed by CR.

The menu for this program is similar to the other ASEAM2.1 report programs. You must first select the report type from a listing. Once the report type is selected, the program lists the available files on the data disk (drive B). You select from this list with the cursor control keys and CR. This will load the data file into memory.

After the data file is selected and loaded into memory, the program will automatically scale the values using a default view angle and coordinates. This may take a few seconds to perform. Finally the graph is drawn on the screen, starting with January (hour 1 through hour 24) through December (hour 1 through 24).

Once the graph is completely on the screen, the computer will "beep" a few times to allow you time to print the screen if desired. A message will appear on the bottom of the screen before returning you to the menu. Once the menu reappears, you can either change the viewing angle and scaling, select a different loads report file to be graphed, or exit to DOS.

12.5 Sample Outputs

12.5.1 Run-Time Graphics

Examples of run-time graphics are shown on the following pages. The graphics vary with system type and plant component. The examples do not include all possible combinations.

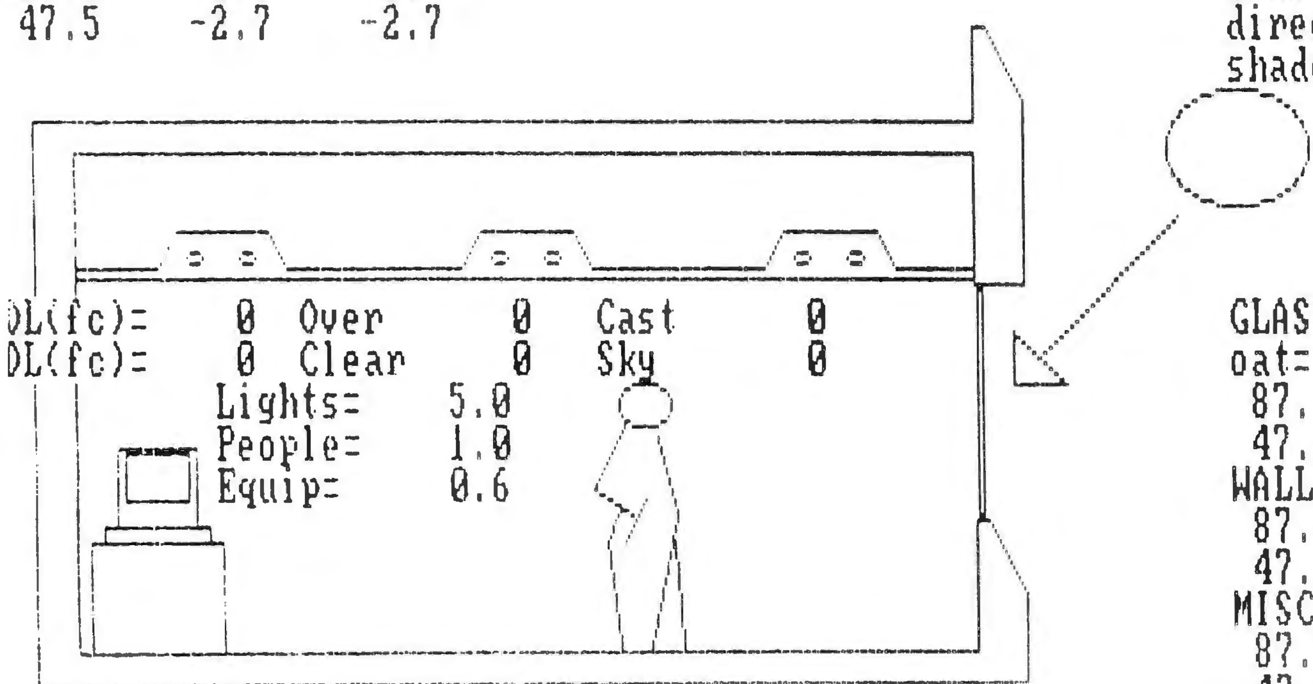
Run-time graphics will be displayed on the screen when you press the F5 key during the calculations. Refer to Section 12.3 for details.

ZONE= 1 MONTH - Jun HOUR=11

ROOF COND

oat=	occup=	unocc=
87.5	0.9	0.9
47.5	-2.7	-2.7

ROOF CLTD= 0.5
WALL CLTD= 0.2
GLASS SOLAR
direct= 4.9
shaded= 2.3



GLASS COND

oat=	occup=	unocc=
87.5	1.6	1.6
47.5	-5.2	-5.2

WALL COND

87.5	0.7	0.7
47.5	-2.1	-2.1

MISC COND

87.5	0.0	0.0
47.5	0.0	0.0

83.6 %

Variable Volume Reheat

47.5 =	50.9 =	P H T	50.9 =	H U M	50.9 =	2.20 KW	55.0 =	C L G	55.0 =
.0048	.0049		.0049		.0049		.0049		.0049
16.6	17.5		17.5		17.5		18.5		18.5

68.0 =
.0053
22.1

PREHEAT = 2,986 X 1.08 X (50.9 - 50.9) = 0
HUMIDITY = 2,986 X 4840 X (.0049 - .0049) = 0
COOLING = 2,986 X 4.50 X (18.5 - 18.5) = 0

REHEAT 1 = 726 X 1.08 X (67.9 - 55.0) = 10,121
REHEAT 2 = 432 X 1.08 X (70.4 - 55.0) = 7,195
REHEAT 3 = 574 X 1.08 X (71.7 - 55.0) = 10,371
REHEAT 4 = 329 X 1.08 X (70.8 - 55.0) = 5,609
REHEAT 5 = 925 X 1.08 X (55.0 - 55.0) = 0

Dec - Occupied
BIN HOURS = 48.6
OPER HOURS= 48.6

REHEAT	REHEAT	REHEAT	REHEAT	REHEAT	
68	-1,126	-2,308	-991	12,992	LOAD
67.9	70.4	71.7	70.8	55.0	TEMP
726	432	574	329	925	CFM
0	0	0	0	0	BASE

20.0 %

Variable Volume Reheat

77.5 =	77.9 =	P	77.9 =	H	77.9 =		82.0 =	C	55.0 =
.0077	.0076	H	.0076	U	.0076	2.03	.0076	L	.0071
27.0	27.0	T	27.0	M	27.0	KW	28.1	G	21.0

78.0 =
.0076
27.1

PREHEAT = 2,868 X 1.08 X (77.9 - 77.9) = 0
HUMIDITY = 2,868 X 4840 X (.0076 - .0076) = 0
COOLING = 2,868 X 4.50 X (28.1 - 21.0) = 91,552

REHEAT 1 = 726 X 1.08 X (55.0 - 55.0) = 0
REHEAT 2 = 432 X 1.08 X (55.0 - 55.0) = 0
REHEAT 3 = 574 X 1.08 X (55.0 - 55.0) = 0
REHEAT 4 = 329 X 1.08 X (55.0 - 55.0) = 0
REHEAT 5 = 806 X 1.08 X (55.0 - 55.0) = 0

Sep - Occupied
BIN HOURS = 7.1
OPER HOURS= 7.1

REHEAT	REHEAT	REHEAT	REHEAT	REHEAT	
13,471	5,236	8,713	6,025	18,848	LOAD
55.0	55.0	55.0	55.0	55.0	TEMP
726	432	574	329	806	CFM
0	0	0	0	0	BASE

Month = Sep   Cycle = Occupied
Bin Temp =   82.5
Bin Hours =   7.1

DHW Usage Load	6,722	BTUH
Losses Load	150	BTUH
DHW Total Load	6,872	BTUH

Avg DHW Usage   10.0 GPH
Pump KW   0.0 KW

Domestic Hot Water Heater

Bin Efficiency = 100.0 %

Supply Water   140.0 deg F

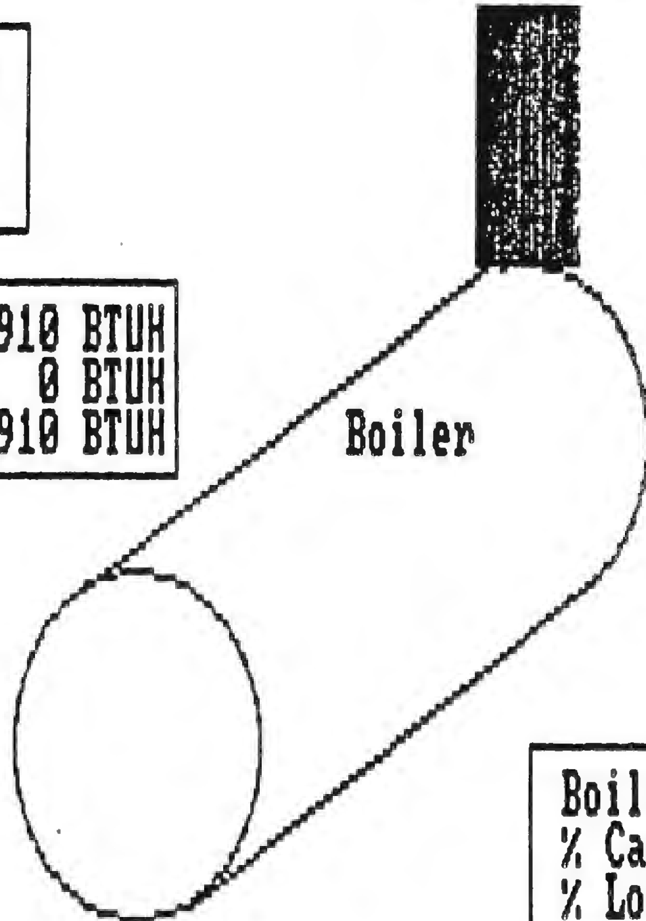
Incoming Water   59.3 deg F

Electricity
2.0 KWH

Energy (KWH)		Equivalent Full Load Hours			Annual	Seasonal
Bin	Annual	Hour	Bin	Annual	Pump KWH	Eff (%)
14	2,899	0.60	4.3	868	0.0	100.00

Cycle: Occupied Jan
Bin Temp = 32.5 °
Bin Hours = 24.0

Heating Load	279,910 BTUH
Total Losses	0 BTUH
Boiler Load	279,910 BTUH



Bin Efficiency = 100.0 %

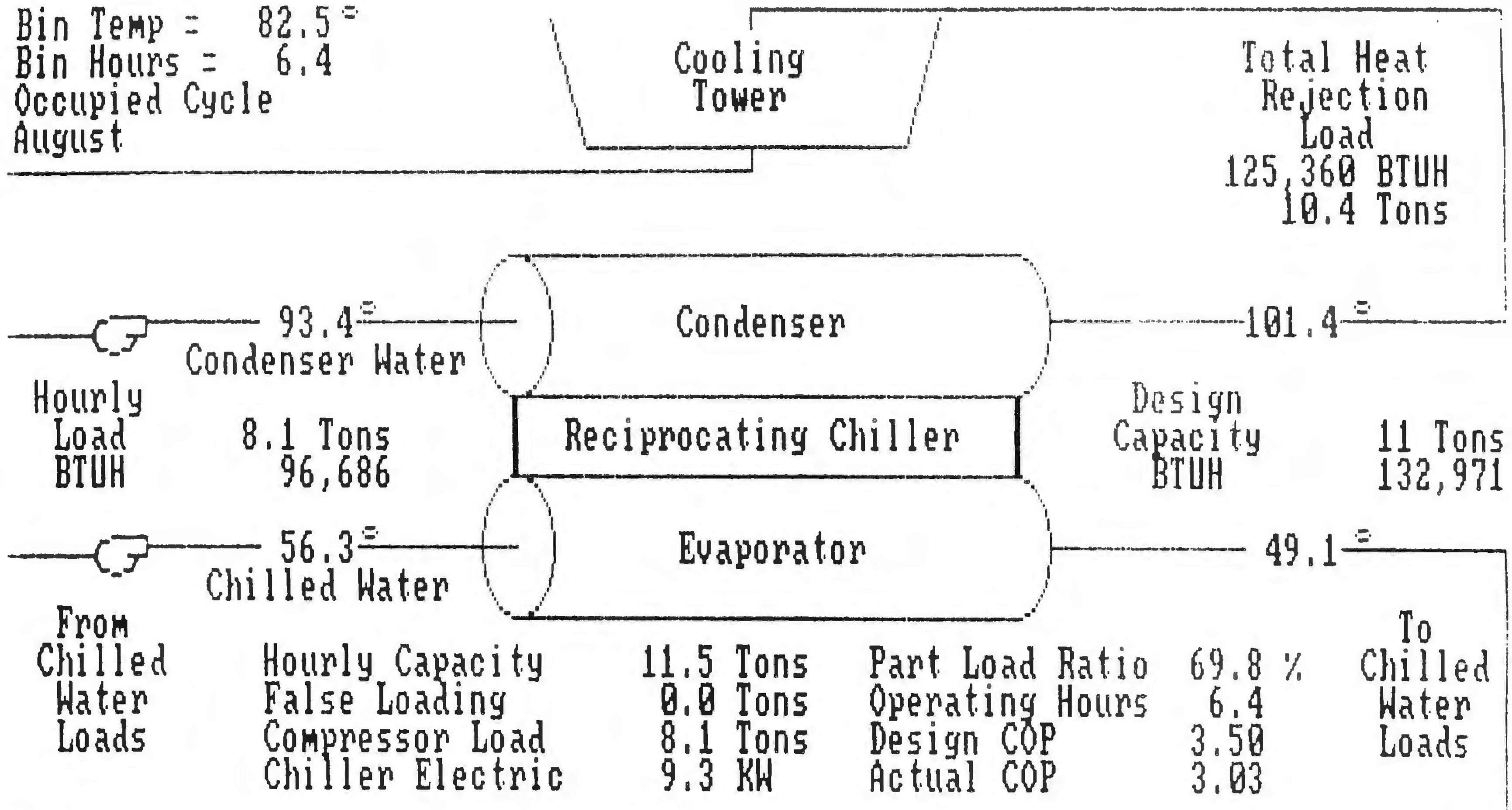
Boiler Plant Losses

% Cap	0.0 %	0 BTUH
% Load	0.0 %	0 BTUH

Electric
49.9 KWH

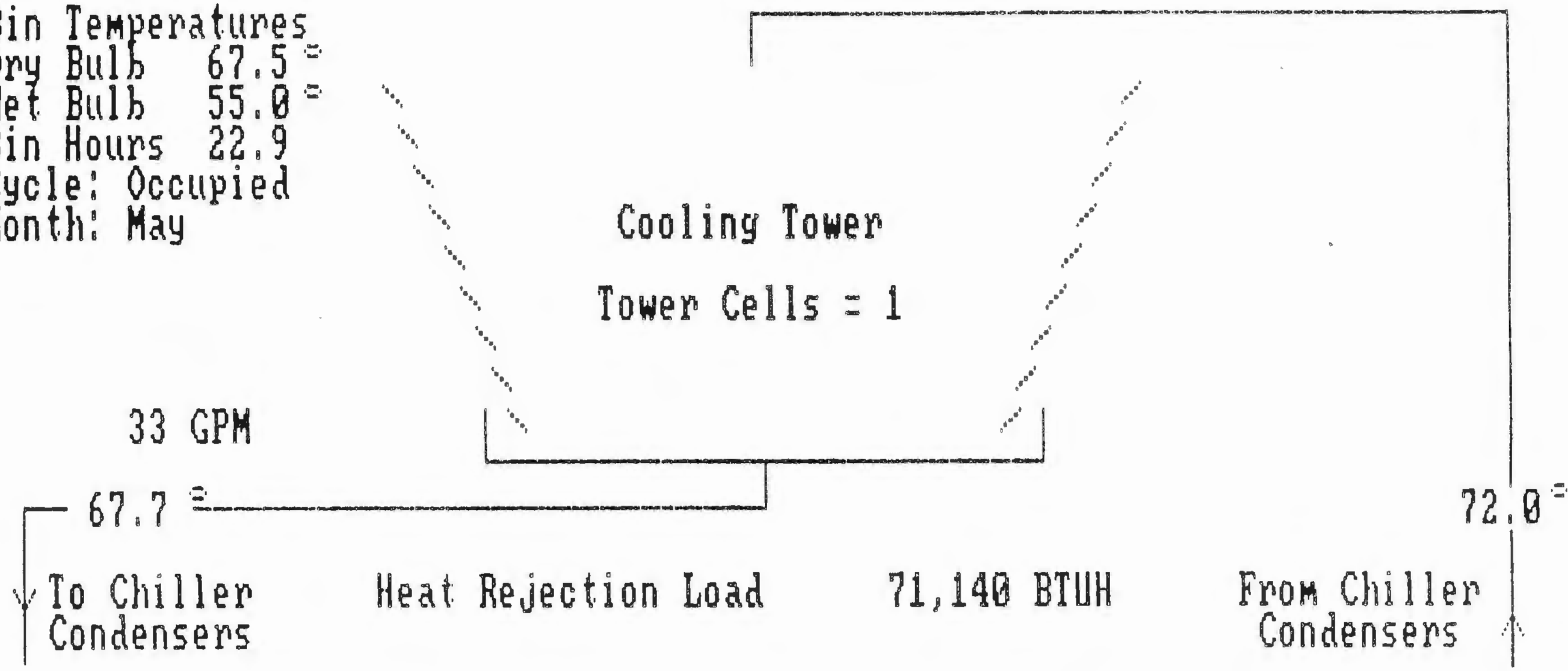
Energy (KWH)		Equivalent Full Load Hours			Annual	Seasonal
Bin	Annual	Hour	Bin	Annual	Htg Hours	Eff (%)
1,200	1,609	0.14	3.3	4	47.9	100.00

SAMPLE SCREEN OUTPUT FOR BOILER CALCULATIONS



Total Electric KWH		Equivalent Full Load Hours			Annual	Seasonal
Bin	Annual	Hour	Bin	Annual	Oper Hours	COP
60	2,574	0.73	4.7	195	422.5	2.78

Bin Temperatures
Dry Bulb 67.5°
Wet Bulb 55.0°
Bin Hours 22.9
Cycle: Occupied
Month: May



	Full Speed	Half Speed	Off
Number of Cells	1	0	0
Percent Run Time	100.0	0.0	0.0

Tower Fans		Pumps		Accum Plant	
KW	Annual KWH	KW	Annual KWH	KW	Annual KWH
0.4	10	0.5	14	0.9	24

12.5.2 Run-Time Calculation Reports

Examples of run-time calculations are shown on the following pages. The calculations vary with system type and plant component. The examples do not include all possible combinations.

Run-time calculations will be printed when you press the F7 key during the calculations. For the Loads segment *only*, run-time calculations will be displayed on the screen when you press the F3 key. Refer to Section 12.3 for details.

Load	Calc	Z#	M#	S#	U-FCT	AREA	OAT	SPC T	WALL LOAD	ACCUM WALL
Wall	Cond	1	1	1	(0.100) (	700) (	42.5 -	68.0) =	-1,785	-1,785
Wall	Cond	1	1	1	(0.100) (	700) (	2.5 -	68.0) =	-4,585	-4,585
Wall	Cond	1	1	1	(0.100) (	700) (	42.5 -	60.0) =	-1,225	-1,225
Wall	Cond	1	1	1	(0.100) (	700) (	2.5 -	60.0) =	-4,025	-4,025

Load		Z#	M#	S#	HR	SOL#	U-FCT	AREA	CLTD	LMC	COL C	CLTD LD	ACC LD
Wall	CLTD	1	1	1	1	1.2	(0.100) (	700)	(18.6 +	11 - 7)	(0.83) =	1,313	1,313
Wall	CLTD	1	1	1	2	2.2	(0.100) (	700)	(16.6 +	11 - 7)	(0.83) =	1,197	1,197
Wall	CLTD	1	1	1	3	3.2	(0.100) (	700)	(14.6 +	11 - 7)	(0.83) =	1,081	1,081
Wall	CLTD	1	1	1	4	4.2	(0.100) (	700)	(12.6 +	11 - 7)	(0.83) =	965	965
Wall	CLTD	1	1	1	5	5.2	(0.100) (	700)	(10.6 +	11 - 7)	(0.83) =	848	848
Wall	CLTD	1	1	1	6	6.2	(0.100) (	700)	(8.8 +	11 - 7)	(0.83) =	744	744
Wall	CLTD	1	1	1	7	7.2	(0.100) (	700)	(7.8 +	11 - 7)	(0.83) =	686	686
Wall	CLTD	1	1	1	8	8.2	(0.100) (	700)	(6.8 +	11 - 7)	(0.83) =	628	628
Wall	CLTD	1	1	1	9	9.2	(0.100) (	700)	(6.0 +	11 - 7)	(0.83) =	581	581
Wall	CLTD	1	1	1	10	10.2	(0.100) (	700)	(6.2 +	11 - 7)	(0.83) =	593	593
Wall	CLTD	1	1	1	11	11.2	(0.100) (	700)	(7.4 +	11 - 7)	(0.83) =	662	662
Wall	CLTD	1	1	1	12	12.2	(0.100) (	700)	(9.6 +	11 - 7)	(0.83) =	790	790
Wall	CLTD	1	1	1	13	13.2	(0.100) (	700)	(12.8 +	11 - 7)	(0.83) =	976	976
Wall	CLTD	1	1	1	14	14.2	(0.100) (	700)	(16.8 +	11 - 7)	(0.83) =	1,208	1,208
Wall	CLTD	1	1	1	15	15.2	(0.100) (	700)	(20.8 +	11 - 7)	(0.83) =	1,441	1,441
Wall	CLTD	1	1	1	16	16.2	(0.100) (	700)	(24.6 +	11 - 7)	(0.83) =	1,661	1,661
Wall	CLTD	1	1	1	17	17.2	(0.100) (	700)	(27.4 +	11 - 7)	(0.83) =	1,824	1,824
Wall	CLTD	1	1	1	18	18.2	(0.100) (	700)	(29.0 +	11 - 7)	(0.83) =	1,917	1,917
Wall	CLTD	1	1	1	19	19.2	(0.100) (	700)	(29.0 +	11 - 7)	(0.83) =	1,917	1,917
Wall	CLTD	1	1	1	20	20.2	(0.100) (	700)	(28.6 +	11 - 7)	(0.83) =	1,894	1,894
Wall	CLTD	1	1	1	21	21.2	(0.100) (	700)	(26.8 +	11 - 7)	(0.83) =	1,790	1,790
Wall	CLTD	1	1	1	22	22.2	(0.100) (	700)	(25.6 +	11 - 7)	(0.83) =	1,720	1,720
Wall	CLTD	1	1	1	23	23.2	(0.100) (	700)	(23.6 +	11 - 7)	(0.83) =	1,604	1,604
Wall	CLTD	1	1	1	24	24.2	(0.100) (	700)	(21.4 +	11 - 7)	(0.83) =	1,476	1,476

Load	Calc	Z#	M#	S#	U-FCT	AREA	OAT	SPC T	BIN LOAD	ACCUM LOAD
Roof	Cond	1	1	1	(0.100) (	900) (	42.5 -	68.0) =	-2,295	-2,295
Roof	Cond	1	1	1	(0.100) (	900) (	2.5 -	68.0) =	-5,895	-5,895
Roof	Cond	1	1	1	(0.100) (	900) (	42.5 -	60.0) =	-1,575	-1,575
Roof	Cond	1	1	1	(0.100) (	900) (	2.5 -	60.0) =	-5,175	-5,175

Load		Z#	M#	S#	HR	SOL#	U-FCT	AREA	CLTD	LMC	COL C	CLTD LD	ACC LD
Roof	CLTD	1	1	1	1	1.2	(0.100) (	900)	(31.2 +	-19 - 7)	(1.00) =	468	1,782
Roof	CLTD	1	1	1	2	2.2	(0.100) (	900)	(27.0 +	-19 - 7)	(1.00) =	90	1,287
Roof	CLTD	1	1	1	3	3.2	(0.100) (	900)	(22.2 +	-19 - 7)	(1.00) =	-342	739
Roof	CLTD	1	1	1	4	4.2	(0.100) (	900)	(18.4 +	-19 - 7)	(1.00) =	-684	281
Roof	CLTD	1	1	1	5	5.2	(0.100) (	900)	(15.4 +	-19 - 7)	(1.00) =	-954	-105
Roof	CLTD	1	1	1	6	6.2	(0.100) (	900)	(12.4 +	-19 - 7)	(1.00) =	-1,224	-480
Roof	CLTD	1	1	1	7	7.2	(0.100) (	900)	(9.6 +	-19 - 7)	(1.00) =	-1,476	-790
Roof	CLTD	1	1	1	8	8.2	(0.100) (	900)	(7.8 +	-19 - 7)	(1.00) =	-1,638	-1,010
Roof	CLTD	1	1	1	9	9.2	(0.100) (	900)	(7.2 +	-19 - 7)	(1.00) =	-1,692	-1,111
Roof	CLTD	1	1	1	10	10.2	(0.100) (	900)	(8.6 +	-19 - 7)	(1.00) =	-1,566	-974
Roof	CLTD	1	1	1	11	11.2	(0.100) (	900)	(12.0 +	-19 - 7)	(1.00) =	-1,260	-598
Roof	CLTD	1	1	1	12	12.2	(0.100) (	900)	(17.2 +	-19 - 7)	(1.00) =	-793	-3
Roof	CLTD	1	1	1	13	13.2	(0.100) (	900)	(23.4 +	-19 - 7)	(1.00) =	-235	741
Roof	CLTD	1	1	1	14	14.2	(0.100) (	900)	(30.4 +	-19 - 7)	(1.00) =	395	1,604
Roof	CLTD	1	1	1	15	15.2	(0.100) (	900)	(37.2 +	-19 - 7)	(1.00) =	1,007	2,448
Roof	CLTD	1	1	1	16	16.2	(0.100) (	900)	(43.2 +	-19 - 7)	(1.00) =	1,547	3,209
Roof	CLTD	1	1	1	17	17.2	(0.100) (	900)	(48.8 +	-19 - 7)	(1.00) =	2,052	3,876
Roof	CLTD	1	1	1	18	18.2	(0.100) (	900)	(52.4 +	-19 - 7)	(1.00) =	2,376	4,293
Roof	CLTD	1	1	1	19	19.2	(0.100) (	900)	(54.0 +	-19 - 7)	(1.00) =	2,520	4,437
Roof	CLTD	1	1	1	20	20.2	(0.100) (	900)	(53.4 +	-19 - 7)	(1.00) =	2,466	4,360

Roof CLTD	1	1	1	21	21.2	(0.100)(900)(50.2 + -19 - 7)(1.00)=	2,178	3,968
Roof CLTD	1	1	1	22	22.2	(0.100)(900)(46.0 + -19 - 7)(1.00)=	1,800	3,520
Roof CLTD	1	1	1	23	23.2	(0.100)(900)(41.0 + -19 - 7)(1.00)=	1,350	2,954
Roof CLTD	1	1	1	24	24.2	(0.100)(900)(36.0 + -19 - 7)(1.00)=	900	2,376

Load Calc	Z#	M#	S#	U-FCT	AREA	OAT	SPC T	BIN LOAD	ACCUM LOAD
Glass Cond	1	1	1	(0.570)(	150)(	42.5 -	68.0)=	-2,180	-2,180
Glass Cond	1	1	1	(0.570)(	150)(	2.5 -	68.0)=	-5,600	-5,600
Glass Cond	1	1	1	(0.570)(	150)(	42.5 -	60.0)=	-1,496	-1,496
Glass Cond	1	1	1	(0.570)(	150)(	2.5 -	60.0)=	-4,916	-4,916

Load	Z#	M#	S#	HR	SOL#	U-FCT	AREA	CLTD	CLTD LOAD	ACCUM LOAD
Glass CLTD	1	1	1	1	1.2	(0.570)(	150)(	0.8 - 7)=	-530	1,252
Glass CLTD	1	1	1	2	2.2	(0.570)(	150)(	-0.2 - 7)=	-616	672
Glass CLTD	1	1	1	3	3.2	(0.570)(	150)(	-1.2 - 7)=	-701	38
Glass CLTD	1	1	1	4	4.2	(0.570)(	150)(	-2.0 - 7)=	-770	-489
Glass CLTD	1	1	1	5	5.2	(0.570)(	150)(	-2.0 - 7)=	-770	-875
Glass CLTD	1	1	1	6	6.2	(0.570)(	150)(	-2.0 - 7)=	-770	-1,249
Glass CLTD	1	1	1	7	7.2	(0.570)(	150)(	-1.6 - 7)=	-735	-1,526
Glass CLTD	1	1	1	8	8.2	(0.570)(	150)(	0.4 - 7)=	-564	-1,575
Glass CLTD	1	1	1	9	9.2	(0.570)(	150)(	2.4 - 7)=	-393	-1,505
Glass CLTD	1	1	1	10	10.2	(0.570)(	150)(	4.6 - 7)=	-205	-1,179
Glass CLTD	1	1	1	11	11.2	(0.570)(	150)(	7.4 - 7)=	34	-564
Glass CLTD	1	1	1	12	12.2	(0.570)(	150)(	9.6 - 7)=	222	219
Glass CLTD	1	1	1	13	13.2	(0.570)(	150)(	12.2 - 7)=	445	1,186
Glass CLTD	1	1	1	14	14.2	(0.570)(	150)(	13.2 - 7)=	530	2,134
Glass CLTD	1	1	1	15	15.2	(0.570)(	150)(	14.0 - 7)=	599	3,047
Glass CLTD	1	1	1	16	16.2	(0.570)(	150)(	13.8 - 7)=	581	3,790
Glass CLTD	1	1	1	17	17.2	(0.570)(	150)(	12.8 - 7)=	496	4,372
Glass CLTD	1	1	1	18	18.2	(0.570)(	150)(	11.6 - 7)=	393	4,687
Glass CLTD	1	1	1	19	19.2	(0.570)(	150)(	9.6 - 7)=	222	4,660
Glass CLTD	1	1	1	20	20.2	(0.570)(	150)(	7.6 - 7)=	51	4,412
Glass CLTD	1	1	1	21	21.2	(0.570)(	150)(	5.6 - 7)=	-120	3,848
Glass CLTD	1	1	1	22	22.2	(0.570)(	150)(	3.8 - 7)=	-274	3,247
Glass CLTD	1	1	1	23	23.2	(0.570)(	150)(	2.8 - 7)=	-359	2,595
Glass CLTD	1	1	1	24	24.2	(0.570)(	150)(	1.8 - 7)=	-445	1,932

Load	Z#	M#	S#	HR	SOL#	AREA	MSHG	CLFG	SHDC	CLF LOAD	ACCUM LOAD
Glass Direct	1	1	1	1	1.2	(150)(	252)	(0.12)	(0.80)=	3,569	3,569
Glass Shade	1	1	1	1	1.2	(0)(	17)	(0.22)	(0.80)=	0	3,569
Glass Direct	1	1	1	2	2.2	(150)(	252)	(0.11)	(0.80)=	3,206	3,206
Glass Shade	1	1	1	2	2.2	(0)(	17)	(0.20)	(0.80)=	0	3,206
Glass Direct	1	1	1	3	3.2	(150)(	252)	(0.09)	(0.80)=	2,661	2,661
Glass Shade	1	1	1	3	3.2	(0)(	17)	(0.18)	(0.80)=	0	2,661
Glass Direct	1	1	1	4	4.2	(150)(	252)	(0.08)	(0.80)=	2,359	2,359
Glass Shade	1	1	1	4	4.2	(0)(	17)	(0.16)	(0.80)=	0	2,359
Glass Direct	1	1	1	5	5.2	(150)(	252)	(0.07)	(0.80)=	2,177	2,177
Glass Shade	1	1	1	5	5.2	(0)(	17)	(0.18)	(0.80)=	0	2,177
Glass Direct	1	1	1	6	6.2	(150)(	252)	(0.09)	(0.80)=	2,600	2,600
Glass Shade	1	1	1	6	6.2	(0)(	17)	(0.35)	(0.80)=	0	2,600
Glass Direct	1	1	1	7	7.2	(150)(	252)	(0.12)	(0.80)=	3,507	3,507
Glass Shade	1	1	1	7	7.2	(0)(	17)	(0.42)	(0.80)=	0	3,507

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WALL   SOLAR   ANGLE  SOLAR    <- AREAS SHADED ->    TOTAL    TOTAL
AZIM  AZIMUTH   DIFF   ALT      OVER          SIDE   SHADED   SUNLIT
 180   125.6   -54.4    5.9      0.0           4.5     4.5     10.5


Glass Direct  1  1  1  8   8.2 (  105)( 252)(0.15)(0.80)=      3,253         3,544
Glass Shade   1  1  1  8   8.2 (   45)(  17)(0.47)(0.80)=        291         3,544

WALL   SOLAR   ANGLE  SOLAR    <- AREAS SHADED ->    TOTAL    TOTAL
AZIM  AZIMUTH   DIFF   ALT      OVER          SIDE   SHADED   SUNLIT
 180   137.0   -43.0   14.3      0.0           2.2     3.0     12.0


Glass Direct  1  1  1  9   9.2 (  120)( 252)(0.23)(0.80)=      5,582         5,799
Glass Shade   1  1  1  9   9.2 (   30)(  17)(0.54)(0.80)=        218         5,799

WALL   SOLAR   ANGLE  SOLAR    <- AREAS SHADED ->    TOTAL    TOTAL
AZIM  AZIMUTH   DIFF   ALT      OVER          SIDE   SHADED   SUNLIT
 180   149.9   -30.1   20.9      0.0           0.4     1.7     13.3


Glass Direct  1  1  1 10  10.2 (  133)( 252)(0.33)(0.80)=      8,912         9,049
Glass Shade   1  1  1 10  10.2 (   17)(  17)(0.60)(0.80)=        138         9,049

WALL   SOLAR   ANGLE  SOLAR    <- AREAS SHADED ->    TOTAL    TOTAL
AZIM  AZIMUTH   DIFF   ALT      OVER          SIDE   SHADED   SUNLIT
 180   164.3   -15.7   25.3      0.0           0.0     1.5     13.5


Glass Direct  1  1  1 11  11.2 (  135)( 252)(0.44)(0.80)=     11,996        12,128
Glass Shade   1  1  1 11  11.2 (   15)(  17)(0.66)(0.80)=        132        12,128

WALL   SOLAR   ANGLE  SOLAR    <- AREAS SHADED ->    TOTAL    TOTAL
AZIM  AZIMUTH   DIFF   ALT      OVER          SIDE   SHADED   SUNLIT
 180   179.8    -0.2   26.8      0.0          -0.0     1.5     13.5


Glass Direct  1  1  1 12  12.2 (  135)( 252)(0.53)(0.80)=     14,407        14,552
Glass Shade   1  1  1 12  12.2 (   15)(  17)(0.71)(0.80)=        145        14,552

WALL   SOLAR   ANGLE  SOLAR    <- AREAS SHADED ->    TOTAL    TOTAL
AZIM  AZIMUTH   DIFF   ALT      OVER          SIDE   SHADED   SUNLIT
 180   195.3    15.3   25.4      0.0           0.0     1.5     13.5


Glass Direct  1  1  1 13  13.2 (  135)( 252)(0.57)(0.80)=     15,594        15,741
Glass Shade   1  1  1 13  13.2 (   15)(  17)(0.73)(0.80)=        147        15,741

WALL   SOLAR   ANGLE  SOLAR    <- AREAS SHADED ->    TOTAL    TOTAL
AZIM  AZIMUTH   DIFF   ALT      OVER          SIDE   SHADED   SUNLIT
 180   209.8    29.8   21.1      0.0           0.4     1.7     13.3


Glass Direct  1  1  1 14  14.2 (  133)( 252)(0.57)(0.80)=     15,332        15,501
Glass Shade   1  1  1 14  14.2 (   17)(  17)(0.75)(0.80)=        170        15,501

WALL   SOLAR   ANGLE  SOLAR    <- AREAS SHADED ->    TOTAL    TOTAL
AZIM  AZIMUTH   DIFF   ALT      OVER          SIDE   SHADED   SUNLIT
 180   222.7    42.7   14.5      0.0           2.1     2.9     12.1
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Glass Direct  1  1  1 15 15.2 (  121)( 252)(0.52)(0.80)=     12,612      12,913
Glass Shade   1  1  1 15 15.2 (   29)(  17)(0.76)(0.80)=        301      12,913

WALL   SOLAR   ANGLE  SOLAR    <- AREAS SHADED ->    TOTAL   TOTAL
AZIM  AZIMUTH   DIFF   ALT      OVER         SIDE    SHADED  SUNLIT
 180   234.2    54.2   6.1       0.0          4.4     4.5     10.5


Glass Direct  1  1  1 16 16.2 (  105)( 252)(0.46)(0.80)=      9,709      10,162
Glass Shade   1  1  1 16 16.2 (   45)(  17)(0.74)(0.80)=        453      10,162

Glass Direct  1  1  1 17 17.2 (  150)( 252)(0.40)(0.80)=     12,098      12,098
Glass Shade   1  1  1 17 17.2 (    0)(  17)(0.74)(0.80)=          0      12,098

Glass Direct  1  1  1 18 18.2 (  150)( 252)(0.35)(0.80)=     10,465      10,465
Glass Shade   1  1  1 18 18.2 (    0)(  17)(0.67)(0.80)=          0      10,465

Glass Direct  1  1  1 19 19.2 (  150)( 252)(0.28)(0.80)=      8,529       8,529
Glass Shade   1  1  1 19 19.2 (    0)(  17)(0.59)(0.80)=          0       8,529

Glass Direct  1  1  1 20 20.2 (  150)( 252)(0.24)(0.80)=      7,319       7,319
Glass Shade   1  1  1 20 20.2 (    0)(  17)(0.48)(0.80)=          0       7,319

Glass Direct  1  1  1 21 21.2 (  150)( 252)(0.20)(0.80)=      6,170       6,170
Glass Shade   1  1  1 21 21.2 (    0)(  17)(0.41)(0.80)=          0       6,170

Glass Direct  1  1  1 22 22.2 (  150)( 252)(0.18)(0.80)=      5,323       5,323
Glass Shade   1  1  1 22 22.2 (    0)(  17)(0.35)(0.80)=          0       5,323

Glass Direct  1  1  1 23 23.2 (  150)( 252)(0.16)(0.80)=      4,718       4,718
Glass Shade   1  1  1 23 23.2 (    0)(  17)(0.30)(0.80)=          0       4,718

Glass Direct  1  1  1 24 24.2 (  150)( 252)(0.14)(0.80)=      4,113       4,113
Glass Shade   1  1  1 24 24.2 (    0)(  17)(0.26)(0.80)=          0       4,113

Load Calc    Z# M# S#  CFM I          OAT     SPC T     BIN LOAD    ACCUM LOAD
Glass Infil   1  1  1 (  131)(1.08)( 42.5 -  68.0)=      -3,598        -3,598
Glass Infil   1  1  1 (  131)(1.08)(  2.5 -  68.0)=      -9,241        -9,241
Glass Infil   1  1  1 (  131)(1.08)( 42.5 -  60.0)=      -2,469        -2,469
Glass Infil   1  1  1 (  131)(1.08)(  2.5 -  60.0)=      -8,113        -8,113

Load Calc           Z# M#    CFM I          OAT     SPC T     BIN LOAD    ACCUM LOAD
Air Change Infil     1  1   (  150)(1.08)( 42.5 -  68.0)=      -4,131        -7,729
Air Change Infil     1  1   (  150)(1.08)(  2.5 -  68.0)=     -10,611       -19,852
Air Change Infil     1  1   (  150)(1.08)( 42.5 -  60.0)=      -2,835        -5,304
Air Change Infil     1  1   (  150)(1.08)(  2.5 -  60.0)=      -9,315       -17,428

Load Calc Z# M# S#    H# BTU/WT  LTG WT  CLFL HTSPC      BIN LOAD      ACCUM LOAD
Lighting   1  1  1  1  7 (3.413)(  1575)(0.13)(1.00)=         677             677
Lighting   1  1  1  2  8 (3.413)(  1575)(0.64)(1.00)=       3,435           3,435
Lighting   1  1  1  3  9 (3.413)(  1575)(0.68)(1.00)=       3,639           3,639
Lighting   1  1  1  4 10 (3.413)(  1575)(0.71)(1.00)=       3,792           3,792
Lighting   1  1  1  5 11 (3.413)(  1575)(0.74)(1.00)=       3,997           3,997
Lighting   1  1  1  6 12 (3.413)(  1575)(0.76)(1.00)=       4,099           4,099
Lighting   1  1  1  7 13 (3.413)(  1575)(0.79)(1.00)=       4,252           4,252
Lighting   1  1  1  8 14 (3.413)(  1575)(0.81)(1.00)=       4,354           4,354
Lighting   1  1  1  9 15 (3.413)(  1575)(0.83)(1.00)=       4,456           4,456
Lighting   1  1  1 10 16 (3.413)(  1575)(0.85)(1.00)=       4,558           4,558
Lighting   1  1  1 11 17 (3.413)(  1575)(0.86)(1.00)=       4,609           4,609
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Load Calc	Z#	M#	S#		H#	BTU/WT	LTG WT	CLFL	HTSPC	BIN LOAD	ACCUM LOAD
Lighting	1	1	1	12	18	(3.413)(	1575)	(0.35)	(1.00)=	1,903	1,903
Lighting	1	1	1	13	19	(3.413)(	1575)	(0.33)	(1.00)=	1,750	1,750
Lighting	1	1	1	14	20	(3.413)(	1575)	(0.30)	(1.00)=	1,597	1,597
Lighting	1	1	1	15	21	(3.413)(	1575)	(0.27)	(1.00)=	1,443	1,443
Lighting	1	1	1	16	22	(3.413)(	1575)	(0.25)	(1.00)=	1,341	1,341
Lighting	1	1	1	17	23	(3.413)(	1575)	(0.23)	(1.00)=	1,239	1,239
Lighting	1	1	1	18	24	(3.413)(	1575)	(0.21)	(1.00)=	1,137	1,137
Lighting	1	1	1	19	1	(3.413)(	1575)	(0.19)	(1.00)=	1,035	1,035
Lighting	1	1	1	20	2	(3.413)(	1575)	(0.18)	(1.00)=	984	984
Lighting	1	1	1	21	3	(3.413)(	1575)	(0.16)	(1.00)=	882	882
Lighting	1	1	1	22	4	(3.413)(	1575)	(0.15)	(1.00)=	831	831
Lighting	1	1	1	23	5	(3.413)(	1575)	(0.15)	(1.00)=	779	779
Lighting	1	1	1	24	6	(3.413)(	1575)	(0.14)	(1.00)=	728	728

Load Calc	Z#	M#	S#		H#	BTU/WT	LTG WT	CLFL	HTSPC	BIN LOAD	ACCUM LOAD
Lighting	1	1	2	1	7	(3.413)(	200)	(0.26)	(1.00)=	180	858
Lighting	1	1	2	2	8	(3.413)(	200)	(0.70)	(1.00)=	475	3,910
Lighting	1	1	2	3	9	(3.413)(	200)	(0.73)	(1.00)=	497	4,136
Lighting	1	1	2	4	10	(3.413)(	200)	(0.75)	(1.00)=	513	4,306
Lighting	1	1	2	5	11	(3.413)(	200)	(0.78)	(1.00)=	535	4,532
Lighting	1	1	2	6	12	(3.413)(	200)	(0.80)	(1.00)=	546	4,645
Lighting	1	1	2	7	13	(3.413)(	200)	(0.82)	(1.00)=	562	4,814
Lighting	1	1	2	8	14	(3.413)(	200)	(0.84)	(1.00)=	573	4,928
Lighting	1	1	2	9	15	(3.413)(	200)	(0.86)	(1.00)=	584	5,041
Lighting	1	1	2	10	16	(3.413)(	200)	(0.87)	(1.00)=	595	5,154
Lighting	1	1	2	11	17	(3.413)(	200)	(0.88)	(1.00)=	601	5,210
Lighting	1	1	2	12	18	(3.413)(	200)	(0.46)	(1.00)=	311	2,214
Lighting	1	1	2	13	19	(3.413)(	200)	(0.43)	(1.00)=	295	2,045
Lighting	1	1	2	14	20	(3.413)(	200)	(0.41)	(1.00)=	279	1,875
Lighting	1	1	2	15	21	(3.413)(	200)	(0.38)	(1.00)=	262	1,705
Lighting	1	1	2	16	22	(3.413)(	200)	(0.37)	(1.00)=	251	1,592
Lighting	1	1	2	17	23	(3.413)(	200)	(0.35)	(1.00)=	240	1,479
Lighting	1	1	2	18	24	(3.413)(	200)	(0.34)	(1.00)=	229	1,366
Lighting	1	1	2	19	1	(3.413)(	200)	(0.32)	(1.00)=	218	1,253
Lighting	1	1	2	20	2	(3.413)(	200)	(0.31)	(1.00)=	213	1,197
Lighting	1	1	2	21	3	(3.413)(	200)	(0.30)	(1.00)=	202	1,084
Lighting	1	1	2	22	4	(3.413)(	200)	(0.29)	(1.00)=	197	1,027
Lighting	1	1	2	23	5	(3.413)(	200)	(0.28)	(1.00)=	191	971
Lighting	1	1	2	24	6	(3.413)(	200)	(0.27)	(1.00)=	186	914

Load Calc	Z#	M#		H#	#PEOP	BTUPP	CLF/DF	HOUR LOAD
People Sensible	1	1	1	8	(6)	(230)	(0.53)=	731
People Latent	1	1	1	8	(6)	(190)	(1.00)=	1,140
People Sensible	1	1	2	9	(6)	(230)	(0.62)=	856
People Latent	1	1	2	9	(6)	(190)	(1.00)=	1,140
People Sensible	1	1	3	10	(6)	(230)	(0.69)=	952
People Latent	1	1	3	10	(6)	(190)	(1.00)=	1,140
People Sensible	1	1	4	11	(6)	(230)	(0.74)=	1,021
People Latent	1	1	4	11	(6)	(190)	(1.00)=	1,140
People Sensible	1	1	5	12	(6)	(230)	(0.77)=	1,063
People Latent	1	1	5	12	(6)	(190)	(1.00)=	1,140
People Sensible	1	1	6	13	(6)	(230)	(0.80)=	1,104
People Latent	1	1	6	13	(6)	(190)	(1.00)=	1,140
People Sensible	1	1	7	14	(6)	(230)	(0.83)=	1,145

People Latent	1	1	7	14	(6)	(190)	(1.00)=	1,140
People Sensible	1	1	8	15	(6)	(230)	(0.85)=	1,173
People Latent	1	1	8	15	(6)	(190)	(1.00)=	1,140
People Sensible	1	1	9	16	(6)	(230)	(0.87)=	1,201
People Latent	1	1	9	16	(6)	(190)	(1.00)=	1,140
People Sensible	1	1	10	17	(6)	(230)	(0.89)=	1,228
People Latent	1	1	10	17	(6)	(190)	(1.00)=	1,140
People Sensible	1	1	11	18	(6)	(230)	(0.42)=	580
People Latent	1	1	11	18	(6)	(190)	(0.00)=	0
People Sensible	1	1	12	19	(6)	(230)	(0.34)=	469
People Latent	1	1	12	19	(6)	(190)	(0.00)=	0
People Sensible	1	1	13	20	(6)	(230)	(0.28)=	386
People Latent	1	1	13	20	(6)	(190)	(0.00)=	0
People Sensible	1	1	14	21	(6)	(230)	(0.23)=	317
People Latent	1	1	14	21	(6)	(190)	(0.00)=	0
People Sensible	1	1	15	22	(6)	(230)	(0.20)=	276
People Latent	1	1	15	22	(6)	(190)	(0.00)=	0
People Sensible	1	1	16	23	(6)	(230)	(0.17)=	235
People Latent	1	1	16	23	(6)	(190)	(0.00)=	0
People Sensible	1	1	17	24	(6)	(230)	(0.15)=	207
People Latent	1	1	17	24	(6)	(190)	(0.00)=	0
People Sensible	1	1	18	1	(6)	(230)	(0.13)=	179
People Latent	1	1	18	1	(6)	(190)	(0.00)=	0
People Sensible	1	1	19	2	(6)	(230)	(0.11)=	152
People Latent	1	1	19	2	(6)	(190)	(0.00)=	0
People Sensible	1	1	20	3	(6)	(230)	(0.10)=	138
People Latent	1	1	20	3	(6)	(190)	(0.00)=	0
People Sensible	1	1	21	4	(6)	(230)	(0.09)=	124
People Latent	1	1	21	4	(6)	(190)	(0.00)=	0
People Sensible	1	1	22	5	(6)	(230)	(0.08)=	110
People Latent	1	1	22	5	(6)	(190)	(0.00)=	0
People Sensible	1	1	23	6	(6)	(230)	(0.07)=	97
People Latent	1	1	23	6	(6)	(190)	(0.00)=	0
People Sensible	1	1	24	7	(6)	(230)	(0.06)=	83
People Latent	1	1	24	7	(6)	(190)	(0.00)=	0

Load Calc	Z#	M#	S#		H#	BTU/WT	WATTS	CLF	BIN LOAD	ACCUM LOAD
Misc Elect	1	1	1	1	8	(3.413)(	225)	(0.60)=	461	461
Misc Elect	1	1	1	2	9	(3.413)(	225)	(0.68)=	522	522
Misc Elect	1	1	1	3	10	(3.413)(	225)	(0.73)=	561	561
Misc Elect	1	1	1	4	11	(3.413)(	225)	(0.77)=	591	591
Misc Elect	1	1	1	5	12	(3.413)(	225)	(0.81)=	622	622
Misc Elect	1	1	1	6	13	(3.413)(	225)	(0.83)=	637	637

Misc Elect	1	1	1	7	14	(3.413)(225)(0.85)=	653	653
Misc Elect	1	1	1	8	15	(3.413)(225)(0.87)=	668	668
Misc Elect	1	1	1	9	16	(3.413)(225)(0.89)=	683	683
Misc Elect	1	1	1	10	17	(3.413)(225)(0.90)=	691	691
Misc Elect	1	1	1	11	18	(3.413)(225)(0.36)=	276	276
Misc Elect	1	1	1	12	19	(3.413)(225)(0.29)=	223	223
Misc Elect	1	1	1	13	20	(3.413)(225)(0.24)=	184	184
Misc Elect	1	1	1	14	21	(3.413)(225)(0.20)=	154	154
Misc Elect	1	1	1	15	22	(3.413)(225)(0.17)=	131	131
Misc Elect	1	1	1	16	23	(3.413)(225)(0.15)=	115	115
Misc Elect	1	1	1	17	24	(3.413)(225)(0.13)=	100	100
Misc Elect	1	1	1	18	1	(3.413)(225)(0.11)=	84	84
Misc Elect	1	1	1	19	2	(3.413)(225)(0.10)=	77	77
Misc Elect	1	1	1	20	3	(3.413)(225)(0.08)=	61	61
Misc Elect	1	1	1	21	4	(3.413)(225)(0.07)=	54	54
Misc Elect	1	1	1	22	5	(3.413)(225)(0.07)=	54	54
Misc Elect	1	1	1	23	6	(3.413)(225)(0.06)=	46	46
Misc Elect	1	1	1	24	7	(3.413)(225)(0.05)=	38	38

SUMMARY OF HOURLY PEAK LOADS BY COMPONENT

HR	SOL HR	OPAQUE	GLASS	LIGHTS	PEOPLE	EQUIP	MIS SENS	TOTAL HOUR
1	1.2	1,252	3,569	1,253	179	84	0	6,337
2	2.2	672	3,206	1,197	152	77	0	5,303
3	3.2	38	2,661	1,084	138	61	0	3,983
4	4.2	-489	2,359	1,027	124	54	0	3,075
5	5.2	-875	2,177	971	110	54	0	2,437
6	6.2	-1,249	2,600	914	97	46	0	2,407
7	7.2	-1,526	3,507	858	83	38	0	2,960
8	8.2	-1,575	3,544	3,910	731	461	0	7,071
9	9.2	-1,505	5,799	4,136	856	522	0	9,809
10	10.2	-1,179	9,049	4,306	952	561	0	13,689
11	11.2	-564	12,128	4,532	1,021	591	0	17,708
12	12.2	219	14,552	4,645	1,063	622	0	21,101
13	13.2	1,186	15,741	4,814	1,104	637	0	23,483
14	14.2	2,134	15,501	4,928	1,145	653	0	24,361
15	15.2	3,047	12,913	5,041	1,173	668	0	22,841
16	16.2	3,790	10,162	5,154	1,201	683	0	20,990
17	17.2	4,372	12,098	5,210	1,228	691	0	23,599
18	18.2	4,687	10,465	2,214	580	276	0	18,222
19	19.2	4,660	8,529	2,045	469	223	0	15,925
20	20.2	4,412	7,319	1,875	386	184	0	14,177
21	21.2	3,848	6,170	1,705	317	154	0	12,195
22	22.2	3,247	5,323	1,592	276	131	0	10,569
23	23.2	2,595	4,718	1,479	235	115	0	9,142
24	24.2	1,932	4,113	1,366	207	100	0	7,718

DIVERSIFIED HOURLY SOLAR LOADS

	HR	SOL HR	OPAQUE	GLASS	FPSS	HOURLY LOAD	ACCUM HOURLY
Solar	1	1.2	1,252	3,569	0.440	2,121	2,121
Solar	2	2.2	672	3,206	0.440	1,706	1,706
Solar	3	3.2	38	2,661	0.440	1,188	1,188
Solar	4	4.2	-489	2,359	0.440	823	823
Solar	5	5.2	-875	2,177	0.440	573	573
Solar	6	6.2	-1,249	2,600	0.440	594	594
Solar	7	7.2	-1,526	3,507	0.440	872	872
Solar	8	8.2	-1,575	3,544	0.440	867	867
Solar	9	9.2	-1,505	5,799	0.440	1,890	1,890
Solar	10	10.2	-1,179	9,049	0.440	3,463	3,463
Solar	11	11.2	-564	12,128	0.440	5,088	5,088
Solar	12	12.2	219	14,552	0.440	6,499	6,499

Solar	13	13.2	1,186	15,741	0.440	7,448	7,448
Solar	14	14.2	2,134	15,501	0.440	7,759	7,759
Solar	15	15.2	3,047	12,913	0.440	7,022	7,022
Solar	16	16.2	3,790	10,162	0.440	6,139	6,139
Solar	17	17.2	4,372	12,098	0.440	7,247	7,247
Solar	18	18.2	4,687	10,465	0.440	6,667	6,667
Solar	19	19.2	4,660	8,529	0.440	5,803	5,803
Solar	20	20.2	4,412	7,319	0.440	5,162	5,162
Solar	21	21.2	3,848	6,170	0.440	4,408	4,408
Solar	22	22.2	3,247	5,323	0.440	3,771	3,771
Solar	23	23.2	2,595	4,718	0.440	3,218	3,218
Solar	24	24.2	1,932	4,113	0.440	2,660	2,660

DIVERSIFIED HOURLY LIGHTING LOADS

	H#	PEAK HR LOAD	DIVR HR LOAD	ACCUM HOURLY LOAD
Lites	1	1,253	1,253	3,374
Lites	2	1,197	1,197	2,903
Lites	3	1,084	1,084	2,271
Lites	4	1,027	1,027	1,850
Lites	5	971	971	1,544
Lites	6	914	914	1,508
Lites	7	858	858	1,729
Lites	8	3,910	3,910	4,777
Lites	9	4,136	4,136	6,026
Lites	10	4,306	4,306	7,769
Lites	11	4,532	4,532	9,620
Lites	12	4,645	4,645	11,144
Lites	13	4,814	4,814	12,262
Lites	14	4,928	4,928	12,687
Lites	15	5,041	5,041	12,063
Lites	16	5,154	5,154	11,293
Lites	17	5,210	5,210	12,457
Lites	18	2,214	2,214	8,881
Lites	19	2,045	2,045	7,848
Lites	20	1,875	1,875	7,037
Lites	21	1,705	1,705	6,113
Lites	22	1,592	1,592	5,363
Lites	23	1,479	1,479	4,697
Lites	24	1,366	1,366	4,026

DIVERSIFIED HOURLY PEOPLE LOADS

	H#	PEAK HR LOAD	DIVR HR LOAD	ACCUM HOURLY LOAD
People	1	179	179	3,553
People	2	152	152	3,055
People	3	138	138	2,409
People	4	124	124	1,974
People	5	110	110	1,654
People	6	97	97	1,605
People	7	83	83	1,812
People	8	731	731	5,508
People	9	856	856	6,881
People	10	952	952	8,721
People	11	1,021	1,021	10,641
People	12	1,063	1,063	12,207
People	13	1,104	1,104	13,366
People	14	1,145	1,145	13,832
People	15	1,173	1,173	13,236
People	16	1,201	1,201	12,493
People	17	1,228	1,228	13,685
People	18	580	580	9,461

People	19	469	469	8,317
People	20	386	386	7,423
People	21	317	317	6,431
People	22	276	276	5,639
People	23	235	235	4,932
People	24	207	207	4,233

DIVERSIFIED HOURLY EQUIPMENT LOADS

	H#	PEAK HR LOAD	DIVR HR LOAD	ACCUM HOURLY LOAD
Equip	1	84	84	3,638
Equip	2	77	77	3,132
Equip	3	61	61	2,471
Equip	4	54	54	2,028
Equip	5	54	54	1,708
Equip	6	46	46	1,651
Equip	7	38	38	1,850
Equip	8	461	461	5,969
Equip	9	522	522	7,404
Equip	10	561	561	9,281
Equip	11	591	591	11,232
Equip	12	622	622	12,829
Equip	13	637	637	14,004
Equip	14	653	653	14,485
Equip	15	668	668	13,904
Equip	16	683	683	13,177
Equip	17	691	691	14,376
Equip	18	276	276	9,737
Equip	19	223	223	8,540
Equip	20	184	184	7,607
Equip	21	154	154	6,584
Equip	22	131	131	5,770
Equip	23	115	115	5,047
Equip	24	100	100	4,333

DIVERSIFIED HOURLY MISC SENSIBLE LOADS

	H#	PEAK HR LOAD	DIVR HR LOAD	ACCUM HOURLY LOAD
Misc Sens	1	0	0	3,638
Misc Sens	2	0	0	3,132
Misc Sens	3	0	0	2,471
Misc Sens	4	0	0	2,028
Misc Sens	5	0	0	1,708
Misc Sens	6	0	0	1,651
Misc Sens	7	0	0	1,850
Misc Sens	8	0	0	5,969
Misc Sens	9	0	0	7,404
Misc Sens	10	0	0	9,281
Misc Sens	11	0	0	11,232
Misc Sens	12	0	0	12,829
Misc Sens	13	0	0	14,004
Misc Sens	14	0	0	14,485
Misc Sens	15	0	0	13,904
Misc Sens	16	0	0	13,177
Misc Sens	17	0	0	14,376
Misc Sens	18	0	0	9,737
Misc Sens	19	0	0	8,540
Misc Sens	20	0	0	7,607
Misc Sens	21	0	0	6,584
Misc Sens	22	0	0	5,770
Misc Sens	23	0	0	5,047
Misc Sens	24	0	0	4,333

DIVERSIFIED HOURLY SUMMARY

	H#	PEAK HR LOAD	DIVR HR LOAD	ACC SYS OCC	ACC SYS UNO
Total	1	6,337	3,638	0	3,638
Total	2	5,303	3,132	0	6,770
Total	3	3,983	2,471	0	9,240
Total	4	3,075	2,028	0	11,268
Total	5	2,437	1,708	0	12,976
Total	6	2,407	1,651	0	14,627
Total	7	2,960	1,850	0	16,477
Total	8	7,071	5,969	0	22,446
Total	9	9,809	7,404	7,404	22,446
Total	10	13,689	9,281	16,685	22,446
Total	11	17,708	11,232	27,918	22,446
Total	12	21,101	12,829	40,747	22,446
Total	13	23,483	14,004	54,750	22,446
Total	14	24,361	14,485	69,235	22,446
Total	15	22,841	13,904	83,139	22,446
Total	16	20,990	13,177	96,316	22,446
Total	17	23,599	14,376	110,692	22,446
Total	18	18,222	9,737	120,429	22,446
Total	19	15,925	8,540	120,429	30,986
Total	20	14,177	7,607	120,429	38,593
Total	21	12,195	6,584	120,429	45,178
Total	22	10,569	5,770	120,429	50,947
Total	23	9,142	5,047	120,429	55,994
Total	24	7,718	4,333	120,429	60,327

SUMMARY OF DIVERSIFIED LOADS BY BIN (OCCUPIED AND UNOCCUPIED)

BIN T	OCC CONST	OCC LINEAR	OCC TOTAL	UNO CONST	UNO LINEAR	UNO TOTAL
42.5	12,043	-12,190	-147	4,309	-8,366	-4,057
37.5	12,043	-14,580	-2,537	4,309	-10,756	-6,447
32.5	12,043	-16,971	-4,928	4,309	-13,146	-8,837
27.5	12,043	-19,361	-7,318	4,309	-15,536	-11,227
22.5	12,043	-21,751	-9,708	4,309	-17,927	-13,618
17.5	12,043	-24,141	-12,098	4,309	-20,317	-16,008
12.5	12,043	-26,531	-14,489	4,309	-22,707	-18,398
7.5	12,043	-28,922	-16,879	4,309	-25,097	-20,788
2.5	12,043	-31,312	-19,269	4,309	-27,488	-23,179

Load Calc	Z#	M#	S#	U-FCT	AREA	OAT	SPC T	WALL LOAD	ACCUM WALL
Wall Cond	1	2	1	(0.100)(	700)(	57.5 -	68.0)=	-735	-735
Wall Cond	1	2	1	(0.100)(	700)(	-2.5 -	68.0)=	-4,935	-4,935
Wall Cond	1	2	1	(0.100)(	700)(	57.5 -	60.0)=	-175	-175
Wall Cond	1	2	1	(0.100)(	700)(	-2.5 -	60.0)=	-4,375	-4,375

Load	Z#	M#	S#	HR	SOL#	U-FCT	AREA	CLTD	LMC	COL C	CLTD LD	ACC LD
Wall CLTD	1	2	1	1	1.1	(0.100)(	700)	(18.8 +	12 -	7)(0.83)=	1,381	1,381
Wall CLTD	1	2	1	2	2.1	(0.100)(	700)	(16.8 +	12 -	7)(0.83)=	1,264	1,264
Wall CLTD	1	2	1	3	3.1	(0.100)(	700)	(14.8 +	12 -	7)(0.83)=	1,148	1,148
Wall CLTD	1	2	1	4	4.1	(0.100)(	700)	(12.8 +	12 -	7)(0.83)=	1,032	1,032
Wall CLTD	1	2	1	5	5.1	(0.100)(	700)	(10.8 +	12 -	7)(0.83)=	916	916
Wall CLTD	1	2	1	6	6.1	(0.100)(	700)	(8.9 +	12 -	7)(0.83)=	807	807
Wall CLTD	1	2	1	7	7.1	(0.100)(	700)	(7.9 +	12 -	7)(0.83)=	748	748
Wall CLTD	1	2	1	8	8.1	(0.100)(	700)	(6.9 +	12 -	7)(0.83)=	690	690
Wall CLTD	1	2	1	9	9.1	(0.100)(	700)	(6.0 +	12 -	7)(0.83)=	639	639
Wall CLTD	1	2	1	10	10.1	(0.100)(	700)	(6.1 +	12 -	7)(0.83)=	646	646
Wall CLTD	1	2	1	11	11.1	(0.100)(	700)	(7.2 +	12 -	7)(0.83)=	711	711
Wall CLTD	1	2	1	12	12.1	(0.100)(	700)	(9.4 +	12 -	7)(0.83)=	834	834
Wall CLTD	1	2	1	13	13.1	(0.100)(	700)	(12.5 +	12 -	7)(0.83)=	1,015	1,015

ASEAM2 Report: PLT-BC-DHW   File Name: DEMO   Date: 04-07-1987
Plant Type: Domestic Hot Water

Sample Single Run Calculation

Month	Bin Temp	Bin Hours	Cycle	Loads Usage	KBTUH Plant	Effic (%)	Input Energy Therms	Pump KWH	Accum Therms
Jan	42.5	33.9	Occupied	7.1	7.3	69.2	0.1	0	4
Jan	37.5	90.0	Occupied	7.1	7.3	69.2	0.1	0	13
Jan	32.5	38.9	Occupied	7.2	7.3	69.2	0.1	0	17
Jan	27.5	20.4	Occupied	7.2	7.4	69.2	0.1	0	19
Jan	22.5	15.7	Occupied	7.3	7.4	69.2	0.1	0	21
Jan	17.5	17.9	Occupied	7.3	7.5	69.2	0.1	0	23
Jan	12.5	2.5	Occupied	7.4	7.5	69.2	0.1	0	23
Jan	7.5	0.7	Occupied	7.4	7.6	69.2	0.1	0	23
Jan	2.5	2.5	Occupied	7.5	7.6	69.3	0.1	0	24

Month	Bin Temp	Bin Hours	Cycle	Loads Usage	KBTUH Plant	Effic (%)	Input Energy Therms	Pump KWH	Accum Therms
Feb	57.5	10.4	Occupied	7.0	7.1	69.1	0.1	0	25
Feb	52.5	11.1	Occupied	7.0	7.2	69.1	0.1	0	26
Feb	47.5	13.2	Occupied	7.1	7.2	69.1	0.1	0	27
Feb	42.5	31.4	Occupied	7.1	7.3	69.2	0.1	0	30
Feb	37.5	33.2	Occupied	7.1	7.3	69.2	0.1	0	34
Feb	32.5	35.4	Occupied	7.2	7.3	69.2	0.1	0	38
Feb	27.5	27.9	Occupied	7.2	7.4	69.2	0.1	0	41
Feb	22.5	9.3	Occupied	7.3	7.4	69.2	0.1	0	42
Feb	17.5	8.6	Occupied	7.3	7.5	69.2	0.1	0	43
Feb	12.5	8.6	Occupied	7.4	7.5	69.2	0.1	0	44
Feb	7.5	7.9	Occupied	7.4	7.6	69.2	0.1	0	44
Feb	2.5	0.7	Occupied	7.5	7.6	69.3	0.1	0	45
Feb	-2.5	4.6	Occupied	7.5	7.7	69.3	0.1	0	45

Month	Bin Temp	Bin Hours	Cycle	Loads Usage	KBTUH Plant	Effic (%)	Input Energy Therms	Pump KWH	Accum Therms
Mar	67.5	5.4	Occupied	6.9	7.0	69.1	0.1	0	46
Mar	62.5	5.7	Occupied	6.9	7.1	69.1	0.1	0	46
Mar	57.5	14.3	Occupied	7.0	7.1	69.1	0.1	0	48
Mar	52.5	15.4	Occupied	7.0	7.2	69.1	0.1	0	49
Mar	47.5	23.9	Occupied	7.1	7.2	69.1	0.1	0	52
Mar	42.5	70.7	Occupied	7.1	7.3	69.2	0.1	0	59
Mar	37.5	59.3	Occupied	7.1	7.3	69.2	0.1	0	65
Mar	32.5	19.3	Occupied	7.2	7.3	69.2	0.1	0	67
Mar	27.5	2.9	Occupied	7.2	7.4	69.2	0.1	0	68
Mar	17.5	8.2	Occupied	7.3	7.5	69.2	0.1	0	69

Month	Bin	Cycle	Loads KBTUH	Effic	Input Energy	Pump	Accum

ASEAM2 Report: SYS-BC-VAVR File Name: DEMO Date: 04-07-1987
System Name: VAV Reheat System Type: VAVR
System Energy Requirements (Plant Loads)

Sample Single Run Calculation

Month Jan Bin Midpt	Cycle Occup Bin Hours	Oper Hours	<------ System Loads on Plant ------> Preheat Energy KBTUH	Humidity Energy KBTUH	Cooling Energy KBTUH	Heating Energy KBTUH	Baseboard Energy KBTUH
17.5	15.7	15.7	0.0	26.1	0.0	108.9	0.0
12.5	17.9	17.9	0.0	28.0	0.0	118.0	0.0
7.5	2.5	2.5	0.0	26.6	0.0	127.1	0.0
2.5	0.7	0.7	0.0	27.2-	0.0	136.2	0.0

Month Feb Bin Midpt	Cycle Occup Bin Hours	Oper Hours	<------ System Loads on Plant ------> Preheat Energy KBTUH	Humidity Energy KBTUH	Cooling Energy KBTUH	Heating Energy KBTUH	Baseboard Energy KBTUH
57.5	2.5	2.5	0.0	0.0	0.0	3.7	0.0
52.5	10.4	10.4	0.0	0.0	0.0	33.0	0.0
47.5	11.1	11.1	0.0	0.0	0.0	50.1	0.0
42.5	13.2	13.2	0.0	4.9	0.0	58.6	0.0
37.5	31.4	31.4	0.0	17.6	0.0	69.5	0.0
32.5	33.2	33.2	0.0	19.8	0.0	79.1	0.0
27.5	35.4	35.4	0.0	22.0	0.0	88.3	0.0
22.5	27.9	27.9	0.0	23.1	0.0	97.4	0.0
17.5	9.3	9.3	0.0	29.4	0.0	106.6	0.0
12.5	8.6	8.6	0.0	31.0	0.0	115.8	0.0
7.5	8.6	8.6	0.0	31.7	0.0	124.9	0.0
2.5	7.9	7.9	0.0	31.9	0.0	134.1	0.0
-2.5	0.7	0.7	0.0	31.8	0.0	143.3	0.0

Month Mar Bin Midpt	Cycle Occup Bin Hours	Oper Hours	<------ System Loads on Plant ------> Preheat Energy KBTUH	Humidity Energy KBTUH	Cooling Energy KBTUH	Heating Energy KBTUH	Baseboard Energy KBTUH
67.5	4.6	4.6	0.0	0.0	0.0	0.0	0.0
62.5	5.4	5.4	0.0	0.0	0.0	0.0	0.0
57.5	5.7	5.7	0.0	0.0	0.0	2.0	0.0
52.5	14.3	14.3	0.0	0.0	0.0	28.1	0.0
47.5	15.4	15.4	0.0	0.0	0.0	47.2	0.0
42.5	23.9	23.9	0.0	20.8	0.0	55.2	0.0
37.5	70.7	70.7	0.0	17.6	0.0	64.6	0.0
32.5	59.3	59.3	0.0	14.7	0.0	75.3	0.0
27.5	19.3	19.3	0.0	22.0	0.0	84.4	0.0

ASEAM2 Report: PLT-BC-REC File Name: DEMO Date: 04-07-1987
Plant Type: Reciprocating Chiller

Sample Single Run Calculation

Month	Chiller Type	#	Bin Temp	Bin Hours	Oper Hours	Equipment Load KBTUH	COP	Input KW	Energy Acc KWH	Tower Load
May	1	1	87.5	1.4	1.4	192.4	2.95	19.1	27	251.2
May	1	1	82.5	18.6	18.6	162.3	2.86	16.6	337	213.4
May	1	1	77.5	39.6	39.6	159.9	2.85	16.5	989	210.4
May	1	1	72.5	38.2	38.2	153.8	2.83	15.9	1,598	202.7
May	1	1	67.5	20.0	20.0	100.7	2.58	11.4	1,826	135.8
May	1	1	62.5	12.5	9.6	60.3	2.44	7.2	1,917	82.5
May	1	1	57.5	27.1	12.0	34.3	2.44	4.1	2,029	46.9

Month	Chiller Type	#	Bin Temp	Bin Hours	Oper Hours	Equipment Load KBTUH	COP	Input KW	Energy Acc KWH	Tower Load
Jun	1	1	92.5	23.2	23.2	254.4	3.10	24.1	2,587	328.3
Jun	1	1	87.5	28.2	28.2	214.6	3.01	20.9	3,177	278.9
Jun	1	1	82.5	39.3	39.3	188.0	2.94	18.8	3,914	245.6
Jun	1	1	77.5	28.2	28.2	174.2	2.89	17.6	4,412	228.4
Jun	1	1	72.5	40.7	40.7	163.4	2.86	16.7	5,094	214.9
Jun	1	1	67.5	21.1	21.1	112.9	2.65	12.5	5,356	151.2
Jun	1	1	62.5	22.9	17.6	60.3	2.44	7.2	5,522	82.5
Jun	1	1	57.5	10.7	4.8	34.3	2.44	4.1	5,566	47.0

Month	Chiller Type	#	Bin Temp	Bin Hours	Oper Hours	Equipment Load KBTUH	COP	Input KW	Energy Acc KWH	Tower Load
Jul	1	1	92.5	5.7	5.7	252.8	3.09	23.9	5,703	326.3
Jul	1	1	87.5	52.9	52.9	213.4	3.00	20.8	6,803	277.3
Jul	1	1	82.5	71.1	71.1	188.8	2.94	18.8	8,141	246.6
Jul	1	1	77.5	38.2	38.2	178.5	2.91	18.0	8,829	233.7
Jul	1	1	72.5	40.4	40.4	171.9	2.89	17.4	9,533	225.5
Jul	1	1	67.5	11.1	11.1	136.3	2.76	14.5	9,693	180.7
Jul	1	1	62.5	2.1	2.1	75.4	2.43	9.1	9,712	103.3

Month	Chiller Type	#	Bin Temp	Bin Hours	Oper Hours	Equipment Load KBTUH	COP	Input KW	Energy Acc KWH	Tower Load
Aug	1	1	92.5	14.3	14.3	258.1	3.11	24.4	10,060	332.9
Aug	1	1	87.5	39.3	39.3	213.0	3.00	20.8	10,877	276.9
Aug	1	1	82.5	42.1	42.1	194.1	2.95	19.3	11,688	253.2
Aug	1	1	77.5	59.6	59.6	180.6	2.91	18.2	12,772	236.4
Aug	1	1	72.5	45.0	45.0	169.5	2.88	17.2	13,548	222.5
Aug	1	1	67.5	19.3	19.3	135.0	2.75	14.4	13,825	179.2
Aug	1	1	62.5	1.8	1.7	75.4	2.43	9.1	13,841	103.3

ASEAM2 Report: PLT-BC-ER File Name: DEMO Date: 04-07-1987
Plant Type: Electric Resistance

Sample Single Run Calculation

Month	Bin Temp	Bin Hours	Cycle	Heating Load KBTUH	Elect Resist KW	Accumulative Hours	Accumulative KWH
Jan	7.5	18.5	Unoccupied	2.6	1	19	14
Jan	2.5	8.3	Unoccupied	7.7	2	27	32

Month	Bin Temp	Bin Hours	Cycle	Heating Load KBTUH	Elect Resist KW	Accumulative Hours	Accumulative KWH
Feb	7.5	13.4	Unoccupied	2.6	1	40	43
Feb	2.5	27.1	Unoccupied	7.7	2	67	103
Feb	-2.5	5.3	Unoccupied	12.8	4	73	123

Month	Bin Temp	Bin Hours	Cycle	Heating Load KBTUH	Elect Resist KW	Accumulative Hours	Accumulative KWH
Dec	7.5	14.8	Unoccupied	2.6	1	87	134
Dec	2.5	12.9	Unoccupied	7.7	2	100	163

ASEAM2 Report: PLT-BC-BLR File Name: DEMO Date: 04-07-1987
Plant Type: Boiler

Sample Single Run Calculation

Month	Boiler Type	#	Bin Temp	Bin Hours	Cycle	Equip Load KBTUH	Effic (%)	Input KW	Accum Hours	Accum KWH
Jan	1	1	42.5	1.4	Occupied	89.8	95.0	27.7	1.4	40
Jan	1	1	37.5	33.9	Occupied	90.1	95.0	27.8	35.4	982
Jan	1	1	32.5	90.0	Occupied	91.1	95.0	28.1	125.4	3,511
Jan	1	1	27.5	38.9	Occupied	108.4	95.0	33.4	164.3	4,813
Jan	1	1	22.5	20.4	Occupied	122.7	95.0	37.9	184.6	5,583
Jan	1	1	17.5	15.7	Occupied	135.1	95.0	41.7	200.4	6,238
Jan	1	1	12.5	17.9	Occupied	146.0	95.0	45.0	218.2	7,042
Jan	1	1	7.5	2.5	Occupied	153.7	95.0	47.4	220.7	7,161
Jan	1	1	2.5	0.7	Occupied	163.4	95.0	50.4	221.4	7,197

Month	Boiler Type	#	Bin Temp	Bin Hours	Cycle	Equip Load KBTUH	Effic (%)	Input KW	Accum Hours	Accum KWH
Feb	1	1	57.5	2.5	Occupied	3.7	95.0	1.1	223.9	7,199
Feb	1	1	52.5	10.4	Occupied	33.0	95.0	10.2	234.3	7,305
Feb	1	1	47.5	11.1	Occupied	50.1	95.0	15.5	245.4	7,476
Feb	1	1	42.5	13.2	Occupied	63.5	95.0	19.6	258.6	7,735
Feb	1	1	37.5	31.4	Occupied	87.1	95.0	26.9	290.0	8,579
Feb	1	1	32.5	33.2	Occupied	98.9	95.0	30.5	323.2	9,592
Feb	1	1	27.5	35.4	Occupied	110.3	95.0	34.0	358.6	10,795
Feb	1	1	22.5	27.9	Occupied	120.5	95.0	37.2	386.4	11,830
Feb	1	1	17.5	9.3	Occupied	136.0	95.0	42.0	395.7	12,220
Feb	1	1	12.5	8.6	Occupied	146.8	95.0	45.3	404.3	12,608

ASEAM2 Report: PLT-BC-CTWR   File Name: DEMO   Date: 04-07-1987
Plant Type: Cooling Tower

Sample Single Run Calculation

Month	Bin Temp	Bin Hours	Heat Rejection Load KBTUH	Electrical KW Tower Fans	Electrical KW Pumps	Plant KWH Bin	Plant KWH Accum
May	87.5	1.4	255.0	0.2	1.3	2	2
May	82.5	18.6	217.3	0.2	1.3	26	28
May	77.5	39.6	214.3	0.1	1.3	56	84
May	72.5	38.2	206.6	0.2	1.3	54	138
May	67.5	20.0	139.7	0.1	1.3	27	165
May	62.5	12.5	86.4	0.1	1.3	17	182
May	57.5	27.1	50.8	0.0	1.3	34	216

Month	Bin Temp	Bin Hours	Heat Rejection Load KBTUH	Electrical KW Tower Fans	Electrical KW Pumps	Plant KWH Bin	Plant KWH Accum
Jun	92.5	23.2	332.2	0.2	1.3	34	250
Jun	87.5	28.2	282.7	0.2	1.3	40	290
Jun	82.5	39.3	249.5	0.1	1.3	55	345
Jun	77.5	28.2	232.3	0.1	1.3	39	385
Jun	72.5	40.7	218.8	0.1	1.3	57	442
Jun	67.5	21.1	155.1	0.1	1.3	29	470
Jun	62.5	22.9	86.4	0.1	1.3	30	501
Jun	57.5	10.7	50.9	0.0	1.3	14	514

Month	Bin Temp	Bin Hours	Heat Rejection Load KBTUH	Electrical KW Tower Fans	Electrical KW Pumps	Plant KWH Bin	Plant KWH Accum
Jul	92.5	5.7	330.2	0.2	1.3	8	522
Jul	87.5	52.9	281.2	0.2	1.3	75	598
Jul	82.5	71.1	250.5	0.1	1.3	100	697
Jul	77.5	38.2	237.6	0.1	1.3	53	751
Jul	72.5	40.4	229.4	0.1	1.3	56	807
Jul	67.5	11.1	184.6	0.1	1.3	15	822
Jul	62.5	2.1	107.1	0.0	1.3	3	825

Month	Bin Temp	Bin Hours	Heat Rejection Load KBTUH	Electrical KW Tower Fans	Electrical KW Pumps	Plant KWH Bin	Plant KWH Accum
Aug	92.5	14.3	336.8	0.2	1.3	21	846
Aug	87.5	39.3	280.7	0.2	1.3	56	901
Aug	82.5	42.1	257.1	0.1	1.3	59	960
Aug	77.5	59.6	240.3	0.1	1.3	83	1,043
Aug	72.5	45.0	226.3	0.1	1.3	63	1,106
Aug	67.5	19.3	183.0	0.1	1.3	26	1,133
Aug	62.5	1.8	107.1	0.0	1.3	2	1,135

12.5.3 LOTUS-Compatible Reports

Examples of LOTUS-compatible reports, after formatting with the template macros, are shown on the following pages. The examples do not include all possible combinations. Refer to Section 12.4.1 for instructions on formatting these reports.

SAMPLE ZONE PEAK LOAD TOTAL REPORT (LB)

Report	Zone	Month	Var Num	12 Mid	1 am	2 am	3 am	4 am	5 am	6 am	7 am	8 am	9 am	10 am	11 am	12 Noon	13 pm	14 pm	15 pm	16 pm	17 pm	18 pm	19 pm	20 pm	21 pm	22 pm
LB	1	1	1	10,006	8,517	6,431	4,955	3,737	3,323	3,889	9,288	12,491	17,238	22,966	28,460	32,384	34,693	34,549	33,751	32,603	27,010	23,859	21,699	18,825	16,484	14,37[illegible]
LB	1	2	1	10,597	9,129	7,085	5,630	4,432	3,998	4,501	9,838	12,896	17,434	22,934	28,220	32,039	34,327	34,288	33,614	32,591	27,102	24,096	22,020	19,229	16,951	14,879
LB	1	3	1	10,403	8,991	7,059	5;660	4,518	4,028	4,363	9,532	12,198	16,176	21,060	25,786	29,325	31,557	31,798	31,460	30,773	25,564	22,950	21,098	18,531	16,421	14,461
LB	1	4	1	9,084	7,755	5,989	4,673	3,615	3,041	3,127	8,046	10,129	13,276	17,264	21,138	24,262	26,411	27,067	27,229	27,041	22,248	20,217	18,697	16,463	14,602	12,809
LB	1	5	1	8,338	7,075	5,440	4,191	3,198	2,558	2,447	7,170	8,794	11,284	14,531	17,769	20,564	22,648	23,633	24,188	24,394	19,928	18,356	17,099	15,127	13,464	11,801
LB	1	6	1	7,796	6,561	4,984	3,763	2,799	2,131	1,933	6,570	7,992	10,194	13,125	16,075	18,726	20,780	21,909	22,637	23,016	18,694	17,324	16,182	14,325	12,748	11,144
LB	1	7	1	8,262	7,005	5,383	4,139	3,153	2,507	2,377	7,080	8,659	11,086	14,262	17,436	20,200	22,277	23,293	23,887	24,131	19,698	18,171	16,939	14,993	13,348	11,699
LB	1	8	1	8,988	7,667	5,917	4,609	3,559	2,977	3,039	7,934	9,961	13,028	16,908	20,722	23,806	25,947	26,643	26,853	26,713	21,960	19,985	18,497	16,295	14,458	12,681
LB	1	9	1	10,288	8,885	6,972	5,583	4,451	3,951	4,257	9,398	11,996	15,878	20,657	25,287	28,778	31,000	31,289	31,009	30,380	25,218	22,672	20,858	18,329	16,248	14,308
LB	1	10	1	10,463	9,006	6,984	5,540	4,354	3,908	4,378	9,681	12,660	17,087	22,463	27,637	31,401	33,678	33,694	33,088	32,132	26,699	23,772	21,740	18,994	16,749	14,700
LB	1	11	1	9,929	8,446	6,373	4,904	3,692	3,272	3,818	9,199	12,357	17,039	22,698	28,128	32,019	34,321	34,210	33,450	32,341	26,779	23,673	21,539	18,690	16,369	14,269
LB	1	12	1	9,550	8,063	5,980	4,507	3,290	2,874	3,435	8,830	12,022	16,752	22,463	27,941	31,856	34,164	34,029	33,240	32,102	26,516	23,376	21,223	18,355	16,020	13,909

SAMPLE SYSTEM LOADS REPORT (SA)

Report	Sys	Cycle	Month	Bin Temp	Number Hours	Load Zone	Div Sen Load	Load Zone	Div Sen Load	Load Zone	Div Sen Load	Load Zone	Div Sen Load	Load Zone	Div Sen Load
SA	1	1	1	67.5	6	1	15530	2	4035	3	6623	4	5256	5	16007
SA	1	1	1	62.5	14	1	12134	2	2420	3	3227	4	3641	5	14207
SA	1	1	1	57.5	9	1	8739	2	805	3	-168	4	2025	5	12407
SA	1	1	1	52.5	5	1	5343	2	-811	3	-3564	4	410	5	10607
SA	1	1	1	47.5	25	1	1948	2	-2426	3	-6960	4	-1205	5	8807
SA	1	1	1	42.5	30	1	-1448	2	-4041	3	-10355	4	-2821	5	7007
SA	1	1	1	37.5	45	1	-4844	2	-5656	3	-13751	4	-4436	5	5207
SA	1	1	1	32.5	65	1	-8239	2	-7272	3	-17146	4	-6051	5	3407
SA	1	1	1	27.5	24	1	-11635	2	-8887	3	-20542	4	-7667	5	1607
SA	1	1	1	22.5	10	1	-15030	2	-10502	3	-23938	4	-9282	5	-193
SA	1	1	1	17.5	14	1	-18426	2	-12118	3	-27333	4	-10897	5	-1993
SA	1	1	1	12.5	1	1	-21822	2	-13733	3	-30729	4	-12512	5	-3793
SA	1	1	2	62.5	7	1	12904	2	3165	3	3866	4	4648	5	15113
SA	1	1	2	57.5	9	1	9508	2	1550	3	470	4	3033	5	13313
SA	1	1	2	52.5	12	1	6113	2	-65	3	-2925	4	1418	5	11513
SA	1	1	2	47.5	29	1	2717	2	-1681	3	-6321	4	-198	5	9713
SA	1	1	2	42.5	51	1	-679	2	-3296	3	-9716	4	-1813	5	7913
SA	1	1	2	37.5	82	1	-4074	2	-4911	3	-13112	4	-3428	5	6113

SAMPLE SYSTEM ENERGY REQUIREMENTS REPORT (SB)

Report	Cycle	Sys	Month	Bin Temp	Number Hours	Oper Hours	Heating Load	Cooling Zone	Baseboard Load	Humidif Zone	Preheat Load	Fan KW Zone	DX KW Load	Furnace Zone
SB	1	1	5	92.5	6	6	96,265	261,478	0	0	0	8.2	0	0
SB	1	1	5	87.5	7	7	107,898	259,281	0	0	0	8.2	0	0
SB	1	1	5	82.5	19	19	119,531	248,454	0	0	0	8.2	0	0
SB	1	1	5	77.5	45	45	131,164	234,518	0	0	0	8.2	0	0
SB	1	1	5	72.5	64	64	142,797	229,209	0	0	0	8.2	0	0
SB	1	1	5	67.5	54	54	154,430	227,828	0	0	0	8.2	0	0
SB	1	1	5	62.5	25	25	166,063	219,467	0	0	0	8.2	0	0
SB	1	1	5	57.5	2	2	177,696	208,527	0	0	0	8.2	0	0
SB	1	1	5	52.5	16	16	189,329	198,526	0	0	0	8.2	0	0
SB	1	1	5	47.5	10	10	200,962	195,029	0	0	0	8.2	0	0
SB	1	1	6	92.5	4	4	93,209	286,835	0	0	0	8.2	0	0
SB	1	1	6	87.5	30	30	104,971	264,299	0	0	0	8.2	0	0
SB	1	1	6	82.5	84	84	116,733	257,601	0	0	0	8.2	0	0
SB	1	1	6	77.5	77	77	128,495	246,917	0	0	0	8.2	0	0
SB	1	1	6	72.5	40	40	140,257	245,217	0	0	0	8.2	0	0
SB	1	1	6	67.5	5	5	152,019	235,663	0	0	0	8.2	0	0

SAMPLE SYSTEM PSYCHROMETRIC REPORT (SC)

Report	Sys	Cycle	Month	Bin Hours	Oper Hours	(----- Temperatures ------) Bin Temp	Return Temp	Mixed Temp	Preheat Temp	Fan D Temp	CLG D Temp	HTG D (DDMZ)	(--- Humidity Ratios ----) Outside	Return	Mixed	Humidif	Cooling Disch	CLG Air Flow CFM	HTG Air Flow CFM	Percent O.A.
SC	1	1	4	12	12	87.5	68.0	69.9	69.9	73.3	55.0	0	0.0066	0.0076	0.0075	0.0075	0.0075	7558	0	0.10
SC	1	1	4	15	15	82.5	68.0	69.4	69.4	72.8	55.0	0	0.0084	0.0080	0.0080	0.0080	0.0078	7558	0	0.10
SC	1	1	4	13	13	77.5	68.0	68.9	68.9	72.3	55.0	0	0.0110	0.0083	0.0086	0.0086	0.0079	7558	0	0.10
SC	1	1	4	18	18	72.5	68.0	68.4	68.4	71.8	55.0	0	0.0087	0.0081	0.0082	0.0082	0.0079	7558	0	0.10
SC	1	1	4	25	25	67.5	68.0	67.9	67.9	71.3	55.0	0	0.0080	0.0081	0.0081	0.0081	0.0079	7558	0	0.10
SC	1	1	4	24	24	62.5	68.0	67.4	67.4	70.8	55.0	0	0.0063	0.0073	0.0072	0.0072	0.0072	7558	0	0.10
SC	1	1	4	38	38	57.5	68.0	66.9	66.9	70.3	55.0	0	0.0059	0.0069	0.0068	0.0068	0.0068	7558	0	0.10
SC	1	1	4	36	36	52.5	68.0	66.4	66.4	69.8	55.0	0	0.0041	0.0051	0.0050	0.0050	0.0050	7558	0	0.10
SC	1	1	4	52	52	47.5	68.0	65.9	65.9	69.3	55.0	0	0.0039	0.0049	0.0048	0.0048	0.0048	7558	0	0.10
SC	1	1	4	7	7	42.5	68.0	65.4	65.4	68.8	55.0	0	0.0033	0.0043	0.0042	0.0042	0.0042	7558	0	0.10
SC	1	1	5	6	6	92.5	78.0	79.4	79.4	82.8	55.0	0	0.0113	0.0075	0.0079	0.0079	0.0071	7558	0	0.10
SC	1	1	5	7	7	87.5	78.0	78.9	78.9	82.3	55.0	0	0.0116	0.0076	0.0080	0.0080	0.0071	7558	0	0.10
SC	1	1	5	19	19	82.5	78.0	78.4	78.4	81.8	55.0	0	0.0105	0.0075	0.0078	0.0078	0.0071	7558	0	0.10
SC	1	1	5	45	45	77.5	78.0	77.9	77.9	81.3	55.0	0	0.0089	0.0074	0.0075	0.0075	0.0071	7558	0	0.10
SC	1	1	5	66	64	72.5	78.0	77.4	77.4	80.8	55.0	0	0.0087	0.0074	0.0075	0.0075	0.0071	7558	0	0.10
SC	1	1	5	54	54	67.5	78.0	76.9	76.9	80.3	55.0	0	0.0093	0.0075	0.0077	0.0077	0.0072	7558	0	0.10
SC	1	1	5	25	25	62.5	78.0	76.4	76.4	79.8	55.0	0	0.0086	0.0075	0.0076	0.0076	0.0072	7558	0	0.10
SC	1	1	5	2	2	57.5	78.0	75.9	75.9	79.3	55.0	0	0.0075	0.0076	0.0074	0.0076	0.0072	7558	0	0.10
SC	1	1	5	16	16	52.5	78.0	75.4	75.4	78.8	55.0	0	0.0065	0.0073	0.0072	0.0072	0.0072	7558	0	0.10
SC	1	1	5	10	10	47.5	78.0	74.9	74.9	78.3	55.0	0	0.0066	0.0073	0.0073	0.0073	0.0072	7558	0	0.10
SC	1	1	6	4	4	92.5	78.0	79.4	79.4	82.8	55.0	0	0.0155	0.0081	0.0088	0.0088	0.0073	7558	0	0.10

SAMPLE PLANT LOADS REPORT (SLDS)

Report	Cyc	Month	Bin Temp	Bin Hours	Chiller Loads: Cent Load	Chiller Loads: Absorp Load	Chiller Loads: Dist Clg Load	Chiller Loads: DB Chill Load	Chiller Loads: Recip Load	Tower Load	Boiler Load	Ele Res Load	Dist Htg Load	DB Heat Load
SLDS	1	5	92.5	6	0	0	0	0	261,477	0	96,265	0	0	0
SLDS	1	5	87.5	7	0	0	0	0	259,281	0	107,898	0	0	0
SLDS	1	5	82.5	19	0	0	0	0	248,453	0	119,531	0	0	0
SLDS	1	5	77.5	45	0	0	0	0	234,518	0	131,164	0	0	0
SLDS	1	5	72.5	64	0	0	0	0	229,209	0	142,797	0	0	0
SLDS	1	5	67.5	54	0	0	0	0	227,827	0	154,430	0	0	0
SLDS	1	5	62.5	25	0	0	0	0	219,466	0	166,063	0	0	0
SLDS	1	5	57.5	2	0	0	0	0	208,526	0	177,696	0	0	0
SLDS	1	5	52.5	16	0	0	0	0	198,525	0	189,329	0	0	0
SLDS	1	5	47.5	10	0	0	0	0	195,028	0	200,962	0	0	0
SLDS	1	6	92.5	4	0	0	0	0	286,835	0	93,209	0	0	0
SLDS	1	6	87.5	30	0	0	0	0	264,298	0	104,971	0	0	0
SLDS	1	6	82.5	84	0	0	0	0	257,601	0	116,732	0	0	0
SLDS	1	6	77.5	77	0	0	0	0	246,917	0	128,494	0	0	0
SLDS	1	6	72.5	40	0	0	0	0	245,216	0	140,256	0	0	0
SLDS	1	6	67.5	5	0	0	0	0	235,663	0	152,018	0	0	0

SAMPLE PLANT DOMESTIC HOT WATER REPORT (PDHW)

Report	Cyc	Month	Bin Temp	Bin Hours	Usage Load	Total Load	Part Load	DHW Effic	KW Used	Pump KW
PDHW	1	1	67.5	14	6,927	6,927	0.615	100.0	2.029	0.0
PDHW	1	1	62.5	9	6,979	6,979	0.620	100.0	2.044	0.0
PDHW	1	1	57.5	5	7,031	7,031	0.625	100.0	2.060	0.0
PDHW	1	1	52.5	25	7,083	7,083	0.629	100.0	2.075	0.0
PDHW	1	1	47.5	30	7,135	7,135	0.634	100.0	2.090	0.0
PDHW	1	1	42.5	45	7,187	7,187	0.638	100.0	2.105	0.0
PDHW	1	1	37.5	65	7,239	7,239	0.643	100.0	2.121	0.0
PDHW	1	1	32.5	24	7,291	7,291	0.648	100.0	2.136	0.0
PDHW	1	1	27.5	10	7,343	7,343	0.652	100.0	2.151	0.0
PDHW	1	1	22.5	14	7,395	7,395	0.657	100.0	2.166	0.0
PDHW	1	1	17.5	1	7,447	7,447	0.662	100.0	2.182	0.0
PDHW	1	1	12.5	7	7,500	7,500	0.666	100.0	2.197	0.0
PDHW	1	2	62.5	9	6,979	6,979	0.620	100.0	2.044	0.0
PDHW	1	2	57.5	12	7,031	7,031	0.625	100.0	2.060	0.0
PDHW	1	2	52.5	29	7,083	7,083	0.629	100.0	2.075	0.0
PDHW	1	2	47.5	51	7,135	7,135	0.634	100.0	2.090	0.0
PDHW	1	2	42.5	82	7,187	7,187	0.638	100.0	2.105	0.0
PDHW	1	2	37.5	23	7,239	7,239	0.643	100.0	2.121	0.0
PDHW	1	2	32.5	11	7,291	7,291	0.648	100.0	2.136	0.0
PDHW	1	2	22.5	3	7,395	7,395	0.657	100.0	2.166	0.0
PDHW	1	3	77.5	8	6,822	6,822	0.606	100.0	1.999	0.0

SAMPLE RECIPROCATING CHILLER REPORT (PREC)

Report	Cyc	Month	Bin Temp	Bin Hours	Oper Hours	Cooling Load	False Load	Cooling Capacity	Part Load Ratio	COP	Plant KW	Ent CW Temp	Lvg CW Temp	Ent CHW Temp	Lvg CHW Temp	Tower Load
PREC	1	9	92.5	2	2	270,904	0	368,627	0.736	3.065	25.9	93.8	101.8	57.0	49.3	350,442
PREC	1	9	87.5	16	16	273,326	0	368,542	0.741	3.069	26.1	93.9	101.9	57.1	49.4	353,464
PREC	1	9	82.5	47	47	266,200	0	368,773	0.721	3.056	25.5	93.6	101.6	56.7	49.2	344,572
PREC	1	9	77.5	36	36	259,542	0	368,929	0.703	3.044	25.0	93.3	101.3	56.3	49.0	336,259
PREC	1	9	72.5	86	86	248,963	0	369,057	0.674	3.024	24.1	92.8	100.8	55.7	48.7	323,044
PREC	1	9	67.5	36	36	239,205	0	369,045	0.648	3.005	23.3	92.3	100.3	55.1	48.4	310,845
PREC	1	9	62.5	15	15	222,956	0	368,748	0.604	2.970	22.0	91.5	99.5	54.2	47.9	290,514
PREC	1	9	57.5	2	2	211,740	0	368,341	0.574	2.944	21.1	91.0	99.0	53.6	47.6	276,467
PREC	1	10	82.5	7	7	239,835	0	369,049	0.649	3.006	23.4	92.3	100.3	55.2	48.4	311,632
PREC	1	10	77.5	48	48	238,105	0	369,036	0.645	3.002	23.2	92.2	100.2	55.1	48.3	309,469
PREC	1	10	72.5	31	31	232,709	0	368,967	0.630	2.991	22.8	92.0	100.0	54.8	48.2	302,720
PREC	1	10	67.5	42	42	227,542	0	368,867	0.616	2.980	22.4	91.7	99.7	54.5	48.0	296,254
PREC	1	10	62.5	40	40	219,284	0	368,633	0.594	2.961	21.7	91.3	99.3	54.0	47.8	285,917
PREC	1	10	57.5	60	60	205,424	0	368,039	0.558	2.928	20.6	90.7	98.7	53.2	47.4	268,551
PREC	1	10	52.5	17	17	198,655	0	367,658	0.540	2.911	20.0	90.3	98.3	52.8	47.2	260,063
PREC	1	10	47.5	3	3	192,543	0	367,262	0.524	2.895	19.5	90.0	98.0	52.5	47.0	252,395
PREC	1	11	72.5	5	5	150,175	31,411	363,172	0.500	2.390	18.4	88.0	96.0	50.0	45.8	206,714
PREC	1	11	67.5	10	10	141,628	39,402	362,062	0.500	2.264	18.3	87.6	95.6	49.5	45.5	197,907
PREC	1	11	62.5	42	42	130,786	49,472	360,516	0.500	2.104	18.2	87.0	95.0	48.9	45.2	186,725
PREC	1	11	57.5	51	51	126,798	53,155	359,909	0.500	2.044	18.2	86.8	94.8	48.7	45.1	182,610

SAMPLE BOILER REPORT (PBLR)

Report	Cyc	Month	Bin Temp	Bin Hours	Oper Hours	Heating Load	Plant Load	Part Load Ratio	Boiler Effic	Fuel Therms
PBLR	1	1	67.5	6.0	1.5	58,664	58,664	0.250	58.73	0.990
PBLR	1	1	62.5	14.0	4.0	70,486	70,486	0.289	60.64	1.160
PBLR	1	1	57.5	9.0	3.0	82,308	82,308	0.338	62.99	1.300
PBLR	1	1	52.5	5.0	1.9	94,129	94,129	0.386	64.90	1.450
PBLR	1	1	47.5	25.0	10.8	105,951	105,951	0.435	66.92	1.580
PBLR	1	1	42.5	30.0	14.5	117,773	117,773	0.484	68.52	1.710
PBLR	1	1	37.5	45.0	23.9	129,595	129,595	0.532	69.99	1.850
PBLR	1	1	32.5	65.0	37.7	141,417	141,417	0.581	71.33	1.980
PBLR	1	1	27.5	24.0	15.1	153,239	153,239	0.629	72.48	2.110
PBLR	1	1	22.5	10.0	6.7	165,060	165,060	0.678	73.40	2.240
PBLR	1	1	17.5	14.0	10.1	176,882	176,882	0.727	74.18	2.380
PBLR	1	1	12.5	1.0	0.7	188,704	188,704	0.775	74.77	2.520
PBLR	1	2	62.5	7.0	1.9	66,418	66,418	0.273	60.49	1.090
PBLR	1	2	57.5	9.0	2.8	78,240	78,240	0.321	62.47	1.250
PBLR	1	2	52.5	12.0	4.4	90,062	90,062	0.370	64.38	1.390
PBLR	1	2	47.5	29.0	12.1	101,884	101,884	0.418	66.39	1.530
PBLR	1	2	42.5	51.0	23.8	113,706	113,706	0.467	68.15	1.660
PBLR	1	2	37.5	82.0	42.3	125,527	125,527	0.516	69.61	1.800
PBLR	1	2	32.5	23.0	12.9	137,349	137,349	0.564	70.97	1.930
PBLR	1	2	27.5	11.0	6.7	149,171	149,171	0.613	72.09	2.060
PBLR	1	3	77.5	3.0	0.7	27,121	27,121	0.250	59.38	0.450
PBLR	1	3	72.5	8.0	2.0	39,065	39,065	0.250	59.43	0.650

12.5.4 BEPS Report

A sample BEPS report is shown on the following page. Refer to Section 12.4.2 for instructions on formatting this report.

ASEAM2 Report: BLDG-END USE Date: 04-07-1987

Sample Single Run Calculation

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Electric Resistance		163	0.56
Electric Boiler		87,196	297.60
Cooling Energy			
Reciprocating Chiller		18,072	61.68
Domestic Hot Water Energy			
Domestic HW Heater	420		42.05
Building Miscellaneous			
Lights		29,409	100.37
Equipment		3,259	11.12
System Miscellaneous			
Fans		12,283	41.92
Plant Miscellaneous			
Cooling Tower		1,617	5.52
Pumping		2,685	9.16
Exterior Lighting		5,000	17.06
Kitchen Range	10		1.00
Consumption Totals	430	159,685	
Unit Cost	$0.500	$0.075	
Dollar Cost	$215	$11,976	$12,192
Site Energy (MBTU)	43.0	545.0	588.1
Source Energy (MBTU)	43.0	1,852.3	1,895.4

12.5.5 Peak Loads Summary

Sample Peak Loads Summaries for one zone and an entire building are shown on the following pages. Refer to Section 12.4.2 for instructions on formatting this report.

Sample Single Run Calculation

Loads Report File: demoLA00

Report: Peak Load Summary

Space: Building
Floor Area: 5,000 sq ft Volume: 50,000 cu ft

	COOLING		HEATING
Time of Peak	Apr hour = 17		Feb hour = 5
Outside Temp	87.5 deg F		-2.5 deg F

	Sensible (BTUH)	Latent (BTUH)	Sensible (BTUH)
Glass Solar	29,365		0
Glass Conduction	8,336		-26,719
Wall Conduction	4,095		-13,125
Roof Conduction	9,750		-31,250
Opaque Solar	25,226		0
Door Conduction	0		0
Misc Conduction	0		0
Occupants	3,275	3,040	0
Lights	31,972		0
Equipment	3,840		0
Misc Sensible	0		0
Infiltration	17,666		-57,854
Total	133,526		-128,948
Total Load / Area	26.7	(BTUH/FT2)	-25.8

Sample Single Run Calculation

Loads Report File: demoLA01

Report: Peak Load Summary

Space: South Exposure
Floor Area: 900 sq ft Volume: 9,000 cu ft

	COOLING		HEATING
Time of Peak	Apr hour = 13		Feb hour = 7
Outside Temp	87.5 deg F		-2.5 deg F

	Sensible (BTUH)	Latent (BTUH)	Sensible (BTUH)
Glass Solar	8,830		0
Glass Conduction	1,667		-5,344
Wall Conduction	1,365		-4,375
Roof Conduction	1,755		-5,625
Opaque Solar	2,365		0
Door Conduction	0		0
Misc Conduction	0		0
Occupants	1,104	1,140	0
Lights	4,814		0
Equipment	637		0
Misc Sensible	0		0
Infiltration	6,006		-19,660
Total	28,543		-35,004
Total Load / Area	31.7	(BTUH/FT2)	-38.9

12.5.6 Parametric Output

Parametric run outputs give an echo copy of the altered input values, the output variables from the calculations, the peak loads, and the LCC results.

The parametric analysis output shows the regression equation generated by LOTUS. The equation estimates total site MBTU consumption as a function of the four independent variables: wall, roof, glass U factors, and lighting watts per square foot.

Since the output of the parametric analysis is LOTUS compatible, you could "sort" these values to determine the optimum combination of inputs, or add additional calculations (e.g., simple payback period).

12.5.7 ECO/LCC Output

The output of an ECO run and life-cycle cost analysis compares the energy consumption between the base case and ECO cases, including the FBLCC output for the LCC analysis and a comparison of two LCC analyses (e.g., base case versus ECO case).

Appendix A - Weather and Solar Data Files

APPENDIX A - WEATHER AND SOLAR DATA FILES

A.1 Bin Temperature Weather Data

ASEAM2.1 can use three different sources for bin weather data:

ASHRAE - six, four-hour blocks (file extension .AWD)
BATTELLE - eight, three-hour blocks (file extension .BWD)
DOD/AF88 - three, eight-hour blocks (file extension .DWD)

(Note 'DOD' stands for Department of Defense, and 'AF88' stands for Air Force Manual AFM88-29)

See Appendix F for the appropriate references that contain the bin temperature data in the above formats.

The type of weather data you use will be determined by availability of the site you require (not all stations are available in all formats). If you have access to the documents (see Appendix F) that contain the bin temperature data, you may enter new stations if desired (see section A.1.2). Since the bin temperature data comes from different sources, you should expect different results from each format. In brief, the following sources are used for each format:

ASHRAE format - bin data is derived from the "WYEC" (Weather Year for Energy Calculations) weather data. The hourly data (8,760 records per year) is a composite of typical monthly weather data taken from different years. There are forty-six stations included in ASEAM2.1 in this format (see section A.3). Hourly temperature data is apportioned in six, four hour time blocks per month.

Battelle format - bin data is derived from two hourly weather data sources: "WYEC" (described above) and "TRY" (Test Reference Year). The hourly TRY weather data is a given years actual hourly data - not a composite as in the WYEC data. Statistical procedures were used to eliminate those years for a given weather station that have extreme weather data - leaving one year as the test reference year. Hourly temperature data is apportioned in eight, three hour time blocks per month.

DOD format - the bin data for this format is "averaged" over several years worth of hourly data. Hourly temperature data is apportioned in three, eight hour time blocks per month.

In determining which weather data station and format to use, you should consider not only the source of data but also the coincidence of the operating hours of the building and the bin divisions. More accurate results will be obtained when the first hour of building operation corresponds to the first hour of a bin and the last hour of building operation corresponds to the last hour of a bin. If such a match is not made exactly, the bins will be subdivided to determine the number of hours in the occupied and unoccupied periods. For example, if your building is operated from 8 a.m. to 4 p.m., the DOD/AF88 data may yield the more accurate results since this time period matches the second time bin exactly. If you were to model this building using the Battelle weather data set, one-third of the hours in the third (6 a.m. to 9 a.m.) and one-third of the hours in the sixth (3 p.m. to 6 p.m.) time bins would be apportioned to occupied times and the remaining hours would be apportioned to unoccupied times.

Since the bin method calculates using diversified occupied and unoccupied period loads, the calculation time for an ASEAM2.1 analysis is not affected by the type of format you use.

A.1.1 Bin Temperature File Format

Printed below is a portion of a sample weather file (in this case, Chicago, Illinois, in ASHRAE format of six, four-hour blocks).

Note that the first sixteen lines of data have the same meaning regardless of the file format.

```
File Contents                                  | See Description Below
                                               | Line Number (not in file)
CHICGOIL                                       |  1
89,-4,92.5,-2.5,130,42,87.83,29.92             |  2
Monthly Weather Data                           |  3
42.5,9,1,31                                    |  4
57.5,13,10,28                                  |  5
67.5,11,23,31                                  |  6
87.5,13,34,30                                  |  7
87.5,11,47,31                                  |  8
92.5,10,58,30                                  |  9
92.5,9,68,31                                   | 10
92.5,9,77,31                                   | 11
92.5,11,86,30                                  | 12
82.5,11,97,31                                  | 13
62.5,11,108,30                                 | 14
57.5,12,119,31                                 | 15
Bin Data                                       | 16
1,1,42.5,0,0,0,2,0,0,.00257,35                 | 17
1,2,37.5,5,2,13,25,19,5,.00291,33              | 18
1,3,32.5,45,40,51,53,44,54,.0033,31            | 19
1,4,27.5,20,30,20,22,25,19,.00255,26           | 20
1,5,22.5,12,4,15,7,13,12,.00195,21             | 21
1,6,17.5,30,28,9,7,12,21,.00146,16             | 22
1,7,12.5,4,12,14,8,6,6,.00107,11               | 23
1,8,7.5,4,4,1,0,5,7,.00102,7                   | 24
1,9,2.5,4,4,1,0,0,0,.00077,2                   | 25
2,10,57.5,2,0,0,3,1,1,.00696,52                | 26

      et cetera
```

The information contained in this file is as follows:

Line 1 - Weather Station Name

Line 2 - A,B,C,D,E,F,G,H (8 values, separated by commas)
where

- A = Design Summer Temperature, 2.5% (from ASHRAE)
- B = Design Winter Temperature, 97,5% (from ASHRAE)
- C = Maximum Bin Temperature (from weather file)
- D = Minimum Bin Temperature (from weather file)
- E = Number of Temperature Bins (total for year)
- F = Weather Station Latitude (degrees North)
- G = Weather Station Longitude (degrees West)
- H = Weather Station Barometric Pressure (inches Hg)

Line 3 - "Monthly Weather Data" - a delimiter line (ignored)

Line 4 - A,B,C,D (4 values, separated by commas)
where

- A = Maximum Bin Temperature, January
- B = Number of Temperature Bins, January
- C = Bin Pointer (line number of first bin, January)
- D = Number of Days, January

Lines 5 through 15 - same as Line 4, one line for each month, February to December

Line 16 - "Bin Data" - a delimiter line (ignored)

A.1.1.1 ASHRAE Format

Beginning on line 17, through the end of the file, the ASHRAE weather data has the following format:

Line 17 - A,B,C,D,E,F,G,H,I,J,K (11 values, separated by commas)
where

- A = Month Number
- B = Bin Number (sequentially)
- C = Bin Temperature (taken at midpoint of five-degree range)
- D = Number of Hours in Bin 1 (0-4 a.m.)
- E = Number of Hours in Bin 2 (4-8 a.m.)
- F = Number of Hours in Bin 3 (8-12 noon)
- G = Number of Hours in Bin 4 (12-4 p.m.)
- H = Number of Hours in Bin 5 (4-8 p.m.)
- I = Number of Hours in Bin 6 (8-12 midnight)
- J = Average Humidity Ratio, this Bin (lbs/lbs)
- K = Mean Coincident Wetbulb Temp, this Bin

Lines 18 through the end of the weather file have the same format as Line 17. The data is stored in order from January through December, from the highest temperature bin of each month to the lowest temperature bin of each month. Note that the bin number of the final bin should be equal to item "E" in Line 2.

A.1.1.2 Battelle Format

Beginning on line 17, through the end of the file, the Battelle weather data has the following format:

Line 17 - A,B,C,D,E,F,G,H,I,J,K,L,M (13 values, separated by commas)
where

A = Month Number
B = Bin Number
C = Bin Temperature (taken at midpoint of five-degree range)
D = Number of Hours in Bin 1 (0-3 a.m.)
E = Number of Hours in Bin 2 (3-6 a.m.)
F = Number of Hours in Bin 3 (6-9 a.m.)
G = Number of Hours in Bin 4 (9-12 noon)
H = Number of Hours in Bin 5 (12-3 p.m.)
I = Number of Hours in Bin 6 (3-6 p.m.)
J = Number of Hours in Bin 7 (6-9 p.m.)
K = Number of Hours in Bin 8 (9-12 midnight)
L = Average Humidity Ratio, this Bin (lbs/lbs)
M = Mean Coincident Wetbulb Temp, this Bin

Lines 18 through the end of the weather file have the same format as Line 17. The data is stored in order from January through December, from the highest temperature bin of each month to the lowest temperature bin of each month. Note that the bin number of the final bin should be equal to item "E" in Line 2.

A.1.1.3 DOD Format

Beginning on line 17, through the end of the file, the DOD weather data has the following format:

Line 17 - A,B,C,D,E,F,G,H (8 values, separated by commas)
where

A = Month Number
B = Bin Number
C = Bin Temperature (taken at midpoint of five-degree range)
D = Number of Hours in Bin 1 (0-8 a.m.)
E = Number of Hours in Bin 2 (8 a.m.-4 p.m.)
F = Number of Hours in Bin 3 (4-12 midnight)
G = Average Humidity Ratio, this Bin (lbs/lbs)
H = Mean Coincident Wetbulb Temp, this Bin

Lines 18 through the end of the weather file have the same format as Line 17. The data is stored in order from January through December, from the highest temperature bin of each month to the lowest temperature bin of each month. Note that the bin number of the final bin should be equal to item "E" in Line 2.

A.1.2 Entering Bin Temperature Weather Data

It is possible to generate your own weather data files, should the locations you wish to model not be included in the weather library diskettes. You will need weather data in one of the three bin formats described above. The ASEAM2.1 Weather Data Input Program will take this data (which you must enter) and write it out in the correct file format.

You may access the Weather Data Input Program when exiting any ASEAM2.1 program, or by marking "Input Data" from the Main Menu and "Weather" from the pull-down menu (shown below).

```
                           ASEAM2 MAIN MENU

 Input Data   Print Reports   Specify Analyses   Run Calcs   Exit DOS
  Loads
  Systems
  Plant
  FBLCC
  NBSLCC
  Weather
  Exit
```

When entering the weather data input program, the first screen which appears is the ASEAM2.1 Weather Menu. To generate new weather data files, mark the "Enter/Store Weather Bins" from the top bar menu. A lower bar menu will appear on the screen. Indicate the desired format for the bin data:

ASHRAE - six, four-hour bins
Battelle - eight, three-hour bins
DOD - three, eight-hour bins

```
                         ASEAM2 WEATHER MENU

 Enter/Store Weather Bins      Enter/Store Solar Bins      Exit


 ASHRAE Format      Battelle Format      DOD Format      Exit
```

The first input screen to appear requires general site data, some of which can be found in the ASHRAE Handbook of Fundamentals.

```
GENERAL WEATHER BIN DATA
--------------------------------------------------------------------------------
Weather File Name                                                      ________
ASHRAE Design Summer Temperature (2.5%)                                _____
ASHRAE Design Winter Temperature (97.5%)                               _____
Weather Station North Latitude (deg) (Use '-' for South Lat)           _____
Weather Station West Longitude (deg) (Use '-' for East Long)           _____
Average Annual Barometric Pressure (in Hg)                             _____

   Month                       Maximum Bin                 Number of
                              Temp (eg 97.5)             Monthly Bins
   January                        _____                       __
   February                       _____                       __
   March                          _____                       __
   April                          _____                       __
   May                            _____                       __
   June                           _____                       __
   July                           _____                       __
   August                         _____                       __
   September                      _____                       __
   October                        _____                       __
   November                       _____                       __
   December                       _____                       __
```

Weather File Name - this is the name of the file the weather station will be stored with. Be sure to use only valid characters (consult your DOS manual if necessary). The weather files included with ASEAM2.1 use the last two characters of the file name for the state abbreviation, but you may choose any file name you wish.

ASHRAE Design Summer Temperature (2.5%) - self-explanatory

ASHRAE Design Winter Temperature (97.5%) - self-explanatory

Weather Station North Latitude (degrees) - use decimal degrees. For example, a station with a north latitude of 35 degrees, 30 minutes would be entered as 35.5. For south latitudes, use a negative decimal number.

Weather Station West Longitude (degrees) - use decimal degrees (see above). For east longitudes, use a negative decimal number

Average Annual Barometric Pressure (inches Hg) - IMPORTANT !! This data item is used throughout the calculations in the psychrometric routines. If your station is located at higher elevations and you use the default value (29.92 for sea level), you will get erroneous results from the calculations. To correct for altitude, see Table 3, page 6.12 of the 1985 ASHRAE Handbook of Fundamentals. The following equation was used in ASEAM2.1 to generate this value for the included weather stations:

$$WSBP = 29.921 * \exp(-alt/27362.2)$$

where

WSBP = weather station barometric pressure (inches Hg)
alt = altitude of weather station (ft)

Maximum Bin Temperature (monthly values) - use the midpoint of the highest bin temperature (that has any hours) for the month. For example, a bin from 65 to 70 degrees would be entered as 67.5 degrees. All bins cover a five degree F range. The maximum bin temperature MUST be entered correctly for each month; all other bin temperatures are calculated by subtracting, in 5 degree increments, from the maximum temperature.

Number of Monthly Bins (monthly values) - enter the total number of temperature bins (5 degree F increments) for the month, counting the highest temperature bin for the month (that has any hours) through the lowest temperature bin for the month (that has any hours).

IMPORTANT - Before you exit this screen, insure all of your data is correct! The data you enter on this input screen is used for the monthly bin data entry. If you make erroneous entries in this screen, you will have to start over at the beginning. There is no editing feature of this program!

After you have completed the above screen of general data, twelve input screens will appear in succession, one per month. The time increments, across the top of the screen, correspond to the hourly bins for the weather data format you chose. The temperature increments, down the left side of the screen, correspond to the number of temperature bins for the month, beginning with the highest bin temperature specified in the first input screen and ending with the lowest bin temperature for the month. Type in values for each temperature bin and time period for each month.

In the following example, the ASHRAE format was selected. The Battelle and DOD format will have different column headers corresponding to the time blocks used for their format.

Monthly Bin Data for January

Bin Temperature Range	Mid 4AM	4AM 8AM	8AM Noon	Noon 4PM	4PM 8PM	8PM Mid	MCWB deg F
55 to 60	___	___	___	___	___	___	___
50 to 55	___	___	___	___	___	___	___
45 to 50	___	___	___	___	___	___	___
40 to 45	___	___	___	___	___	___	___
35 to 40	___	___	___	___	___	___	___
30 to 35	___	___	___	___	___	___	___
25 to 30	___	___	___	___	___	___	___
20 to 25	___	___	___	___	___	___	___
15 to 20	___	___	___	___	___	___	___
10 to 15	___	___	___	___	___	___	___
5 to 10	___	___	___	___	___	___	___
0 to 5	___	___	___	___	___	___	___
-5 to 0	___	___	___	___	___	___	___
-10 to -5	___	___	___	___	___	___	___
-15 to -10	___	___	___	___	___	___	___

When entering data, you may wish to use the "Num Lock" key and enter data with the numeric keypad. After pressing this key, enter the number of bin hours with the numeric keypad and complete the entry with the "enter" key - ASEAM2.1 will automatically take you to the next entry leaving you in the "Num Lock" mode. If you make mistakes during entry, you should use the backspace key or delete entry key (F3) to correct your entry - the cursor keys will type additional numbers in the "Num Lock" mode.

After you have completed each monthly input screen, a new screen will appear that summarizes the data you have just entered. Hourly data for columns and rows will be totalized so you can quickly spot any errors in your data. If your data is correctly entered, enter "Y" to the prompt, and a new input screen will appear for the next month. If your data has errors, indicate "N" to the prompt and you will be returned to the data screen just entered (the data will still be there) and correct the erroneous entries.

NOTE - The DOD bin weather data, as published, does not always "add" up to the proper number of hours in each time block! The authors recommend that you adjust the bin with the most hours (adding or subtracting the appropriate number of hours) to correct this deficiency.

After you have completed the last input screen for December and verified the entries, the weather data file will automatically be generated and stored on the data disk in drive "b". The filename will be whatever you entered on the first data item of the first screen with one of the following extensions:

.AWD - ASHRAE format
.BWD - Battelle format
.DWD - DOD format

The ASEAM2.1 Weather Menu will then appear again on the screen. If you do not want to create any additional weather or solar files, mark "Exit." If you wish to create another weather data file, follow the directions above again. If you wish to create a solar data file, mark "Enter/Store Solar Bins."

A.1.3 Modifying Weather Data File

You may change the weather data if desired. By knowing the file format for the weather bins (see section A.1.1) and using a text editor, it is possible to "shift" the bins up or down easily. For example, suppose you want to simulate that January is two degrees colder and February is three degrees warmer than the data contained in the weather file. To simulate these changes, follow these steps:

1) Preserve the original weather data by copying the ORIGINAL weather data file to a new file name. You MUST use the same extension!

   (e.g., 'copy b:chicgoil.awd b:chicnewd.awd" (CR))

2) Enter your text editor (or word processor) and retrieve the new file. The EDLIN program on your DOS diskette will work just fine. Note that this file is in ASCII format - a DOS text file! Since many data files in ASEAM2.1 have lines extending beyond the normal 80 column right margins, you may have to set your right margins to 254 before retrieving the file, otherwise some word processors may automatically reformat the file.

3) Edit only the Maximum Bin Temperature for the Month to reflect the changes. In the above example, using the Chicago ASHRAE data format in section A.1.1), the following changes would be made:

Original File Contents	line #
CHICGOIL	1
89,-4,92.5,-2.5,130,42,87.83,29.92	2
Monthly Weather Data	3
42.5,9,1,31	4
57.5,13,10,28	5
etc.	

NEW FILE CONTENTS	line #	NOTE
CHICGOIL	1	(same)
89,-4,92.5,-2.5,130,42,87.83,29.92	2	(same)
Monthly Weather Data	3	(same)
40.5,9,1,31	4	42.5 to 40.5
60.5,13,10,28	5	57.5 to 60.5
etc.		

It is not necessary to change any other data - ASEAM2.1 calculates the actual bin temperature by subtracting, in 5 degree increments, from the maximum bin temperature for each month. The bin temperature in lines 17 through the end of file are not used in the calculations. (They are useful, however, if you want to "import" the weather file into LOTUS (tm). You must first copy the file to another file with a ".prn" file name extension before importing.)

4) After all the changes have been made with your text editor, save the file. Be sure to save the file as a DOS text file!

> BEWARE - Many word processors have their own format for saving text and data files - complete with margin settings, page control keys, etc. It is ABSOLUTELY NECESSARY that all ASEAM2.1 editing done on ASCII files be saved in an ASCII or DOS TEXT file format. ASEAM2.1 will abort if you fail to do this since the file format will be different.

5) Exit your text editor. You may print the new file, if desired, using the Weather Data Report Program in ASEAM2.1.

You may check to see if the file was saved in the proper format by "typing" the file (e.g., 'type b:chicnewd.awd' (CR)). If non-ASCII characters (symbols - not numbers or characters) are displayed on your screen, you have NOT saved the file in the proper format!

If you run the calculations using the newly created weather file, you will note that the outside air bin temperatures used for the calculations will start at the new values (e.g., 40.5, 35.5, 30.5, etc - instead of the normal 42.5, 37.5, 32.5 etc.)

> BEWARE - There is one limitation that you must be aware of when changing weather data in this manner - only the outside air dry bulb temperature bin has been changed for each bin calculation. The outside air humidity level remains the same! That is, the data for the bin humidity ratio and mean coincident wet bulb temperature is not changed by this method (the last two data items in lines 17 through the end of file for each weather format). The errors this introduces into the energy calculations are dependent on the amount of outside air entering the building (through infiltration and ventilation) and also the amount of "shifting" you do. Larger infiltration and ventilation requirements (latent cooling and humidification), combined with larger "shifts" will obviously result in larger errors.

A.1.4 Custom Weather Data

The authors have in the past converted hourly weather data for specific sites and years into bin format for ASEAM2.1 use. Unfortunately, the hourly data nearly always comes to us in different "shapes and sizes". As an example, we have received temperature data in degrees Celsius and Fahrenheit, on floppy disks or magnetic tape, in WBAN three hour formats or hourly TRY formats, etc. It is impossible to distribute a program to you that covers all cases that you could use without modification.

The National Climatic Data Center in Asheville, North Carolina, has in their archive storage, hourly (or three hourly) weather data for numerous stations throughout the world. For a nominal fee, they will distribute to you on floppy diskettes actual hourly weather data for a given year and site. They have been extremely helpful to us in the past. If you wish to contact them, write to:

National Climatic Data Center
Federal Building
Asheville, North Carolina 28801-2696

They will take telephone orders at (704) 259-0682.

If you wish to create custom bin temperature files for use with ASEAM2.1, please contact the authors.

A.2 Solar Weather Data

ASEAM2.1 uses solar data files to retrieve calculation parameters during the execution of the loads calculations. The file format is described below along with using the weather data input program to generate additional solar data files.

Although the equations used to calculate sunrise time, solar altitude, etc. are straightforward and could have been placed in the loads calculations, the authors have chosen instead to store the needed calculation parameters in a solar data file. If you perform numerous ASEAM2.1 calculations with the parametric processor, for example, the calculation time required would be substantially less if these variables are retrieved instead of calculated for each run.

You can create and use a solar data file for your specific location and use any bin temperature file - the file names for the solar and bin temperature files do not have to be the same.

A.2.1 Solar Data File Format

The solar file contains data for the solar dependent loads calculations only. Included in the data are the solar altitude and azimuth angles (for exterior window shading), and the footcandles incident on vertical surfaces facing the eight directions (N,NE,E,SE,S,SW,W,NW) due to the direct (sun) and sky (clear) components. Other data required for the daylighting and exterior shading calculations are calculated within the loads segment of ASEAM2.1 and are not stored in the solar file.

The calculation parameters for the solar data files are calculated for the 15th of each month, using local time instead of solar time. Daylight savings time has been included. Solar azimuth has been stored in degrees clockwise from north. If you attempt to verify this data against ASHRAE tables, for example, you will find discrepancies since most of the ASHRAE tables use the 21st of each month and solar time instead of local time.

Like the bin temperature file, you may import the solar data into LOTUS (tm) - but first copy the original file to another file with the required '.prn' extension for LOTUS (tm).

A portion of a solar data file, in this case Chicago, Illinois, is shown below. The extension for all solar files is ".NSD". For consistency, the bin temperature file names have the same first eight characters as their corresponding solar data files. Again, you may select different weather files (both temperature and solar) when you "specify analysis" for the calculations.

APPENDIX A - WEATHER AND SOLAR DATA FILES

```
File Contents                                   | See Description Below
                                                | Line Number
  CHICGOIL                                      |  1
  143,42,87.83                                  |  2
  Monthly Solar/Load Data                       |  3
  11.3,.44,7.35,16.65,9,1                       |  4
  12,.47,6.87,17.31,11,10                       |  5
  11.9,.51,6.13,17.88,11,21                     |  6
  11.6,.54,5.24,18.46,13,32                     |  7
  10.3,.61,4.58,18.99,14,45                     |  8
  9.4,.67,4.34,19.37,15,59                      |  9
  8.6,.7,4.57,19.33,15,74                       | 10
  8,.68,5.05,18.8,13,89                         | 11
  9.2,.63,5.59,17.94,12,102                     | 12
  10,.61,6.14,17.07,11,114                      | 13
  11.1,.41,6.78,16.42,10,125                    | 14
  11,.38,7.29,16.27,9,135                       | 15
  Hourly Solar Data                             | 16
                                                                  additional
  Lines 17 through the end of file                                   data
  1,8,6,125.5,144,207,534,623,375,165,133,124,0,266,1621,1889,     ... ,1
  1,9,14.4,136.9,234,315,772,965,819,333,238,216,0,0,2744,4006,    ... ,2
  1,10,21,149.8,261,351,702,1055,1000,533,310,253,0,0,2473,4850,   ... ,3
    ...
  2,7,1.2,108.5,38,68,150,142,56,37,31,32,0,184,398,381,120,0,0,0,10

   et cetera
```

The information contained in this file is as follows:

Line 1 - Solar Station Name

Line 2 - A,B,C (three values, separated by commas)
where
A = Number of Annual Solar Bins (i.e.: sum of monthly hours)
B = Solar Station (or actual site) Latitude (degrees North)
C = Solar Station (or actual site) Longitude (degrees West)

Line 3 - "Monthly Solar/Load Data" - a delimiter line (ignored)

Line 4 - A,B,C,D,E,F (six values, separated by commas)
where
A = Average Monthly Wind Speed, January (miles per hour)
B = Fraction Percent Sunshine (decimal), January
C = Local Sunrise Time (decimal hours), January
D = Local Sunset Time (decimal hours), January
E = Integer Number of Hours Sun is Up, January
F = Pointer, Line Number for First Hour of January

Line 5-15 - same as Line 4, one line for each month, February to December.

Line 16 - "Hourly Solar Data" - a delimiter line (ignored)

Line 17 - A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,Q,R,S,T,U (twenty one values)
where
A = Month Number
B = Local Hour Number (hour beginning at this time)
C = Solar Altitude for this hour (degrees from horizontal)
D = Solar Azimuth for hour (degrees clockwise from North)
E-L = Vertical Illuminance from Clear Sky (footcandles) on N,NE,E,SE,S,SW,W,NW surfaces, respectively
N-T = Vertical Illuminance from the direct Sun (footcandles) on N,NE,E,SE,S,SW,W,NW surfaces, respectively
U : Bin Number (begins at 1 for first line of hourly data)

Lines 18-... - same as Line 17, one line for each hour that the sun is up. The sequence of lines is from sunrise to sunset hour for January, then February, on through December. Note that the number of the last solar bin (item "T" in the last line) should be equal to item "A" in line 2.

A.2.2 Entering Solar Data

There is only one screen of data to input for the generation of a solar data file. After you have entered the last value, calculations will be performed and a solar data file will be generated. The ASEAM2.1 Weather Menu will then reappear on the screen. The file will automatically be saved on the diskette in drive 'b:' and will have the same name you specify on the first data entry of the screen plus the extension ".NSD". Before you proceed with the data entry, insure that the disk in drive 'b:' has at least 25,000 bytes available for each solar data file you wish to create.

(Note: it is normal for the program to take a few minutes to do the calculations for this file. The screen will be updated during the calculations).

```
GENERAL SOLAR DATA
------------------------------------------------------------------------------
Solar File Name                                                       ________
Solar Station North Latitude (deg) (Use '-' for South Lat)            _______
Solar Station West Longitude (deg) (Use '-' for East Long)            _______
Time Zone Number                                                      __
  4=Atlantic   5=Eastern   6=Central   7=Mountain   8=Pacific
Daylight Savings Time (Y/N)                                           _

   Month                      Wind Speed                    Fraction %
                                (MPH)                        Sunshine
   January                      ____                           __
   February                     ____                           __
   March                        ____                           __
   April                        ____                           __
   May                          ____                           __
   June                         ____                           __
   July                         ____                           __
   August                       ____                           __
   September                    ____                           __
   October                      ____                           __
   November                     ____                           __
   December                     ____                           __
```

Solar File Name - this is the name of the file the solar data will be stored with. Be sure to use only valid characters (consult your DOS manual if necessary). The solar files included with ASEAM2.1 use the last two characters of the file name for the state abbreviation, but you may choose any file name you wish.

Solar Station North Latitude (degrees) - use decimal degrees. For example, a station with a north latitude of 35 degrees, 30 minutes would be entered as 35.5. For south latitudes, use a negative decimal number.

Solar Station West Longitude (degrees) - use decimal degrees (see above). For east longitudes, use a negative decimal number

Time Zone Number - enter the time zone number for your solar data file. If your station is not in one of the listed time zones, or your station is in east longitudes, use the following table as a general guide:

Degrees West Longitude	Time Zone Number
0 to 15	0
15 to 30	1
30 to 45	2
45 to 60	3
60 to 75	4
75 to 90	5
90 to 105	6
105 to 120	7
120 to 135	8
135 to 150	9
150 to 165	10
165 to 180	11

Degrees East Longitude	Time Zone Number
0 to 15	23
15 to 30	22
30 to 45	21
45 to 60	20
60 to 75	19
75 to 90	18
90 to 105	17
105 to 120	16
120 to 135	15
135 to 150	14
150 to 165	13
165 to 180	12

Daylight Savings Time (Y/N) - enter either a 'Y' or 'N'. ASEAM2.1 will automatically adjust the local hour if daylight savings is used at your location.

Wind Speed (MPH) - monthly values. Enter the average wind speed for each month in miles per hour. This data is used in the infiltration calculations. You should be able to obtain this information from any climatic atlas, or possibly from the local weather bureau.

Fraction Percent Sunshine (monthly values) - enter in percent (not decimal). This data is used to determine the diversified solar loads. Section A.2.2.1 below contains these values for several stations across the United States.

After you have completed all of the above input data items, the solar calculations will be performed, the solar file will be stored on the data disk (drive 'b:') and you will be returned to the ASEAM2.1 Weather Menu.

A.2.2.1 Fraction Percent Sunshine Data

Printed below are the fraction percent sunshine values for several U.S. stations. These monthly values are also available from the Local Climatological Data Annual Summary for each station (under the column heading "Percent of Possible Sunshine"). This document is available from NCDC (see section A.1.4 above for address). Since local meteorological stations, generally airports, are used to supply this information to NCDC, you may be able to get this information locally also.

Mean Percentage of Possible Sunshine for Selected Locations

State & Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
AL, Birmingham,	43	49	58	63	66	67	62	65	66	67	58	44	59
Montgomery	51	53	61	69	73	72	66	69	69	71	64	48	64
AK, Anchorage	39	46	56	58	50	51	45	39	35	32	33	29	45
Fairbanks	34	50	61	68	55	53	45	35	31	28	38	29	44
Juneau	30	32	39	37	34	35	28	30	25	18	21	18	30
Nome	44	46	48	53	51	48	32	26	34	35	36	30	41
AZ, Phoenix	76	79	83	88	93	94	84	84	89	88	84	77	85
Yuma	83	87	91	94	97	98	92	91	93	93	90	83	81
AR, Little Rock	44	53	57	62	67	72	71	73	71	74	58	47	62
CA, Eureka	40	44	50	53	54	56	51	46	52	48	42	39	49
Fresno	46	63	72	83	89	94	97	97	93	87	73	47	78
Los Angeles	70	69	70	67	68	69	80	81	80	76	79	72	73
Red Bluff	50	60	65	75	79	86	95	94	89	77	64	50	75
Sacramento	44	57	67	76	82	90	96	95	92	82	65	44	77
San Diego	68	67	68	66	60	60	67	70	70	70	76	77	68
San Francisco	53	57	63	69	70	75	68	63	70	70	62	54	66
CO, Denver —	67	67	65	63	61	69	68	68	71	71	67	65	67
Grand Junction	58	62	64	67	71	79	78	72	77	74	67	58	69
CT, Hartford	46	55	56	54	57	60	62	60	57	55	46	46	58
D.C., Washington	46	53	56	57	61	64	64	62	62	61	54	47	58
FL, Apalachicola	59	62	62	71	77	70	64	63	62	74	66	53	66
Jacksonville	58	59	66	71	71	63	62	63	58	58	61	53	62
Key West	68	75	78	78	76	70	69	71	65	65	69	66	71
Miami Beach	66	72	73	73	68	62	65	67	62	62	65	65	67
Tampa	63	67	71	74	75	66	61	64	64	67	67	61	68
GA, Atlanta	48	53	57	65	68	68	62	63	65	67	60	47	60
HI, Hilo	48	42	41	34	31	41	44	38	42	41	34	36	38
Honolulu	62	64	60	62	64	68	67	70	70	68	63	60	65
Lihue	48	48	48	46	51	60	58	59	67	58	51	49	54
ID, Boise	40	48	59	67	68	75	89	86	81	66	46	37	66
Pocatello	37	47	58	64	66	72	82	81	78	68	48	36	64
IL, Cairo	46	53	59	65	71	77	82	79	75	73	56	46	65
Chicago	44	49	53	56	63	69	73	70	65	61	47	41	59
Springfield	47	51	54	58	64	69	76	72	73	64	53	46	60
IN, Evansville	42	49	55	61	67	73	78	76	73	67	52	42	64
Ft. Wayne	38	44	51	55	62	69	74	69	64	58	41	38	57
Indianapolis	41	47	49	55	62	68	74	70	65	64	48	38	59
IA, Des Moines	56	56	56	59	62	66	75	70	64	64	53	48	62
Dubuque	48	52	52	58	60	63	73	67	61	55	44	40	57
Sioux City	55	58	58	59	63	67	75	72	67	65	53	50	63
KS, Concordia	60	60	62	63	65	73	79	76	72	70	64	58	67
Dodge City	67	66	68	68	68	74	78	78	76	75	70	67	71
Wichita	61	63	64	64	68	73	80	77	73	69	67	59	69
KY, Louisville	41	57	52	57	64	68	72	69	68	64	51	58	59
LA, New Orleans	49	50	57	63	68	64	58	60	64	70	60	46	58
Shreveport	48	54	58	60	60	78	79	80	79	77	65	60	69
MI, Eastport	45	51	52	52	51	53	55	57	54	50	37	40	50
MA, Boston	47	56	57	56	59	62	64	63	61	58	48	48	57

State & Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MI, Alpena	29	43	52	56	59	64	70	64	52	44	24	22	51
Detroit	34	42	48	52	58	65	69	66	61	54	35	29	53
Grand Rapids	26	37	48	54	60	66	72	67	58	50	31	22	48
Marquette	31	40	47	52	53	56	63	57	47	38	24	24	47
S. St. Marie	28	44	50	54	54	59	63	58	45	36	21	22	47
MN, Duluth	47	55	60	58	58	60	68	63	53	47	36	40	55
Minneapolis	49	54	55	57	60	64	72	69	60	54	40	40	56
MS, Vicksburg	46	50	57	64	69	73	69	72	74	71	60	45	64
MO, Kansas City	55	57	59	60	64	70	76	73	70	67	59	52	65
St. Louis	48	49	58	59	64	68	72	68	67	65	54	44	61
Springfield	48	54	57	60	63	69	77	72	71	65	58	48	63
MT, Havre	49	58	61	63	63	65	78	75	64	57	48	46	62
Helena	46	55	58	60	59	63	77	74	63	57	48	43	60
Kalispell	28	40	49	57	58	60	77	73	61	50	28	20	53
NE, Lincoln	57	59	60	60	63	69	75	71	67	66	59	55	64
North Platte	63	63	64	62	64	72	78	74	72	70	62	58	68
NV, Ely	61	64	68	65	67	79	79	81	81	73	67	62	72
Las Vegas	74	77	78	81	85	91	84	86	92	84	83	75	82
Reno	59	64	69	75	77	82	90	89	86	76	68	58	78
Winnemucca	52	60	64	70	78	83	90	90	86	75	62	53	74
NH, Concord	48	53	55	53	51	58	57	58	55	50	43	43	52
NJ, Atlantic City	51	57	58	59	62	65	67	68	65	54	58	52	60
NM, Albuquerque	70	72	72	78	79	84	76	75	81	80	79	70	76
Roswell	69	72	75	77	76	80	76	75	74	74	74	69	74
NY, Albany	43	51	53	53	57	62	63	61	58	54	39	38	53
Binghamton	31	39	41	44	50	56	54	51	47	43	29	26	44
Buffalo	32	41	49	51	59	67	70	67	60	51	31	28	53
Canton	37	47	50	48	54	61	63	61	54	45	30	31	49
New York	49	56	57	59	62	65	66	64	64	61	53	50	59
Syracuse	31	38	45	50	58	64	67	63	56	47	29	26	50
NC, Asheville	48	53	56	61	64	63	59	59	62	64	59	48	58
Raleigh	50	56	59	64	67	65	62	62	63	64	62	52	61
ND, Bismark	52	58	56	57	58	61	73	69	62	59	49	48	59
Devils Lake	53	60	59	60	59	62	71	67	59	56	44	45	58
Fargo	47	55	56	58	62	63	73	69	60	57	39	46	59
Williston	51	59	60	63	66	66	78	75	65	60	48	48	63
OH, Cincinnati	41	46	52	56	62	69	72	66	68	60	46	39	57
Cleveland	29	36	45	52	61	67	71	68	62	54	32	25	50
Columbus	36	44	49	54	63	68	71	68	66	60	44	35	55
OK, Oklahoma City	57	60	63	64	65	74	76	78	74	68	64	57	68
OR, Baker	41	49	56	81	63	67	83	81	74	62	46	37	60
Portland	27	34	41	49	52	56	70	65	55	42	28	23	48
Roseburg	24	32	40	51	57	59	79	77	68	42	28	18	51
PA, Harrisburg	43	52	55	57	61	65	68	63	62	58	47	43	57
Philadelphia	45	56	57	58	61	62	64	61	62	51	53	49	57
Pittsburgh	32	39	45	50	57	62	64	61	62	54	39	30	51
RI, Block Island	45	54	57	56	58	60	62	62	60	59	50	44	56
SC, Charleston	58	60	65	72	73	70	66	66	67	68	68	57	66
Columbia	53	57	62	68	69	68	63	65	64	68	64	51	63

State & Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
SD, Huron	55	62	60	62	65	68	76	72	66	61	52	49	63
Rapid City	58	62	63	62	61	66	73	73	69	66	58	54	64
TN, Knoxville	42	49	53	59	64	66	64	59	64	64	53	41	57
Memphis	44	51	57	64	68	74	73	74	70	69	56	45	64
Nashville	42	47	54	60	65	69	69	68	69	65	55	42	59
TX, Abilene	64	68	73	66	73	86	83	85	73	71	72	66	73
Amarillo	71	71	75	75	75	82	81	81	79	76	75	70	76
Austin	46	50	57	60	62	72	76	79	70	70	57	49	63
Brownsville	44	49	51	57	65	73	78	78	67	70	54	44	61
Del Rio	53	55	61	63	60	66	75	80	89	65	58	52	63
El Paso	74	77	81	85	87	87	78	78	80	82	80	73	80
Ft. Worth	56	57	66	66	67	75	78	78	74	70	63	58	68
Galveston	50	50	55	61	69	76	72	71	70	74	62	49	63
San Antonio	48	51	56	58	60	69	74	75	69	67	55	49	62
UT, Salt Lake City	48	53	61	68	73	78	82	82	84	73	56	49	69
VT, Burlington	34	43	48	47	53	59	62	59	51	43	25	24	48
VA, Norfolk	50	57	60	63	67	66	66	64	63	64	60	51	62
Richmond	49	55	59	63	67	66	65	62	63	64	58	50	61
WA, North Head	28	37	42	48	48	48	50	46	48	41	31	27	41
Seattle	27	34	42	48	53	48	62	58	53	36	28	24	43
Spokane	28	47	53	63	64	68	82	79	68	53	28	22	54
Tatoosh Island	28	36	39	45	47	46	48	44	4	38	26	23	41
Walla Walla	24	35	51	63	67	72	86	84	72	59	33	20	56
Yakima	34	49	62	70	72	74	86	86	74	61	38	29	61
WV, Elkins	33	37	42	47	55	55	56	53	55	51	41	33	47
Parkersburg	30	36	42	49	56	60	63	60	60	53	37	29	48
WS, Green Bay	44	51	55	56	58	64	70	65	58	52	40	40	54
Madison	44	48	52	53	58	64	70	66	60	56	41	38	54
Milwaukee	44	48	53	58	60	65	73	67	62	56	44	39	56
WY, Cheyenne	65	66	64	61	59	68	70	68	69	69	65	63	66
Lander	66	70	71	66	65	74	76	75	72	67	61	62	69
Sheridan	56	61	62	61	51	67	76	74	67	60	53	52	68
Yellowstone Park	39	51	55	57	56	63	73	71	65	57	45	38	54
PR, San Juan	64	69	71	68	59	62	65	67	61	63	63	65	65

Based on period of record through December 1959, except in a few instances.

These charts and tabulation derived from "normals, Means, and Extremes" table in U.S. Weather Bureau publication Local Climatological Data.

A.3 Available Bin Temperature Weather Stations

On the following pages you will find an alphabetical listing by state of the U.S. bin temperature weather stations available (at this printing) in all three formats. See Appendix F (Suggested References) for the official document names containing this data.

This data was printed from a LOTUS (tm) worksheet file contained on your bin weather temperature diskette (file name - WEAFILES.WKS). You may load this file into LOTUS (tm) and perform typical data base functions (sorting to find stations near your locality, with similar design or degree day data, etc.). Only the ASHRAE format files are included in the ASEAM2.1 distribution. You will have to enter the bin weather data for any other station. There is no known source (the authors have looked) that have this data on any type of computer media.

You may notice that the data may differ widely when comparing heating degree days, for example, for the same station stored in different formats. The reasons are that the data base items were taken from different sources of bin data: WYEC versus TRY hourly data or DOD average data:

> Data base items (e.g., heating degree days) for files stored in the DOD format were taken from the DOD AFM88-29 manual (not ASHRAE).
>
> Data base items using the ASHRAE format or Battelle format (WYEC data) were taken from the ASHRAE Handbooks.
>
> Data base items for files in the Battelle TRY format were taken from weather data summaries produced by the DOE program using these hourly TRY data files.

The headings for most of the columns are self-explanatory. Some columns in this printout need further explanation:

Weather Station Name - many of the DOD stations have military abbreviations (e.g., AFB - Air Force Base, NAS - Naval Air Station)

Weather Type - the following abbreviations are used:

> DOD — defense weather data — available in three, eight hour periods
> AWD — ASHRAE weather data — available in six, four hour periods
> BWD-WYEC — Battelle weather data using WYEC hourly data - available in eight, three hour time periods
> BWD-TRY — Battelle weather data using TRY hourly data - available in eight, three hour time periods

Alt (ft) — the altitude or elevation of the station (in feet)

MCWB — mean coincident wet bulb temperature in degrees F. This value is coincident with the design summer temperature in the previous column.

Cooling Degree Days — this data, for consistency and completeness, was taken from the DOD AFM88-29 manual for all bin weather formats.

Weather Filename — if there anything printed in this column, this station's solar and bin temperature data files are included in the ASEAM2.1 weather data diskettes, and are stored with this file name.

ASEAM2 WEATHER STATIONS

Weather Station Name	State	Weather Type	N Lat Deg.Min	W Long Deg.Min	Alt (ft)	Max Bin Temp deg F	Min Bin Temp deg F	Winter Design (97.5%)	Heating Deg Days base 65	Summer Design (2.5%)	MCWB (2.5%) deg F	Cooling Deg Days base 65	Weather Filename
Adak NAVSTA/Mitchell Field	AK	DOD	51.53	176.39	19	72.5	7.5	23	8,825	59	56	0	
Barrow	AK	DOD	71.18	156.47	31	67.5	-52.5	-41	20,265	53	50	0	
Eielson AFB/Fairbanks	AK	DOD	64.40	147.06	545	87.5	-57.5	-48	14,498	77	59	30	
Elmendorf AFB/Anchorage	AK	DOD	61.15	148.48	212	82.5	-32.5	-16	10,722	68	57	8	
Juneau MAP	AK	DOD	58.22	134.35	12	82.5	-12.5	1	9,007	70	58	0	
Kodiak	AK	DOD	57.45	152.29	73	77.5	2.5	13	8,860	65	56	0	
Nome MAP	AK	DOD	64.30	.165.26	13	77.5	-37.5	-27	14,325	62	55	0	
Birmingham	AL	BWD-TRY	33.36	86.54	610	97.5	12.5	21	3,020	89	77	1,928	
Birmingham	AL	AWD	33.30	86.50	610	97.5	12.5	21	2,551	94	75	1,928	BIRMHMAL
Birmingham MAP	AL	DOD	33.34	86.45	620	102.5	2.5	21	2,844	94	75	1,928	
Fort Rucker/Cairns AAF	AL	DOD	31.16	85.43	305	97.5	12.5	27	1,968	92	76	2,386	
Huntsville	AL	DOD	34.42	86.35	606	92.5	-2.5	16	3,302	93	74	1,808	
Maxwell AFB/Montgomery	AL	DOD	32.23	86.22	169	102.5	7.5	25	2,153	94	77	2,489	
Blytheville AFB	AR	DOD	35.57	89.57	264	102.5	-2.5	15	3,760	94	77	1,789	
Fort Smith	AR	DOD	35.20	94.22	463	107.5	-2.5	17	3,336	98	76	2,022	
Little Rock	AR	AWD	34.40	92.10	257	107.5	12.5	20	3,219	96	77	1,925	LITLRKAR
Little Rock AFB	AR	DOD	34.55	92.09	311	97.5	2.5	18	3,241	94	77	2,034	
Davis-Monthan/Tucson	AZ	DOD	32.11	110.54	2,654	107.5	17.5	33	1,574	101	67	2,985	
Flagstaff	AZ	DOD	35.08	111.40	7,006	87.5	-12.5	4	7,322	82	55	140	
Fort Huachuca/Libby	AZ	DOD	31.35	110.20	4,664	97.5	17.5	28	2,551	92	62	1,573	
Luke AFB/Glendale	AZ	DOD	33.33	112.22	1,101	117.5	22.5	34	1,410	108	71	3,601	
Phoenix	AZ	AWD	33.30	112.00	1,117	112.5	22.5	34	1,765	107	71	3,508	PHOENXAZ
Phoenix	AZ	BWD-TRY	33.24	112.00	1,117	112.5	22.5	32	1,918	106	76	3,508	
Yuma MCAS/IAP	AZ	DOD	32.39	114.37	213	117.5	32.5	39	1,005	109	72	4,195	
Alameda/Nimitz Field	CA	DOD	37.47	122.19	15	97.5	32.5	40	2,507	79	63	189	
Arcata	CA	DOD	40.59	124.06	218	87.5	32.5	33	5,029	69	59	0	
Beale AFB/Marysville	CA	DOD	39.07	121.26	113	107.5	22.5	30	2,835	100	69	1,525	
Bishop	CA	DOD	37.22	118.22	4,108	107.5	2.5	15	4,313	100	61	1,037	
Castle AFB/Merced	CA	DOD	37.23	120.34	188	112.5	22.5	31	2,590	99	69	1,566	
Edwards AFB	CA	DOD	34.54	117.52	2,302	112.5	7.5	22	3,077	102	67	1,829	
Fresno	CA	BWD-TRY	36.48	119.42	326	107.5	27.5	30	3,177	99	72	1,671	
Los Angeles	CA	BWD-TRY	33.54	118.24	99	102.5	37.5	45	1,872	78	67	615	
Los Angeles	CA	BWD-WYEC	34.00	118.20	99	102.5	37.5	43	2,061	80	68	615	
Los Angeles	CA	AWD	34.00	118.20	99	102.5	37.5	43	2,061	80	68	615	LOSANGCA
Los Angeles IAP	CA	DOD	33.56	118.24	97	102.5	37.5	43	1,819	80	68	615	
McClellan/Sacramento	CA	DOD	38.40	121.24	76	107.5	22.5	31	2,566	99	69	1,406	
Moffett Field NAS	CA	DOD	37.25	122.03	34	92.5	27.5	36	2,511	81	65	239	
Norton/San Bernadino	CA	DOD	34.06	117.14	1,156	107.5	27.5	33	1,978	99	69	1,499	
Sacramento	CA	BWD-TRY	38.30	121.30	17	102.5	27.5	28	3,664	96	70	1,159	
San Diego	CA	BWD-TRY	32.24	117.12	48	97.5	27.5	46	1,396	77	68	584	
San Diego FWF	CA	DOD	32.43	117.09	48	97.5	27.5	46	1,782	78	70	584	
San Francisco	CA	BWD-TRY	37.36	122.24	8	87.5	32.5	38	3,705	76	64	108	
Travis AFB/Fairfield	CA	DOD	38.16	121.56	62	107.5	22.5	32	2,725	95	67	831	
Vandenberg AFB/Lompoc	CA	DOD	34.43	120.34	368	97.5	32.5	38	3,451	70	61	66	

Weather Station Name	State	Weather Type	N Lat Deg.Min	W Long Deg.Min	Alt (ft)	Max Bin Temp deg F	Min Bin Temp deg F	Winter Design (97.5%)	Heating Deg Days base 65	Summer Design (2.5%)	MCWB (2.5%) deg F	Cooling Deg Days base 65	Weather Filename
Buckley ANGB/Denver	CO	DOD	39.42	104.45	5,663	97.5	-22.5	1	6,239	90	60	582	
CO Springs/Peterson	CO	DOD	38.49	104.43	6,145	97.5	-17.5	2	6,473	88	57	461	
Denver	CO	AWD	39.50	104.50	5,283	97.5	-2.5	1	6,283	91	59	625	DENVERCO
Grand Junc/Walker Fld	CO	DOD	39.07	108.32	4,843	102.5	-17.5	7	5,605	94	59	1,140	
Pueblo Memorial	CO	DOD	38.17	104.31	4,684	102.5	-22.5	0	5,394	95	61	981	
Trinidad	CO	DOD	37.16	104.20	5,761	97.5	-17.5	3	5,642	91	61	705	
Washington, Dist of Columbia	DC	BWD-WYEC	38.50	77.00	14	92.5	12.5	17	4,224	91	74	1,415	
Washington, Dist of Columbia	DC	AWD	38.50	77.00	14	92.5	12.5	17	4,224	91	74	1,415	WASHNTDC
Washington, Dist of Columbia	DC	BWD-TRY	38.54	77.00	14	92.5	12.5	17	4,247	91	76	1,415	
Dover AFB	DE	DOD	39.08	75.28	28	102.5	2.5	15	4,756	90	75	1,115	
Wilmington Airport	DE	DOD	39.40	75.36	78	102.5	2.5	14	4,940	89	74	992	
Eglin AFB/Valparaiso	FL	DOD	30.29	86.31	85	97.5	12.5	29	1,658	91	77	2,620	
Fort Myers/Page Fld	FL	DOD	26.35	81.52	15	97.5	32.5	44	457	92	78	3,711	
Homestead AFB	FL	DOD	25.29	80.24	7	92.5	37.5	47	218	89	78	3,906	
Jacksonville	FL	BWD-TRY	30.30	81.42	80	97.5	22.5	33	1,385	92	78	2,775	
Jacksonville/Cecil NAS	FL	DOD	30.13	81.53	80	97.5	22.5	31	1,379	93	77	2,775	
Key West NAS	FL	DOD	24.34	81.41	6	92.5	47.5	55	102	90	79	4,663	
MacDill AFB/Tampa	FL	DOD	27.51	82.30	13	97.5	27.5	40	560	91	77	3,493	
McCoy AFB/Orlando	FL	DOD	28.27	81.20	96	97.5	27.5	38	709	91	76	3,354	
Miami	FL	AWD	25.50	80.20	7	92.5	37.5	47	214	90	77	4,038	MIAMI-FL
Miami	FL	BWD-TRY	25.48	80.18	7	92.5	37.5	49	186	89	79	4,038	
Miami	FL	BWD-WYEC	25.50	80.20	7	92.5	37.5	47	214	90	77	4,038	
Patrick/Cocoa Beach	FL	DOD	28.14	80.36	9	97.5	32.5	43	452	88	78	3,405	
Pensacola/Sherman Fld	FL	DOD	30.21	87.19	30	97.5	12.5	30	1,654	91	78	2,642	
Tallahassee	FL	BWD-WYEC	30.20	84.20	58	97.5	22.5	30	1,485	92	76	2,563	
Tallahassee	FL	AWD	30.20	84.20	58	97.5	22.5	30	1,485	92	76	2,563	TALHASFL
Tampa	FL	BWD-TRY	28.00	82.30	19	97.5	27.5	42	626	90	78	3,366	
Tampa	FL	AWD	28.00	82.30	19	97.5	27.5	40	683	91	77	3,366	TAMPA-FL
Tyndall AFB/Panama City	FL	DOD	30.04	85.35	18	97.5	17.5	33	1,413	90	77	2,737	
Atlanta	GA	AWD	33.40	84.30	1,005	92.5	12.5	22	2,961	92	74	1,589	ATLNTAGA
Atlanta	GA	BWD-TRY	33.42	84.24	1,005	92.5	12.5	25	3,105	87	76	1,589	
Atlanta/Hartsfld IAP	GA	DOD	33.39	84.26	1,010	102.5	2.5	22	3,095	92	74	1,589	
Augusta/Bush Fld	GA	DOD	33.22	81.58	136	102.5	12.5	23	2,547	95	76	1,995	
Ft. Benning/Lawson AAF	GA	DOD	32.21	85.00	232	97.5	7.5	24	2,406	93	76	2,203	
Glynco NAS/Brunswick	GA	DOD	31.15	81.29	25	97.5	17.5	29	1,765	91	78	2,423	
Hunter AAF/Savannah	GA	DOD	32.01	81.08	42	102.5	17.5	27	2,029	91	77	2,372	
Moody AFB/Valdosta	GA	DOD	30.58	83.12	233	102.5	22.5	31	1,549	94	77	2,716	
Robins AFB/Macon	GA	DOD	32.38	83.36	294	102.5	7.5	25	2,244	93	76	2,276	
Turner AFB/Albany NAS	GA	DOD	31.36	84.05	223	102.5	17.5	29	1,793	95	76	2,631	
Barbers Point NAS	HI	DOD	21.19	158.05	34	92.5	52.5	62	1	86	74	3,929	
Des Moines	IA	AWD	41.30	93.40	948	97.5	-17.5	-5	6,588	91	74	928	DESMONIA
Des Moines MAP	IA	DOD	41.32	93.39	938	102.5	-17.5	-5	6,710	91	74	928	
Sioux City MAP	IA	DOD	42.24	96.23	1,095	102.5	-17.5	-7	6,953	92	74	932	

Weather Station Name	State	Weather Type	N Lat Deg.Min	W Long Deg.Min	Alt (ft)	Max Bin Temp deg F	Min Bin Temp deg F	Winter Design (97.5%)	Heating Deg Days base 65	Summer Design (2.5%)	MCWB (2.5%) deg F	Cooling Deg Days base 65	Weather Filename
Boise	ID	BWD-TRY	43.30	116.12	2,842	102.5	-2.5	15	5,945	92	64	714	
Boise	ID	BWD-WYEC	43.30	116.10	2,842	102.5	-2.5	10	5,809	94	64	714	
Boise	ID	AWD	43.30	116.10	2,842	102.5	-2.5	10	5,809	94	64	714	BOISE-ID
Lewiston	ID	DOD	46.23	117.01	1,413	102.5	-17.5	6	5,464	93	64	657	
Mountain Home AFB	ID	DOD	43.02	115.54	2,996	107.5	-12.5	8	5,732	97	63	907	
Pocatello	ID	DOD	42.55	112.36	4,454	97.5	-22.5	-1	7,063	91	60	437	
Chicago	IL	BWD-TRY	41.48	87.48	658	92.5	-2.5	3	6,237	89	74	664	
Chicago	IL	AWD	42.00	87.50	658	92.5	-2.5	-4	6,639	89	74	664	CHICGOIL
Chicago	IL	BWD-WYEC	42.00	87.50	658	92.5	-2.5	-4	6,639	89	74	664	
Chicago /O Hare IAP	IL	DOD	41.59	87.54	658	97.5	-17.5	-4	6,497	89	74	664	
Evansville/Dress Rgnl. Aprt.	IL	DOD	38.03	87.32	381	102.5	-12.5	9	4,624	93	75	1,364	
Glenview NAS	IL	DOD	42.05	87.49	659	97.5	-17.5	-3	6,582	89	74	832	
Moline/Quad City Aprt.	IL	DOD	41.27	90.31	582	97.5	-17.5	-4	6,395	91	75	893	
Scott AFB/Belleville	IL	DOD	38.33	89.51	453	102.5	-7.5	6	4,855	92	76	1,421	
Springfield/Capital	IL	DOD	39.50	89.40	588	102.5	-12.5	2	5,558	92	74	1,116	
Grissom AFB/Bunker Hill	IN	DOD	40.39	86.09	813	97.5	-17.5	-1	6,278	88	73	837	
Indianapolis	IN	AWD	39.40	86.20	793	97.5	-7.5	2	5,699	90	74	974	INDAPLIN
Indianapolis	IN	BWD-TRY	39.54	86.18	793	97.5	-7.5	0	6,036	88	76	974	
South Bend/St. Joseph Aprt.	IN	DOD	41.42	86.19	773	97.5	-12.5	1	6,462	89	73	695	
Terre Haute/Hulman Fld.	IN	DOD	39.27	87.18	585	107.5	-17.5	4	5,351	92	74	1,110	
Dodge City	KS	AWD	37.50	100.00	2,594	102.5	2.5	5	4,986	95	69	1,411	DODGCTKN
Dodge City	KS	DOD	37.46	99.58	2,582	102.5	-7.5	5	5,046	97	69	1,411	
Dodge City	KS	BWD-TRY	37.30	100.00	2,594	102.5	2.5	3	5,659	97	71	1,411	
Forbes ANGB/Topeka	KS	DOD	38.57	95.40	1,064	107.5	-7.5	4	5,309	93	76	1,430	
Fort Riley/Marshall AAF	KS	DOD	39.03	96.46	1,065	107.5	-12.5	3	5,306	95	75	1,503	
Goodland/Renner Fld.	KS	DOD	39.22	101.42	3,654	107.5	-17.5	0	6,119	96	65	925	
McConnell AFB/Wichita	KS	DOD	37.38	97.16	1,371	107.5	-7.5	8	4,695	96	74	1,687	
Fort Campbell/Campbell AAF	KY	DOD	36.40	87.29	571	102.5	-7.5	10	4,290	92	75	1,472	
Fort Knox/Goodman AAF	KY	DOD	37.54	85.58	753	97.5	-12.5	7	4,616	90	75	1,360	
Louisville	KY	BWD-TRY	38.12	85.42	474	92.5	-7.5	10	4,660	93	74	1,268	
Barksdale AFB/Shreveport	LA	DOD	32.30	93.40	167	102.5	7.5	24	2,337	94	77	2,451	
England AFB/Alexandria	LA	DOD	31.20	92.33	89	97.5	12.5	27	1,964	94	77	2,606	
Lake Charles	LA	AWD	30.10	93.10	14	97.5	27.5	31	1,459	93	77	2,739	LKCHASLA
Lake Charles	LA	BWD-TRY	30.06	93.12	14	97.5	27.5	32	1,895	92	80	2,739	
Lake Charles	LA	BWD-WYEC	30.10	93.10	14	97.5	27.5	31	1,459	93	77	2,739	
Lake Charles MAP	LA	DOD	30.07	93.13	9	102.5	17.5	31	1,498	93	77	2,739	
New Orleans	LA	BWD-TRY	30.00	90.18	3	97.5	17.5	32	1,877	90	79	2,703	
New Orleans NAS	LA	DOD	29.50	90.01	3	97.5	17.5	31	1,617	91	78	2,703	
Boston	MA	BWD-WYEC	42.20	71.00	15	97.5	2.5	9	5,634	88	71	661	
Boston	MA	BWD-TRY	42.24	71.00	15	97.5	2.5	15	5,874	88	74	661	
Boston	MA	AWD	42.20	71.00	15	97.5	2.5	9	5,634	88	71	661	BOSTONMA
Hanscom AFB/Bedford	MA	DOD	42.28	71.17	133	97.5	-17.5	3	6,474	90	73	591	

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Otis AFB/Falmouth	MA	DOD	41.39	70.31	132	92.5	-2.5	9	6,132	82	71	490	
Westover AFB	MA	DOD	42.12	72.32	245	97.5	-17.5	0	6,794	87	71	584	
Andrews AFB	MD	DOD	38.49	76.52	279	97.5	2.5	14	4,551	90	74	1,237	
Patuxent River NAS	MD	DOD	38.17	76.26	38	97.5	7.5	18	4,307	89	75	1,377	
Bangor IAP/Dow AFB	ME	DOD	44.48	68.50	192	92.5	-22.5	-6	8,034	83	68	304	
Brunswick NAS	ME	DOD	43.54	69.56	75	92.5	-17.5	-2	7,552	81	68	308	
Loring AFB	ME	DOD	46.57	67.53	746	92.5	-22.5	-12	9,500	80	66	152	
Portland	ME	AWD	43.40	70.20	61	92.5	-2.5	-1	7,511	84	71	252	PORTLNME
Portland	ME	BWD-TRY	43.42	70.18	61	92.5	-2.5	0	7,712	84	72	252	
Detroit	MI	AWD	42.20	83.00	633	92.5	2.5	6	6,232	88	72	743	DETROTMI
Detroit	MI	BWD-TRY	42.12	83.18	633	92.5	2.5	4	6,549	88	77	743	
K I Sawyer AFB	MI	DOD	46.21	87.24	1,220	97.5	-22.5	-11	9,498	82	68	198	
Kincheloe AFB	MI	DOD	46.15	84.28	799	92.5	-22.5	-10	9,234	81	68	173	
Lansing/Capital City Aprt.	MI	DOD	42.47	84.36	841	97.5	-12.5	1	6,904	87	72	535	
Muskegon/Muskegon Co Aprt	MI	DOD	43.10	86.14	625	92.5	-12.5	6	6,890	84	70	469	
Selfridge ANGB/Mt. Clemens	MI	DOD	42.36	82.50	583	97.5	-12.5	3	6,665	86	72	661	
Traverse City Aprt.	MI	DOD	44.45	85.35	624	97.5	-22.5	1	7,698	86	71	376	
Wurtsmith AFB/Oscoda	MI	DOD	44.27	83.24	634	97.5	-17.5	-3	7,929	85	70	363	
Duluth IAP	MN	DOD	46.50	92.11	1,428	92.5	-32.5	-16	9,757	82	68	176	
International Falls IAP	MN	DOD	48.34	93.23	1,179	97.5	-37.5	-25	10,547	83	68	176	
Minneapolis	MN	AWD	44.50	93.10	822	92.5	-22.5	-12	8,382	89	73	527	MINAPLMN
Minneapolis	MN	BWD-TRY	44.54	93.12	822	92.5	-22.5	-16	8,443	90	75	527	
Minneapolis-St. Paul IAP	MN	DOD	44.53	93.13	834	97.5	-27.5	-12	8,310	89	73	527	
Columbia	MO	BWD-TRY	39.00	92.18	778	112.5	-7.5	7	5,302	90	77	1,269	
Columbia Regional Aprt.	MO	DOD	38.58	92.22	778	112.5	-7.5	4	5,078	94	74	1,269	
Ft. Leonard Wood/Forney AAF	MO	DOD	37.45	92.09	1,158	102.5	-7.5	9	4,707	91	75	1,314	
Kansas City	MO	BWD-TRY	39.06	94.36	742	102.5	-2.5	5	5,160	93	78	1,420	
Kansas City	MO	AWD	39.10	94.40	742	102.5	-2.5	6	4,711	96	74	1,420	KANCTYMO
RichardsGebaur AFB/Grandview	MO	DOD	38.51	94.33	1,090	102.5	-7.5	3	5,218	91	76	1,261	
Springfield MAP	MO	DOD	37.14	93.23	1,268	107.5	-7.5	9	4,570	93	74	1,382	
St Louis	MO	AWD	38.50	90.20	535	97.5	-2.5	6	4,900	94	75	1,475	STLOUSMO
St Louis	MO	BWD-TRY	38.50	90.20	535	97.5	-2.5	6	4,900	94	75	1,475	
St Louis/Lambert IAP	MO	DOD	38.45	90.23	535	107.5	-7.5	6	4,750	94	75	1,475	
Columbus AFB	MS	DOD	33.39	88.27	219	102.5	2.5	20	2,890	93	77	2,039	
Jackson	MS	BWD-TRY	32.18	90.06	310	102.5	2.5	24	2,583	93	79	2,321	
Jackson/Allen Thompson Fld	MS	DOD	32.19	90.05	310	102.5	2.5	25	2,300	95	76	2,321	
Keesler AFB/Biloxi	MS	DOD	30.25	88.55	26	97.5	12.5	31	1,549	92	79	2,793	
Meridan NAS/McCain Field	MS	DOD	32.33	88.34	317	102.5	2.5	21	2,712	93	76	1,935	
Billings/Logan IAP	MT	DOD	45.48	108.32	3,567	102.5	-22.5	-10	7,265	91	64	498	
Glasgow AFB	MT	DOD	48.25	106.32	2,760	97.5	-32.5	-18	9,251	89	63	404	
Great Falls	MT	BWD-TRY	47.30	111.24	3,664	92.5	-17.5	-14	7,689	88	61	339	
Great Falls	MT	AWD	47.30	111.20	3,664	92.5	-17.5	-15	7,750	88	60	339	GRTFALMT

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Helena	MT	DOD	46.36	112.00	3,828	97.5	-37.5	-16	8,190	88	60	256	
Malmstrom AFB	MT	DOD	47.30	111.11	3,525	102.5	-32.5	-15	7,671	89	61	370	
Missoula	MT	DOD	46.55	114.05	3,190	102.5	-22.5	-6	7,931	88	61	188	
Omaha	NB	BWD-WYEC	41.20	95.50	978	97.5	-2.5	-3	6,612	91	75	1,173	
Omaha	NB	AWD	41.20	95.50	978	97.5	-2.5	-3	6,612	91	75	1,173	OMAHA-NB
Omaha	NB	BWD-TRY	41.18	95.54	978	97.5	-2.5	-1	6,430	90	78	1,173	
Cherry Point MCAS	NC	DOD	34.54	76.53	29	97.5	12.5	24	2,832	90	78	1,922	
Elizabeth City CGAS/MAP	NC	DOD	36.16	76.11	12	102.5	12.5	22	3,207	91	77	1,593	
Fort Bragg/Simmons AAF	NC	DOD	35.08	78.56	242	102.5	12.5	21	3,105	92	76	1,760	
Greensboro	NC	DOD	36.05	79.57	897	97.5	2.5	18	3,825	91	73	1,341	
Raleigh	NC	BWD-TRY	35.48	78.48	433	92.5	12.5	20	3,839	88	76	1,394	
Raleigh	NC	AWD	35.50	78.50	433	92.5	12.5	20	3,393	92	75	1,394	RALEGHNC
Seymour Johnson AFB	NC	DOD	35.20	77.58	109	97.5	17.5	21	3,124	91	76	1,769	
Bismarck	ND	BWD-WYEC	46.50	100.50	1,647	97.5	-22.5	-19	8,851	91	68	487	
Bismarck	ND	AWD	46.50	100.50	1,647	97.5	-22.5	-19	8,851	91	68	487	BISMRKND
Bismarck	ND	BWD-TRY	46.48	100.48	1,647	97.5	-22.5	-19	9,724	91	71	487	
Bismarck MAP	ND	DOD	46.46	100.45	1,647	102.5	-37.5	-19	9,044	91	68	487	
Grand Forks AFB	ND	DOD	47.57	97.24	911	97.5	-32.5	-22	9,963	87	70	400	
Minot AFB	ND	DOD	48.25	101.21	1,668	102.5	-32.5	-20	9,625	89	67	398	
Grand Island	NE	DOD	40.58	98.19	1,841	107.5	-22.5	-3	6,420	94	71	1,036	
North Platte/Lee Bird Fld	NE	DOD	41.08	100.41	2,775	107.5	-22.5	-4	6,743	94	69	802	
Offutt AFB	NE	DOD	41.07	95.55	1,048	102.5	-17.5	-3	6,213	91	75	1,157	
Scottsbluff	NE	DOD	41.52	103.36	3,958	102.5	-17.5	-3	6,774	92	65	666	
Pease AFB/Portsmouth	NH	DOD	43.04	70.49	101	97.5	-12.5	2	6,846	85	71	681	
McGuire AFB	NJ	DOD	40.01	74.36	133	97.5	2.5	11	5,139	89	74	983	
Newark IAP	NJ	DOD	40.42	74.10	7	97.5	2.5	14	5,034	91	73	1,024	
Albuquerque	NM	BWD-TRY	35.06	106.36	5,310	102.5	7.5	17	4,597	92	64	1,394	
Albuquerque	NM	BWD-WYEC	35.00	106.40	5,310	102.5	7.5	16	4,348	94	61	1,394	
Albuquerque	NM	AWD	35.00	106.40	5,310	102.5	7.5	16	4,348	94	61	1,394	ALBUQRNM
Albuquerque IAP/Kirtland AFB	NM	DOD	35.03	106.37	5,311	102.5	-2.5	16	4,337	94	61	1,394	
Cannon AFB/Clovis	NM	DOD	34.23	103.19	4,283	102.5	-7.5	13	4,046	93	65	1,297	
Farmington MAP	NM	DOD	36.44	108.14	5,503	97.5	-17.5	6	5,713	93	62	749	
Holloman AFB/Alamogordo	NM	DOD	32.51	106.06	4,093	107.5	-2.5	19	3,223	94	64	1,870	
Ely	NV	DOD	39.17	114.51	6,253	92.5	-22.5	-4	7,814	87	56	207	
Fallon NAS/Van Voorhis Fld	NV	DOD	39.25	118.42	3,934	102.5	-7.5	12	5,229	96	63	892	
Las Vegas	NV	AWD	36.10	115.10	2,162	112.5	17.5	28	2,709	106	65	2,946	LASVEGNV
Las Vegas	NV	BWD-WYEC	36.10	115.10	2,162	112.5	17.5	28	2,709	106	65	2,946	
Nellis AFB/Las Vegas	NV	DOD	36.15	115.02	1,868	112.5	17.5	27	2,377	107	68	3,089	
Stead AFB/Reno	NV	DOD	39.40	119.52	5,023	97.5	-17.5	8	6,398	89	58	385	
Tonopah MAP	NV	DOD	38.04	117.05	5,426	102.5	-7.5	10	5,900	92	59	631	
Winnemucca MAP	NV	DOD	40.54	117.48	4,301	102.5	-12.5	3	6,629	94	60	407	

ASEAM2 WEATHER STATIONS

Weather Station Name	State	Weather Type	N Lat Deg.Min	W Long Deg.Min	Alt (ft)	Max Bin Temp deg F	Min Bin Temp deg F	Winter Design (97.5%)	Heating Deg Days base 65	Summer Design (2.5%)	MCWB (2.5%) deg F	Cooling Deg Days base 65	Weather Filename
Albany	NY	DOD	42.45	73.48	275	97.5	-17.5	-1	6,888	88	72	574	
Albany	NY	BWD-TRY	42.45	73.48	275	97.5	-17.5	2	7,328	86	74	574	
Buffalo	NY	BWD-TRY	42.48	78.42	705	87.5	2.5	7	6,943	82	70	437	
Griffis AFB/Rome	NY	DOD	43.14	75.25	514	92.5	-22.5	-5	7,331	85	70	472	
New York	NY	BWD-WYEC	40.50	73.50	19	97.5	7.5	15	4,811	89	73	1,048	
New York	NY	AWD	40.50	73.50	19	97.5	7.5	15	4,811	89	73	1,048	NEWYOKNY
New York	NY	BWD-TRY	40.48	73.54	19	97.5	7.5	16	4,689	86	75	1,048	
Newburgh/Stewart AFB	NY	DOD	41.30	74.06	471	97.5	-17.5	4	6,336	88	72	731	
Niagara Falls IAP	NY	DOD	43.06	78.57	590	97.5	-12.5	7	6,688	86	72	549	
Plattsburgh AFB	NY	DOD	44.39	73.28	235	92.5	-27.5	-8	8,044	83	69	341	
Suffolk Co/Westhampton Bch	NY	DOD	40.51	72.38	67	97.5	-2.5	10	5,951	83	71	547	
Syracuse/HancockIAP	NY	DOD	43.07	76.07	410	97.5	-12.5	2	6,772	87	71	591	
Akron/Akron-Canton Aprt.	OH	DOD	40.55	81.26	1,208	97.5	-7.5	6	6,224	86	71	634	
Cincinnati	OH	BWD-TRY	39.06	84.42	869	97.5	-17.5	8	5,042	90	75	1,080	
Cincinnati Aprt./Covington	OH	DOD	39.03	84.40	869	97.5	-17.5	6	5,070	90	72	1,080	
Cleveland	OH	BWD-WYEC	41.20	81.50	777	92.5	-7.5	5	6,351	88	72	613	
Cleveland	OH	AWD	41.20	81.50	777	92.5	-7.5	5	6,351	88	72	613	CLEVLNOH
Cleveland	OH	BWD-TRY	41.24	81.54	777	92.5	-7.5	8	6,578	86	74	613	
Dayton	OH	BWD-WYEC	39.50	84.10	997	97.5	-12.5	4	5,622	89	72	936	
Dayton	OH	AWD	39.50	84.10	997	97.5	-12.5	4	5,622	89	72	936	DAYTONOH
Toledo/Toledo Express Aprt	OH	DOD	41.36	83.48	669	92.5	-12.5	1	6,381	88	73	685	
Wright-Patterson AFB/Dayton	OH	DOD	39.49	84.03	824	97.5	-12.5	3	5,455	89	73	1,036	
Altus AFB	OK	DOD	34.39	99.16	1,378	107.5	-2.5	16	3,346	100	73	2,347	
Fort Sill/Post AAF	OK	DOD	34.39	98.24	1,187	107.5	2.5	16	3,367	99	74	2,217	
Oklahoma City	OK	AWD	35.20	97.40	1,280	102.5	12.5	13	3,725	97	74	1,876	OKHMCTOK
Oklahoma City	OK	BWD-TRY	35.24	97.36	1,280	102.5	12.5	9	4,226	98	77	1,876	
Tinker AFB/Oklahoma City	OK	DOD	35.25	97.23	1,291	107.5	-2.5	13	3,680	98	75	2,068	
Tulsa	OK	BWD-TRY	36.12	95.54	650	112.5	-2.5	10	3,849	92	79	1,949	
Tulsa IAP	OK	DOD	36.12	95.54	650	112.5	-2.5	13	3,680	98	75	1,949	
Vance AFB/Enid	OK	DOD	36.21	97.55	1,307	112.5	-2.5	13	3,971	100	74	2,088	
Astoria	OR	DOD	46.09	123.53	8	92.5	17.5	29	5,295	71	62	13	
Eugene	OR	DOD	44.07	123.13	359	102.5	-2.5	22	4,854	89	66	239	
Kingsley Field	OR	DOD	42.09	121.44	4,092	97.5	-7.5	9	6,987	87	60	228	
Medford	OR	BWD-TRY	42.24	122.54	1,298	102.5	12.5	25	5,178	94	66	562	
Medford	OR	AWD	42.20	122.50	1,298	102.5	12.5	23	5,008	94	67	562	MEDFRDOR
Medford	OR	DOD	42.22	122.52	1,298	102.5	2.5	23	4,930	94	67	562	
Medford	OR	BWD-WYEC	42.20	122.50	1,298	102.5	12.5	23	5,008	94	67	562	
Pendleton	OR	DOD	45.41	118.51	1,482	102.5	-17.5	5	5,240	93	64	656	
Portland	OR	BWD-TRY	45.36	122.36	21	102.5	12.5	27	5,202	86	66	300	
Portland	OR	AWD	45.40	122.40	21	102.5	12.5	23	4,635	85	67	300	PORTLNOR
Portland IAP	OR	DOD	45.36	122.36	21	102.5	7.5	23	4,792	85	67	300	
Harrisburg IAP/Olmsted	PA	DOD	40.12	76.46	308	102.5	-2.5	11	5,315	91	74	1,025	
Philadelphia	PA	BWD-TRY	39.54	75.18	7	92.5	12.5	16	5,301	87	77	1,104	
Pittsburgh	PA	BWD-TRY	40.30	80.42	1,137	92.5	-2.5	10	5,870	87	73	647	

ASEAM2 WEATHER STATIONS

Weather Station Name	State	Weather Type	N Lat Deg.Min	W Long Deg.Min	Alt (ft)	Max Bin Temp deg F	Min Bin Temp deg F	Winter Design (97.5%)	Heating Deg Days base 65	Summer Design (2.5%)	MCWB (2.5%) deg F	Cooling Deg Days base 65	Weather Filename
Pittsburgh	PA	AWD	40.30	80.10	1,137	92.5	-2.5	5	5,987	86	71	647	PITSBRPA
Pittsburgh/Gtr Pburgh IAP	PA	DOD	40.30	80.13	1,137	97.5	-7.5	5	5,930	86	71	647	
Wilkes-Barre-Scranton Aprt.	PA	DOD	41.20	75.44	930	97.5	-7.5	5	6,277	87	71	608	
Williamsport	PA	DOD	41.15	76.55	524	97.5	-12.5	7	5,981	89	72	698	
Quonset Point NAS	RI	DOD	41.36	71.25	30	97.5	-7.5	9	5,840	85	72	690	
Charleston	SC	BWD-WYEC	32.50	80.00	41	97.5	17.5	27	2,033	91	78	2,078	
Charleston	SC	BWD-TRY	32.54	80.00	41	97.5	17.5	28	2,389	89	78	2,078	
Charleston	SC	AWD	32.50	80.00	41	97.5	17.5	27	2,033	91	78	2,078	CHRLTNSC
Charleston AFB/MAP	SC	DOD	32.54	80.02	45	97.5	17.5	27	2,146	91	78	2,078	
Greenville-Spartanburg Aprt	SC	DOD	34.54	82.13	957	97.5	7.5	22	3,163	91	74	1,573	
Myrtle Beach AFB	SC	DOD	33.41	78.56	25	97.5	12.5	24	2,696	89	78	1,823	
Shaw AFB/Sumter	SC	DOD	33.58	80.28	252	102.5	12.5	25	2,453	92	76	2,160	
Ellsworth AFB/Rapid City	SD	DOD	44.08	103.06	3,276	102.5	-17.5	-7	7,049	92	65	738	
Huron	SD	DOD	44.23	98.13	1,281	102.5	-27.5	-14	8,055	93	72	716	
Sioux Falls/Foss Fld	SD	DOD	43.34	96.44	1,418	102.5	-22.5	-11	7,838	91	72	719	
Bristol/Tri City Aprt	TN	DOD	36.29	82.24	1,507	97.5	-2.5	14	4,306	89	72	1,107	
Knoxville/Alcoa Ang Sta	TN	DOD	35.49	83.59	980	102.5	2.5	19	3,478	92	73	1,569	
Memphis	TN	BWD-TRY	35.06	90.00	322	102.5	-2.5	20	3,297	93	80	1,996	
Memphis NAS/Millington	TN	DOD	35.20	89.53	322	102.5	-2.5	17	3,445	93	77	1,996	
Nashville	TN	AWD	36.10	86.40	577	97.5	12.5	14	3,578	94	74	1,694	NASHVLTN
Nashville	TN	BWD-TRY	36.06	86.54	577	97.5	12.5	16	3,677	90	77	1,694	
Nashville	TN	BWD-WYEC	36.10	86.40	577	97.5	12.5	14	3,578	94	74	1,694	
Sewart AFB/Smyrna Aprt	TN	DOD	36.00	86.32	543	102.5	-7.5	13	3,949	92	74	1,691	
Amarillo	TX	BWD-TRY	35.12	101.42	3,607	102.5	12.5	16	4,645	94	70	1,433	
Amarillo	TX	DOD	35.14	101.52	3,604	102.5	-7.5	11	4,183	95	67	1,433	
Amarillo	TX	AWD	35.10	101.40	3,607	102.5	12.5	11	3,985	95	67	1,433	AMARLOTX
Bergstrom AFB/Austin	TX	DOD	30.12	97.40	541	102.5	12.5	28	1,712	97	75	3,078	
Brownsville	TX	BWD-WYEC	25.50	97.30	16	97.5	32.5	39	600	93	77	3,874	
Brownsville	TX	BWD-TRY	25.54	97.24	16	97.5	32.5	43	646	92	79	3,874	
Brownsville	TX	AWD	25.50	97.30	16	97.5	32.5	39	600	93	77	3,874	BRNSVLTX
Brownsville IAP	TX	DOD	25.54	97.26	19	97.5	27.5	39	650	93	77	3,874	
Carswell AFB/Fort Worth	TX	DOD	32.47	97.26	650	107.5	12.5	23	2,301	99	75	2,858	
Corpus Christi NAS	TX	DOD	27.42	97.17	19	97.5	22.5	38	899	91	79	3,687	
Dallas	TX	AWD	32.50	96.50	481	102.5	22.5	22	2,363	100	75	2,755	DALLASTX
El Paso	TX	BWD-TRY	31.48	106.24	3,918	102.5	12.5	22	2,881	95	69	2,098	
El Paso	TX	AWD	31.50	106.20	3,918	102.5	12.5	24	2,700	98	64	2,098	ELPASOTX
El Paso	TX	BWD-WYEC	31.50	106.20	3,918	102.5	12.5	24	2,700	98	64	2,098	
Ellington AFB/Houston	TX	DOD	29.37	95.10	40	102.5	17.5	31	1,384	94	78	2,937	
Fort Bliss/Biggs AAF	TX	DOD	31.51	106.23	3,947	107.5	2.5	23	2,432	97	65	2,253	
Fort Hood/Robert Gray AAF	TX	DOD	31.04	97.50	1,015	107.5	12.5	25	1,959	97	73	2,792	
Fort Worth	TX	BWD-TRY	32.54	97.00	544	97.5	17.5	22	2,555	96	77	2,755	
Fort Worth	TX	BWD-WYEC	32.50	96.50	481	102.5	22.5	22	2,363	100	75	2,755	
Houston	TX	BWD-TRY	29.42	95.18	50	97.5	22.5	30	1,772	92	79	2,889	
Kelly AFB/San Antonio	TX	DOD	29.23	98.35	690	102.5	12.5	29	1,520	97	74	3,190	

ASEAM2 WEATHER STATIONS

Weather Station Name	State	Weather Type	N Lat Deg.Min	W Long Deg.Min	Alt (ft)	Max Bin Temp deg F	Min Bin Temp deg F	Winter Design (97.5%)	Heating Deg Days base 65	Summer Design (2.5%)	MCWB (2.5%) deg F	Cooling Deg Days base 65	Weather Filename
Laughlin AFB	TX	DOD	29.22	100.47	1,081	107.5	7.5	31	1,542	98	73	3,281	
Lubbock	TX	BWD-TRY	33.42	101.48	3,243	102.5	7.5	19	3,888	93	71	1,647	
Perrin AFB/Sherman	TX	DOD	33.43	96.40	763	107.5	7.5	20	2,837	98	75	2,337	
San Antonio	TX	BWD-TRY	29.30	98.30	792	102.5	22.5	30	2,045	97	77	2,994	
San Antonio	TX	AWD	29.30	98.30	792	102.5	22.5	30	1,546	97	73	2,994	SANANTTX
Waco/James Connally Aprt	TX	DOD	31.38	97.04	475	107.5	12.5	25	2,081	99	75	2,878	
Webb AFB/Big Spring	TX	DOD	32.13	101.31	2,561	107.5	7.5	20	2,678	97	69	2,382	
Dugway PG/Michales AAF	UT	DOD	40.12	112.56	4,340	102.5	-12.5	5	5,877	96	62	1,088	
Hill AFB/Ogden	UT	DOD	41.07	111.58	4,785	97.5	-12.5	10	6,081	92	62	920	
Salt Lake City	UT	AWD	40.50	112.00	4,220	102.5	2.5	8	6,052	95	62	927	SALTLCUT
Salt Lake City	UT	BWD-TRY	40.48	112.00	4,220	102.5	2.5	9	6,421	93	63	927	
Wendover AF Range	UT	DOD	40.44	114.02	4,237	102.5	2.5	12	5,673	95	59	1,137	
Fort Belvoir/Davison AAF	VA	DOD	38.43	77.11	69	97.5	-7.5	12	4,891	90	75	1,120	
Langley AFB/Hampton	VA	DOD	37.05	76.21	10	97.5	7.5	20	3,623	90	77	1,539	
Norfolk	VA	BWD-TRY	36.54	76.12	26	97.5	17.5	23	3,473	90	78	1,441	
Richmond	VA	BWD-TRY	37.30	77.18	164	102.5	2.5	19	4,721	90	78	1,353	
Richmond/Byrd IAP	VA	DOD	37.30	77.20	164	102.5	2.5	17	3,939	92	76	1,353	
Roanoke/Woodrum Aprt	VA	DOD	37.19	79.58	1,193	102.5	7.5	16	4,307	91	72	1,030	
Burlington	VT	BWD-TRY	44.30	73.12	331	97.5	-17.5	-5	8,096	85	72	396	
Fairchild AFB/Spokane	WA	DOD	47.37	117.38	2,462	102.5	-17.5	7	6,790	90	62	416	
McChord AFB/Tacoma	WA	DOD	47.09	122.29	322	92.5	2.5	24	5,287	82	65	94	
Moses Lake/Grant Co	WA	DOD	47.12	119.19	1,185	102.5	-17.5	7	5,809	94	65	707	
Seattle	WA	AWD	47.30	122.20	386	87.5	12.5	26	5,145	80	64	129	SEATTLWA
Seattle	WA	BWD-TRY	47.30	122.18	386	87.5	12.5	29	5,669	84	65	129	
Seattle	WA	BWD-WYEC	47.30	122.20	386	87.5	12.5	26	5,145	80	64	129	
Seattle NSA	WA	DOD	47.41	122.15	47	97.5	12.5	27	4,650	82	66	162	
Green Bay/Austin-Straubel	WI	DOD	44.29	88.08	682	97.5	-27.5	-9	8,098	85	72	386	
La Crosse MAP	WI	DOD	43.52	91.15	651	97.5	-27.5	-9	7,417	88	73	695	
Madison	WI	AWD	43.10	89.20	858	92.5	-17.5	-7	7,863	88	73	460	MADISNWS
Madison	WI	BWD-TRY	43.06	89.18	858	92.5	-17.5	-6	7,517	87	73	460	
Madison	WI	BWD-WYEC	43.10	89.20	858	92.5	-17.5	-7	7,863	88	73	460	
Madison/Traux Field	WI	DOD	43.08	89.20	858	97.5	-27.5	-7	7,730	88	73	460	
Charleston/Kanawha Aprt	WV	DOD	38.22	81.36	939	102.5	-7.5	11	4,590	90	73	1,055	
Elkins/Randolph Co Aprt	WV	DOD	38.53	79.51	1,948	92.5	-12.5	6	5,975	84	70	389	
Huntington	WV	DOD	38.25	82.30	565	102.5	-12.5	10	4,374	91	74	1,098	
Casper IAP	WY	DOD	42.55	106.28	5,338	102.5	-22.5	-5	7,555	90	57	458	
Cheyenne	WY	BWD-TRY	41.12	104.48	6,126	92.5	-17.5	-3	7,382	85	60	327	
Cheyenne	WY	AWD	41.10	104.50	6,126	92.5	-17.5	-1	7,381	86	58	327	CHEYNEWY
Cheyenne MAP	WY	DOD	41.09	104.49	6,126	97.5	-22.5	-1	7,255	86	58	327	
Rock Springs	WY	DOD	41.36	109.04	6,745	92.5	-22.5	-3	8,410	84	55	227	
Sheridan	WY	DOD	44.46	106.58	3,964	102.5	-27.5	-8	7,708	91	62	346	

Appendix B - Input Screen Forms

APPENDIX B - INPUT SCREEN FORMS

B.1 How to Use the Input Forms

Input forms for Loads, Systems, Plant, and Life-Cycle Costing are presented in the following pages. After you have collected data about the building to be modeled, whether from plans, a building walk-through, or interviews with operating personnel, it is suggested that you enter data on these forms before entering the data using the input programs. (You will need to copy the forms which are used for each zone or each system many times. Each screen is shown here only once, even though you may fill out the screen for ten different zones or systems.)

Above each input form is a description of the data it contains, the file name for the screen display, and space for you to enter the building, zone or system which to which the data pertains. The screen display file is the one you must access if you want to alter the default values or limits on the values. Refer to Appendix C for instructions on how to change the screen input files.

B.2 Loads Input Screens

All Loads Input screen data files have the extension .LIS. The file name is given above each screen.

The Building/Project Data screens appear only once for the building. The External Shading and Monthly Diversity Factors screens, although they appear with the zone screens, may be defined only once per building. Thus, if you specify one set of monthly diversity factor in zone 1 and another in zone 5, the latest entered values will be used for the entire building (in this case, zone 5). All other screens appear once per zone. Not all screens may be applicable to your building. For example, if you do not specify a daylighting analysis, the daylighting screens will never appear.

These input forms are provided for your convenience in collecting data. Refer to Chapter 5 for discussion of the Loads input questions.

B.2.1 Project/Building (LIPROJDT)

Building:______________

```
Building Names & ID'S:
  Building File Name                          ________
  Building Name                               ________________________
  Project Number                              ________________________

Building Location:
  Building Address                            ________________________
                                              ________________________
                                              ________________________

Building Type:
  Building Type                               ________________________

Building Areas and Zones:
  Building Gross Floor Area                   __________  ft2
  Building Net Conditioned Area               __________  ft2
  Number of Zones                             __
```

B.2.2 Project/Building Screen 2 (LIPRJ2DT)

Building:______________

```
Building Location:
  North Latitude (Use '-' for South Lat)           ______ deg
  West Longitude (Use '-' for East Long)           ______ deg

Operating Schedules:
  Typical weekday occupancy starting hour          __
  Typical weekday operating hours per day          __
    (Use only 8, 10, 12, 14, 16)

Summer thermostat schedule beginning month number  __
Summer thermostat schedule ending month number     __

Time Zone Number                                   __
  5=Eastern    6=Central    7=Mountain    8=Pacific

Daylight Savings Time Used (Y/N)                   _
```

B.2.3 Occupancy Schedules (LIOCCSDT) Building:______________

```
OCCUPANCY SCHEDULES
-----------------------------------------------------------------------------
    Enter the typical OCCUPIED schedule - Use military time (5:30 pm = 1730)

           Values should be in 'hundreds' of hours  - 8 am = 800

             If UNOCCUPIED for entire day - use   0  to  0

        (See Caution in User's Manual if Occupied for Entire Day)


                   Day of Week

                   Weekdays .... from  ____  to  ____
                   Saturdays ... from  ____  to  ____
                   Sundays ..... from  ____  to  ____
```

B.2.4 Zones (LIZONEDT) Building:______________ Zone # ___

```
Zone label                                ________________________________

Zone function (Opt)                                          ________
Zone area                                                    ________  ft²
Zone volume                                                  ________  ft3
  (or) Floor to ceiling height                               __  ft

Thermostat Set Point Temperatures
  Summer occupied temperature                                ____  °F
  Winter occupied temperature                                ____  °F
  Winter unoccupied temperature                              ____  °F
```

B.2.5 Lighting (LILITEDT)

Building:______________ Zone # ___

	Ltg Func 1	Ltg Func 2	Ltg Func 3	Ltg Func 4
Function name (or 'NA')	________	________	________	________
Average function area (ft^2)	______	______	______	______
Installed watts/ft^2	____	____	____	____
(times) Percent of function area	__	__	__	__
(or) Total installed watts	______	______	______	______
Daylighting (Y/N)	_	_	_	_
Controlite filename (if appl)	______	______	______	______
Lighting system type (Opt)	________	________	________	________
Percent light heat to space (%)	__	__	__	__
'A' classification	__	__	__	__
'B' classification	_	_	_	_

A classification - .45, .55, .65, .75 (See ASHRAE F26.19 T15)
B classification - A, B, C, D (See ASHRAE F26.19 T16)

B.2.6 Daylighting (LIDAYLDT)

Building:______________ Zone # ___

	Ltg Func 1	Ltg Func 2	Ltg Func 3	Ltg Func 4
Function name (or 'NA')	________	________	________	________
Window orientation (N,NW,etc)	__	__	__	__
Ground reflectance (%)	__	__	__	__
Typical room window area (ft2)	____	____	____	____
Glass visible transmittance (%)	__	__	__	__
Room depth from window (ft)	__	__	__	__
Room length (ft)	__	__	__	__
Ceiling height (ft)	__	__	__	__
Wall reflectance (%)	__	__	__	__
Present footcandles in space	__	__	__	__
Design footcandles for space	__	__	__	__
Sensor location (1=Max 2=Mid 3=Min)	_	_	_	_
Percent of lights controlled	__	__	__	__
Control type ('D'im or 'S'tep)	_	_	_	_

B.2.7 Daylighting Control (LIDAYCDT)

Building:______________ Zone # ___

	Ltg Func 1	Ltg Func 2	Ltg Func 3	Ltg Func 4
Function name (or 'NA')	________	________	________	________
For Dimming Control Only				
Minimum FC maintained by lights	___	___	___	___
% of total power at min FC (%)	___	___	___	___
For Stepped Control Only				
Number of Steps (max=4)	_	_	_	_
Step 1 artificial FC	___	___	___	___
Step 1 lighting watts	___	___	___	___
Step 2 artificial FC	___	___	___	___
Step 2 lighting watts	___	___	___	___
Step 3 artificial FC	___	___	___	___
Step 3 lighting watts	___	___	___	___
Step 4 artificial FC	___	___	___	___
Step 4 lighting watts	___	___	___	___

B.2.8 People (LIPEOPDT)

Building:______________ Zone # ___

PEOPLE		
Number of people in zone	___	
(or) Square feet per person	___	
Sensible load per person	___	BTUH per person
Latent load per person	___	BTUH per person

B.2.9 Electrical Equipment (LIELECDT) **Building:**______________ **Zone #** ___

ELECTRICAL EQUIPMENT	Type 1	Type 2
Electric equipment name (or 'NA')	_______________	_______________
Installed watts/ft²	_____	_____
(times) Percent of zone area	___	___
(or) Total installed watts	________	________
Hooded (Y/N)	_	_

All watts are converted to space heat gains

B.2.10 Misc Sensible Loads (LIMSENDT) **Building:**______________ **Zone #** ___

MISCELLANEOUS SENSIBLE LOADS	Type 1	Type 2
Load source name (or 'NA')	_______________	_______________
Installed BTUH/ft²	_____	_____
(times) Percent of zone area	___	___
(or) Total installed BTUH	_____	_____
Hooded (Y/N)	_	_

Enter Heat Gains as (+) and Heat Losses as (-)

B.2.11 Walls (LIWALLDT) **Building:**_____________ **Zone #** ___

WALLS	Wall 1	Wall 2	Wall 3	Wall 4
Name (or 'NA')	__________	__________	__________	__________
Wall Orient (N,NE,etc)	__	__	__	__
Area (ft^2)	______	______	______	______
U-Factor ($BTUH/ft^2$-°)	_____	_____	_____	_____
Wall Construction Group	_	_	_	_
Color Correction	___	___	___	___

Wall Construction Groups - see page F26.9 ('A' through 'G')
Color Correction Codes 1=Dark .83=Medium .65=Light

B.2.12 Roofs (LIROOFDT) **Building:**_____________ **Zone #** ___

ROOFS	Roof 1	Roof 2
Name (or 'NA')	__________	__________
Area (ft^2)	______	______
U-Factor ($BTUH/ft^2$-°)	_____	_____
Roof Construction Code	__	__
Color Correction	___	___
Susp Ceil Plenum (Y/N)	_	_

Roof Construction Codes - see ASHRAE F26.8 T5 - numbers 1 thru 13
Color Correction Codes 1 = Dark Colored or in an industrial area
.5 = permanently light colored or in rural area

B.2.13 Windows (LIWNDODT)

Building: ______________ **Zone #** ___

WINDOWS Name (or 'NA')	Window 1	Window 2	Window 3	Window 4
Window orient (N,NE,etc)	__	__	__	__
Fenestration area (ft^2)	______	______	______	______
Shading coefficient	___	___	___	___
U-Factor (BTUH/ft^2-°)	____	____	____	____
Space mass code (1=light 2=medium 3=heavy)	_	_	_	_
Crack length (lin ft)	______	______	______	______
Leakage coefficient	__	__	__	__
INPUTS REQUIRED FOR SHADING				
Window shading model # 0=None OR 1,2, or 3	_	_	_	_
Percent window area	___	___	___	___

B.2.14 External Shading (LISHADDT)

Building: ______________ **ALL ZONES**

SHADING DETAILS (All dimensions in inches)	Model 1	Model 2	Model 3
Window Model Name (or 'NA')	________	________	________
Window Width	_______	_______	_______
Window Height	_______	_______	_______
Overhang Details			
Overhang Depth	_______	_______	_______
Top of Window to Overhang	_______	_______	_______
Overhang extension beyond left edge of window	_______	_______	_______
Overhang extension beyond right edge of window	_______	_______	_______
Depth of vert projection at end of overhang	_______	_______	_______
Left Fin Details			
Depth of left fin	_______	_______	_______
Left fin extension above top of window	_______	_______	_______
Distance from left edge of window to left fin	_______	_______	_______
Dist from left fin bottom to bottom of window	_______	_______	_______
Right Fin Details			
Depth of right fin	_______	_______	_______
Right fin extension above top of window	_______	_______	_______
Dist from right edge of window to right fin	_______	_______	_______
Dist from right fin bottom to bottom of window	_______	_______	_______

B.2.15 Doors (LIDOORDT) **Building:______________ Zone # ___**

DOORS	Door 1	Door 2
Name (or 'NA')	__________	__________
Area (ft^2)	______	______
U-Factor (BTUH/ft^2-°)	_____	_____
Crack length (lin ft)	______	______
Leakage coefficient	___	___

B.2.16 Infiltration (LIINFLDT) **Building:______________ Zone # ___**

INFILTRATION		
Occupied air change rate	____	air changes per hour
Unoccupied air change rate	____	air changes per hour

These entries exclude infiltration by crack length method

B.2.17 Misc Conduction (LIMCONDT) **Building:______________ Zone # ___**

MISCELLANEOUS CONDUCTION	Type 1	Type 2
Name (or 'NA')	______________	______________
Area (ft^2)	______	______
U-Factor (BTUH/ft^2-°)	_____	_____
Reference temperature at design summer (°F)	_____	_____
Reference temperature at design winter (°F)	_____	_____

B.2.18 Diversity Factors (LIDIVRDT) **Building:______________ Zone # ___**

		OCCUPIED PERIOD	UNOCCUPIED PERIOD	MONTHLY DIV FC TABLE # (1-4)
People:				
	Avg % of full occupancy	____	____	____
Lights:				
Office	Avg % of installed capacity	____	____	____
NA	Avg % of installed capacity	____	____	____
NA	Avg % of installed capacity	____	____	____
NA	Avg % of installed capacity	____	____	____
Electric Equipment:				
Misc	Avg % of installed capacity	____	____	____
NA	Avg % of installed capacity	____	____	____
Miscellaneous Sensible Loads:				
NA	Avg % of installed capacity	____	____	____
NA	Avg % of installed capacity	____	____	____

B.2.19 Monthly Diversity Factors (LIMONDDT) Building:____________ ALL ZONES

Enter Monthly Diversity Factors (0 - 100 %) for each month/schedule

Month	Mon Sch 1	Mon Sch 2	Mon Sch 3	Mon Sch 4
January	___	___	___	___
February	___	___	___	___
March	___	___	___	___
April	___	___	___	___
May	___	___	___	___
June	___	___	___	___
July	___	___	___	___
August	___	___	___	___
September	___	___	___	___
October	___	___	___	___
November	___	___	___	___
December	___	___	___	___

B.3 Systems Input Screens

All Systems Input screen data files have the extension .SIS. The file name is given above each screen.

The System Type and Zone Assignment screens appear only once for the building. All other screens appear once for each system. Not all screens may be applicable to your building. For example, if you do not specify a DX Cooling, this screen will never appear. These input forms are provided for your convenience in collecting data. Refer to Chapter 6 for a discussion of each of the systems input questions.

B.3.1 Systems Definitions (SISYSDAT)

Building:______________

Total number of systems __

System #	System Label	System Type (Use Codes Below)
1	________________________	__
2	________________________	__
3	________________________	__
4	________________________	__
5	________________________	__
6	________________________	__
7	________________________	__
8	________________________	__
9	________________________	__
10	________________________	__

Heating and Cooling System Types

1=DDMZ 2=CVRH 3=VAVR 4=CBVAV 5=SZRH 6=FCU 7=WSHP 8=AAHP

Heating Only Systems

9=BB 10=FURN 11=UH 12=HV

Cooling Only Systems

13=WAC

B.3.2 System-Zone Assignment (SIZONDAT)

Building:______________

Zone Number	Zone Label	Heating Cooling System #	Heating ONLY System #	Cooling ONLY System #
1	South Exposure	__	__	__
2	West Exposure	__	__	__
3	North Exposure	__	__	__
4	East Exposure	__	__	__
5	Core Area - No exposures except roof	__	__	__

B.3.3 Heating (SIHTGDAT)

Building:______________ **System #**___

```
Energy Source for Heating
  Heating coil plant type (see codes below)                     _
Heating Availability
  Outside temperature above which heating is off                ___ °F
  Heating available beginning month #                           __
  Heating available ending month #                              __

Heating Discharge Conditions
  Design heating coil discharge temperature                     ___ °F

(Dual Duct System Only)
  Discriminator Control (Y/N)                                   _
  Outside temperature at maximum hot deck temperature           ___ °F
    Maximum hot deck temperature                                ___ °F
  Outside temperature at minimum hot deck temperature           ___ °F
    Minimum hot deck temperature                                ___ °F
-------------------------------------------------------------------------------
                          Heating Coil Plant Types
0=None   1=Boiler   2=Elect Resist   3=District Heat   4=DB Chiller   5=Furnace
```

B.3.4 Cooling (SICLGDAT)

Building:______________ **System #**___

```
Energy Source for Cooling
  Cooling coil plant type (see codes below)                     _

Cooling Availability
  Outside temperature below which cooling is off                ___ °F
  Cooling available beginning month #                           __
  Cooling available ending month #                              __

Cooling Discharge Conditions
  Design cooling coil discharge temperature                     ___ °F
  Discriminator control (Y/N)                                   _
  Maximum cooling coil discharge temperature                    ___ °F

                          Cooling Coil Plant Types
  0=None     1=DX      2=Centrifugal      3=Absorption      4=District Cooling
  5=Double Bundle      6=Cooling Tower (WSHP only)          7=Reciprocating
```

B.3.5 Preheat (SIPRHDAT)

Building:____________ System #___

```
Energy Source for Preheat
  Preheat coil plant type (see codes below)                    _

Preheat Availability
  Outside temperature above which preheat is off               ___ °F
  Preheat available beginning month #                          __
  Preheat available ending month #                             __

Preheat Discharge Conditions
  Design preheat coil discharge temperature                    ___ °F

                         Preheat Coil Plant Types
    0=None      1=Boiler      2=Electric Resistance        3=District Heat
```

B.3.6 Humidification (SIHUMDAT)

Building:____________ System #___

```
Energy Source for Humidification
  Humidification plant type (see codes below)                      _

Humidification Availability
  Outside temperature above which humidification is off            ___ °F
  Humidification available beginning month #                       __
  Humidification available ending month #                          __
  Humidification available during unoccupied cycle (Y/N)           _

Humidification Discharge Conditions
  Minimum relative humidity maintained (% RH)                      __ % RH

                         Humidification Plant Types
  0=None      1=Boiler      2=Electric Resistance        3=District Heat
```

B.3.7 Baseboard (SIBBDAT)

Building:______________ **System #**___

```
Energy Source for Baseboard
  Baseboard plant type (see codes below)                               _

Baseboard Availability
  Outside temperature above which baseboard is off                   ___ °F
  Baseboard available beginning month #                              __
  Baseboard available ending month #                                 __

Baseboard Control and Capacity
  Baseboard control type
    (1 = thermostatic   2 = reset by outside temperature)              _

Percent of design heating load satisfied at design winter            ___ %
Percent of design heating load satisfied at balance temp             ___ %

                              Baseboard Plant Types
    0=None       1=Boiler        2=Electric Resistance        3=District Heat
```

B.3.8 Fans (SIFANDAT)

Building:______________ **System #**___

```
Supply Fans
  Total supply fan power required (blank=default)                  ___  KW
    (or) Supply fan power per 1000 CFM                             ____ KW/1000 CFM
  Supply fan temperature rise (blank=default)                      ____ °F

Return Fans
  Total return fan power required (blank=default)                  ___  KW
    (or) Return fan power per 1000 CFM                             ____ KW/1000 CFM
  Return fan temperature rise (blank=default)                      ____ °F

  (VAV) Minimum percent of design air volume when heating          ___  %
  (VAV) Air volume control method                                  _
   (1=Variable Speed   2=Discharge Dampers   3=Inlet Vanes)

Fan Control Method (1=On Continuously  2=Cycles with load)
  Occupied cycle fan control method                                _
  Unoccupied cycle fan control method                              _
```

B.3.9 Outside Air Parameters (SIOACDAT) Building:______________ System #___

```
Occupied Cycle Only
  Outside air damper control method (see codes below)      _
  Minimum percent outside air intake                       ___ %
  Dry bulb switchover temperature                          ___ °F

Unoccupied Cycle Only
  Outside air damper control method (see codes below)      _
  Minimum percent outside air intake                       ___ %
  Dry bulb switchover temperature                          ___ °F

                    Outside Air Damper Control Methods
   1=No Outside Air     2=Fixed Dampers      3=Dry Bulb      4=Enthalpy
                                           (Economizer)    (Economizer)
```

B.3.10 Heat Pump Cooling (SIHPCDAT) Building:______________ System #___

```
Heat Pump Cooling Capacity (Total Cooling)
  Zonal total cooling capacity method                                _
    (1=Capacities Entered by Zone  2=Autosized)
    (if autosized)  Percent of design total load satisfied          ___ %

Heat Pump Cooling Capacity (Sensible Cooling)
  Zonal sensible cooling capacity method                             _
    (1=Capacities Entered by Zone  2=Autosized)
    (if autosized)  Percent of design sensible load satisfied       ___ %

Cooling Performance
  Design coefficient of performance                                 ____

Water Source Heat Pump Only
  Outside temperature at minimum fluid loop temperature             ___ °F
    Minimum fluid loop temperature                                  ___ °F
  Outside temperature at maximum fluid loop temperature             ___ °F
    Maximum fluid loop temperature                                  ___ °F
```

B.3.11 Heat Pump Heating (SIHPHDAT) Building:_____________ System #___

Heat Pump Heating Capacity		
Zonal heating capacity method	_	
(1=Capacities Entered by Zone 2=Autosized)		
(if autosized) Percent of max heat pump load satisfied	___	%
Air/Air Heat Pump Backup		
AAHP backup heating source	_	
(1=Furnace 2=Electric Resistance)		
Outside temperature below which backup heating is on	___	°F
Zonal electric resistance backup heating capacity method	_	
(1=Capacities Entered by Zone 2=Autosized)		
(if autosized) Percent of design heating load satisfied	___	%
Heating Performance		
Design heating coefficient of performance	____	

B.3.12 Furnace (SIFURDAT) Building:_____________ System #___

Furnace Energy Source		
Furnace fuel source (see codes below)	_	
Furnace Heat Output		
Furnace capacity (blank=autosize)	_____	KBTUH
(if autosized) Percent of design load satisfied	___	%
Furnace Efficiency		
Furnace efficiency at design load	___	%
Furnace Losses		
Losses as percent of design load (at design load)	___	%
Losses as percent of design load (at no load)	___	%
Pilot gas annual consumption	___	therms

Furnace Fuel Codes

1=Electric 2=Natural Gas 3=#2 Oil 4=#4 Oil 5=#6 Oil

B.3.13 Zone Air Parameters (SIAIRDAT) Building:______________ System #___

```
Zone Air Flow Sizing
  Zonal air volume method                                       _
    (1=Air Flows Entered by Zone     2=Autosized)
    (if autosized)  Percent of design default air flow          ___ %

Zone Fan Power
  Zonal fan power method                                        _
    (1=Zone Fan KW Entered by Zone    2=Autosized)
    (if autosized)  Percent of design default fan kw            ___ %
```

B.3.14 Direct Expansion Cooling (SIDXDAT) Building:______________ System #___

```
DX Cooling Capacity (Total Cooling)
  DX total cooling capacity (blank=autosized)                       ______ tons
    (if autosized)  Percent of design total load satisfied          ___    %

Cooling Performance
  Design coefficient of performance                                 ____
  Minimum unloading ratio (% of capacity)                           ___    %
  Minimum hot gas bypass ratio (% of capacity)                      ___    %

DX Condenser
  Condenser fan KW (blank=default)                                  ___    KW
  Outside temperature below which condenser fan is off              ___    °F
```

B.4 Plant Input Screens

All Plant Input screen data files have the extension .PIS. The file name is given above each screen.

These input forms are provided for your convenience in collecting data. Refer to Chapter 7 for a discussion of each of the plant input questions.

B.4.1 Energy Costs/Conversions (PIENEDAT) Building:______________

Fuel Type	Energy Units	Unit Cost $ / Unit	Conversion Factors (BTU/Unit) Site	Source
Electricity	KWH	_____	_____	_____
Natural Gas	Therms	_____	_____	_____
#2 Oil	Gallons	_____	_____	_____
#4 Oil	Gallons	_____	_____	_____
#6 Oil	Gallons	_____	_____	_____
Dist Heating	MBTU	_____	_____	_____
Dist Cooling	MBTU	_____	_____	_____

B.4.2 Miscellaneous Energy Consumption (PIMECDAT) Building:______________

Label for Miscellaneous Energy Consumption	Fuel Units (See Codes Below)	Annual Consumption in Energy Units
____________________	_	_____
____________________	_	_____
____________________	_	_____
____________________	_	_____
____________________	_	_____

Fuel Code	Fuel Type	Energy Units
1	Natural Gas	therms
2	Oil	gallons
3	Electricity	KWH
4	Dist Heating	MBTU
5	Dist Cooling	MBTU

B.4.3 Centrifugal Chiller (PICENDAT) **Building:**______________

	Type 1	Type 2	
Centrifugal Chiller Cooling Capacity			
Chiller cooling capacity per chiller (or 'NA')	_______	_______	tons
(or) Percent design load satisfied per chiller	___	___	%
Number of chillers of this capacity	_	_	
Cooling Performance			
Design coefficient of performance	_____	_____	
Minimum unloading ratio (% of capacity)	__	__	%
Minimum part load ratio (% of capacity)	__	__	%
Load management/operating method (1 = always on 2 = as needed)	_	_	
Chilled Water Parameters			
Chilled water temperature at design load	___	___	°F
Chilled water temperature at minimum load	____	____	°F
Chilled water flow (blank=autosized)	____	____	gpm
Chilled water pump kw (blank=autosized)	____	____	KW

B.4.4 Absorption Chiller (PIABCDAT) **Building:**______________

ASEAM2 PLANT INPUT
ABSORPTION CHILLER PLANT FILE:DEMO

	Type 1	Type 2	
Absorption Chiller Cooling Capacity			
Chiller cooling capacity per chiller (or 'NA')	_______	_______	tons
(or) Percent design load satisfied per chiller	___	___	%
Number of chillers of this capacity	_	_	
Heat input energy source (1=Boiler 2=Dist Heat)	_	_	
Cooling Performance			
Design coefficient of performance	_____	_____	
Minimum part load ratio (% of capacity)	__	__	%
Number of absorption stages	_	_	
Load management/operating method (1 = always on 2 = as needed)	_	_	
Chilled Water Parameters			
Chilled water temperature at design load	___	___	°F
Chilled water temperature at minimum load	____.	____	°F
Chilled water flow (blank=autosized)	____	____	gpm
Chilled water pump kw (blank=autosized)	____	____	KW

B.4.5 Double Bundle Chiller (PIDBCDAT)

Building:________

	Type 1	Type 2	
Double Bundle Chiller Cooling Capacity			
Chiller cooling capacity per chiller (or 'NA')	______	______	tons
(or) Percent design load satisfied per chiller	___	___	%
Number of chillers of this capacity	_	_	
Cooling Performance			
Design coefficient of performance	____	____	
Minimum unloading ratio (% of cap - clg mode)	__	__	%
Minimum unloading ratio (% of cap - htg mode)	__	__	%
Minimum part load ratio (% of capacity)	__	__	%
Load management/operating method (1 = always on 2 = as needed)	_	_	
Chilled Water Parameters			
Chilled water temperature at design load	____	____	°F
Chilled water temperature at minimum load	____	____	°F
Chilled water flow (blank=autosized)	____	____	gpm
Chilled water pump kw (blank=autosized)	___	___	KW
Heat Recovery Parameters			
Design heat recovery temperature	___	___	°F
Heat recovery backup (1=Boiler 2=Dist Htg)	_	_	

B.4.6 Reciprocating Chiller (PIRECDAT)

Building:______________

	Type 1	Type 2	
Reciprocating Chiller Cooling Capacity			
Chiller cooling capacity per chiller (or 'NA')	____	____	tons
(or) Percent design load satisfied per chiller	___	___	%
Number of chillers of this capacity	_	_	
Cooling Performance			
Design coefficient of performance	____	____	
Minimum unloading ratio (% of capacity)	__	__	%
Minimum part load ratio (% of capacity)	__	__	%
Load management/operating method (1 = always on 2 = as needed)	_	_	
Chilled Water Parameters			
Chilled water temperature at design load	____	____	°F
Chilled water temperature at minimum load	____	____	°F
Chilled water flow (blank=autosized)	____	____	gpm
Chilled water pump KW (blank=autosized)	___	___	KW

B.4.7 Cooling Tower (PITOWDAT) — Building:______________

Cooling Tower Heat Rejection Capacity		
Total heat rejection	______	tons
(or) Percent of design heat rejection load satisfied	___	%
Tower Performance		
Number of tower cells (blank=autosized)	_	
Fan KW per cell (blank=autosized)	___	KW
Number of fan speeds (1 or 2)	_	
Approach temperature	__	°F
Condenser Water Parameters		
Condenser water temperature at design load	___	°F
Condenser water temperature at minimum load	___	°F
Condenser water flow rate (blank=autosized)	___	gpm
Condenser water pump KW (blank=autosized)	___	KW

B.4.8 Domestic Hot Water (PIDHWDAT) — Building:______________

Domestic Hot Water Energy Source		
Domestic Hot Water Energy Source (0=None 1=Electric 2=Nat Gas 3=Oil 4=Boiler 5=District)	_	
(if oil) Oil Type (2 or 4 or 6)	_	
(if gas) Annual pilot consumption	___	therms
DHW Capacity and Usage		
Domestic Hot Water Heating Capacity (blank=autosized)	____	KBTUH
(if autosized) Peak hourly DHW usage	____	gal/hr
Average hourly DHW usage - occupied cycle	____	gal/hr
Average hourly DHW usage - unoccupied cycle	____	gal/hr
DHW Temperatures		
Domestic hot water supply temperature	___	°F
DHW inlet temperature - design summer	__	°F
DHW inlet temperature - design winter	__	°F
Circulating Pumps		
Circulating pump KW - occupied cycle	___	KW
Circulating pump KW - unoccupied cycle	___	KW
DHW Efficiency and Losses		
Design DHW heating efficiency	___	%
DHW losses - occupied cycle	______	BTUH
DHW losses - unoccupied cycle	______	BTUH

B.4.9 Boiler (PIBLRDAT)

Building:______________

Boiler Energy			
Boiler Energy Source	_	_	
(0=None 1=Electric 2=Nat Gas 3=Oil)			
(if oil) Oil type (2 or 4 or 6)	_	_	
(if gas) Annual pilot consumption	____	____	therms
Boiler Heating Capacity			
Boiler heating capacity (per boiler)	______	______	KBTUH
(or) % max heating load satisfied (per boiler)	___	___	%
Number of boilers with this capacity	_	_	
Load management/operation	_	_	
(1 = always on 2 = as needed)			
Boiler Performance			
Boiler efficiency method (1=user entered 2=calc)	_	_	
Design boiler efficiency	____	____	%
(if calc) Combustion air temperature	___	___	°F
(if calc) Stack temperature	___	___	°F
(if calc) Air-Fuel ratio	____	____	Lb/Lb
Minimum part load operating ratio (% of capacity)	__	__	%
Boiler pump KW (blank=autosized)	___	___	KW
Boiler losses - percent of capacity	__	__	%
Boiler losses - percent of load	__	__	%

B.5 NBSLCC Economic Input Forms

All NBSLCC economic input screen files have the extension .FIS.

B.5.1 Project Information (FIPROJDT)

```
NBSLCC INPUT -
LCC PROJECT DATA                                                 LCC FILE:
---------------------------------------------------------------------------
  Project Title                                                  ___________
  Study Period                                                   __     years
  Construction Period                                            __     years
  Base Year (e.g.1987)                                           ____
  Tax Status Code (see reference manual page 84)                 _____
    (1=for profit  2=owner-occupied  3=non-profit)
  Discount Rate Type (1=Real (non-profit only), 2=Nominal)       2____
  General Inflation Rate (%/Year Average over Study Period)      _____  %
  Discount Rate                                                  _____  %
  Marginal Federal Income Tax Rate                               _____  %
  Marginal State Income Tax Rate                                 _____  %
  Property Tax Rate                                              _____  %
  Capital Gains Adjustment Factor                                _____  %
  Depreciation Recapture Code (see reference manual page 91)     _
    (0=none  1=capital gain  2=ordinary income  3=combination)
  Depreciation Basis Adjustment Factor                           _____  %
  Sales Tax Rate                                                 _____  %
  DOE Region (for Default Energy Prices)                         __
  Building Type (1=Residential  2=Commercial  3=Industrial)       _
```

B.5.2 Capital Component (FICAPCDT)

```
NBSLCC INPUT -
CAPITAL COMPONENTS DATA FOR:                                     LCC FILE:
---------------------------------------------------------------------------
Capital Component Data (Use F4 to Delete this Component)         Item # 1
Component Name (or 'NA')                                         __________
Initial Cost of Component (dollars)                              _______
Percent Subject to Sales Tax                                     _____
Expected Component Life (Years - Use '999' for Land)             ___
Depreciation Method Code                                         _
  0 = no depreciation calculated
  1 = straight line
  2 = declining balance (accelerated)
  3 = sum of years digits
  4 = depreciation table (user entered)
Depreciation Life (years)                                        __
Depreciation Acceleration Rate (%) (Code 2 only)                 ___
Depreciation Salvage Value (Percent of Initial Cost)             ___
Additional First Year Depreciation Factor                        ___
Average Escalation Rate During Planning/Construction Period      ___
Average Escalation Rate During Occupancy                         ___
Property Tax Assessment Factor (%)                               ___
Tax Credit Rate (Percent of Initial Cost)                        ___
Resale Value Factor (Percent of Initial Cost)                    ___
```

B.5.3 Cost Phasing (Screen done in PLCCDATA)

```
NBSLCC INPUT
COST PHASING SCHEDULE BY YEAR OF PLANNING/CONSTRUCTION PERIOD AND AT OCCUPANCY
------------------------------------------------------------------------------

Capital Component # 1  -

Enter Percentage of Cost for Each Year

Planning/Construction Year 1   ( 1987 )         ____
Planning/Construction Year 2   ( 1988 )         ____
Planning/Construction Year 3   ( 1989 )         ____
At Occupancy                   ( 1990 )       100.00
```

B.5.4 Capital Component Replacement (FIREPLDT)

```
NBSLCC INPUT -
REPLACEMENTS TO CAPITAL COMPONENTS                              LCC FILE:
------------------------------------------------------------------------------

Capital Component # 1  -

                                          Replacements to Capital Component
                                             1         2         3         4
                                         --------- --------- --------- ---------
Year of Replacement (or 'NA')             __        __        __        __
  (from occupancy year e.g. '2')
Init Cost of Replacement (Unadjusted)    _________ _________ _________ _________
Percent Subject to Sales Tax             ____      ____      ____      ____
Expected Replacement Life (years)        __        __        __        __
Depr Salv Val Factor (% of repl cost)    ____      ____      ____      ____
Depreciation Life (years)                __        __        __        __
Resale Value (% of replacement cost)     ____      ____      ____      ____
Property Tax Assessment Factor (%)       ____      ____      ____      ____
```

B.5.5 Depreciation (FIDEPRDT)

```
NBSLCC INPUT -

Year (Use F6 to Copy Last Capital Component Depreciation Table)
Capital Component # 1  -

     Year            Year            Year            Year            Year
        1 _____        11 _____        21 _____        31 _____        41 _____
        2 _____        12 _____        22 _____        32 _____        42 _____
        3 _____        13 _____        23 _____        33 _____        43 _____
        4 _____        14 _____        24 _____        34 _____        44 _____
        5 _____        15 _____        25 _____        35 _____        45 _____
        6 _____        16 _____        26 _____        36 _____        46 _____
        7 _____        17 _____        27 _____        37 _____        47 _____
        8 _____        18 _____        28 _____        38 _____        48 _____
        9 _____        19 _____        29 _____        39 _____        49 _____
       10 _____        20 _____        30 _____        40 _____        50 _____
```

B.5.6 Mortgage (FIMORTDT)

```
NBSLCC INPUT -
MORTGAGE LOAN                                                  LCC FILE:
---------------------------------------------------------------------------

                                             Constrt         Permanent Loans
                                              Loan       1       2       3       4
                                             -------  ------- ------- ------- -------
% of Total Cost Borrowed (or 'NA')            _____    _____   _____   _____   _____

Loan Type Code                                 _        _       _       _       _
 1=fully amortized (equal payments)
 2=interest only (principal at end)
 3=interest and principal at end

Annual Interest Rate (%)                      _____    _____   _____   _____   _____
Life of Loan (years)                           __       __      __      __      __
Number of Payments per Year                    __       __      __      __      __
Points Paid (% of loan amount)                _____    _____   _____   _____   _____
```

B.5.7 Operational and Maintenance (FIOMCSDT)

```
NBSLCC INPUT -
OPERATING AND MAINTENANCE COSTS                              LCC FILE:
------------------------------------------------------------------------
Annually Recurring Costs
 Annual Recurring Cost (Base-Year Dollars)                     ______
 Average Annual Rate of Increase (%)                           ____
Non-Annually Recurring Costs
 Number of Non-Annually Recurring Costs                        __
 Average Annual Rate of Increase (%)                           ____

            Non-Annually Recurring Costs (Base Year Dollars)
           (Note: Years begin with Occupancy; e.g. 1,2,...50)
------------------------------------------------------------------------
No Year  Amt     No Year  Amt     No Year  Amt     No Year  Amt     No Year  Amt
 1  __  _____    11  __  _____    21  __  _____    31  __  _____    41  __  _____
 2  __  _____    12  __  _____    22  __  _____    32  __  _____    42  __  _____
 3  __  _____    13  __  _____    23  __  _____    33  __  _____    43  __  _____
 4  __  _____    14  __  _____    24  __  _____    34  __  _____    44  __  _____
 5  __  _____    15  __  _____    25  __  _____    35  __  _____    45  __  _____
 6  __  _____    16  __  _____    26  __  _____    36  __  _____    46  __  _____
 7  __  _____    17  __  _____    27  __  _____    37  __  _____    47  __  _____
 8  __  _____    18  __  _____    28  __  _____    38  __  _____    48  __  _____
 9  __  _____    19  __  _____    29  __  _____    39  __  _____    49  __  _____
10  __  _____    20  __  _____    30  __  _____    40  __  _____    50  __  _____
```

B.5.8 Energy Cost (FIENECDT)

```
NBSLCC INPUT -
ENERGY COST DATA                                             LCC FILE:
------------------------------------------------------------------------
Number of Energy Types                                         _
Cumulative General Inflation from Mid-1987 to Date (%)         ____
  (For DOE Escalation Rates ONLY)

                                                      Energy Type
                                                  1         2         3
                                              --------- --------- ---------
Energy Type Code                              _         _         _
 1=Electricity        2=Distillate Fuel Oil
 3=Residual Fuel Oil         4=Natural Gas
 5=Liquified Petroleum Gas (LPG)  6 = Coal

Annual Consumption (MBTU)                     ______    ______    ______
Price per MBTU (Use F8 for DOE default)       _____     _____     _____
Demand (or other) Charge                      _____     _____     _____
Price Escalation Method                       _         _         _
 1 = User Entered
 2 = Defaulted
Average Annual Rate of Increase (%)           ____      ____      ____
  During Plan/Construction
```

B.5.9 Energy Escalation (FIENEEDT)

```
NBSLCC INPUT -
ENERGY ESCALATION                                                    LCC FILE:
--------------------------------------------------------------------------------
Fuel Type 1   -  Electricity

Number of Discrete
Time Intervals   __

 # Dur Annual    # Dur Annual    # Dur Annual    # Dur Annual    # Dur Annual
   Yrs Rate %      Yrs Rate %      Yrs Rate %      Yrs Rate %      Yrs Rate %
 ------------    ------------    ------------    ------------    ------------
 1 __  ______   11 __  ______   21 __  ______   31 __  ______   41 __  ______
 2 __  ______   12 __  ______   22 __  ______   32 __  ______   42 __  ______
 3 __  ______   13 __  ______   23 __  ______   33 __  ______   43 __  ______
 4 __  ______   14 __  ______   24 __  ______   34 __  ______   44 __  ______
 5 __  ______   15 __  ______   25 __  ______   35 __  ______   45 __  ______
 6 __  ______   16 __  ______   26 __  ______   36 __  ______   46 __  ______
 7 __  ______   17 __  ______   27 __  ______   37 __  ______   47 __  ______
 8 __  ______   18 __  ______   28 __  ______   38 __  ______   48 __  ______
 9 __  ______   19 __  ______   29 __  ______   39 __  ______   49 __  ______
10 __  ______   20 __  ______   30 __  ______   40 __  ______   50 __  ______
```

B.6 FBLCC Economic Input Forms

All FBLCC economic input screen data files have the extension .FIS. The file name is given above each screen.

B.6.1 Project Information (FLCCPROJ)

```
FBLCC INPUT -
PROJECT INFORMATION                                          LCC FILE:
--------------------------------------------------------------------------
Section 1. Project Title:                                       __________
-------------------------


Section 2.  Basic LCC Analysis Assumptions:
-------------------------------------------

LCC Analysis Type                                                    _
  1 = Energy Conservation or Renewable Energy Projects (NBS 135)
  2 = Non-Energy Related Projects (OMB Circular A-94)

Study Period (Years)                                                 __
Occupancy Year (e.g. 1987)                                           ____
DOE Region (1-11)                                                    __
Building Type                                                        _
  1 = Residental  2 = Commercial  3 = Industrial
```

B.6.2 Capital Component Data (FLCCCAPC)

```
FBLCC INPUT
CAPITAL COMPONENTS DATA                                      LCC FILE:
--------------------------------------------------------------------------
Capital Component Data (Use F4 to Delete THIS Component)    Item # 1

Component Name (or 'NA')                                    __________
Initial Cost of Component (dollars)                         ______
Initial Conservation-Related Cost                           ______
Expected Component Life (Years) - Use '999' for Land        ___
Average Escalation Rate During Planning/Construction Period ___
Average Escalation Rate During Occupancy                    ___
Resale Value Factor (Percent of Initial Cost)               ___
```

B.6.3 Cost Phasing (Screen done in FLCCDATA)

```
FBLCC INPUT
COST PHASING SCHEDULE BY YEAR OF PLANNING/CONSTRUCTION PERIOD AND AT OCCUPANCY
------------------------------------------------------------------------------

Capital Component # 1  - SAMPLE

Enter Percentage of Cost for Each Year

Planning/Construction Year 1   ( 1987 )       _____
Planning/Construction Year 2   ( 1988 )       _____
At Occupancy                   ( 1989 )      100.00
```

B.6.4 Capital Components Replacement (FLCCREPL)

```
FBLCC INPUT
REPLACEMENTS TO CAPITAL COMPONENTS                                 LCC FILE:
------------------------------------------------------------------------------

Capital Component # 1  - SAMPLE

                                              Replacements to Capital Component
                                                 1       2       3       4
                                              ------- ------- ------- -------
Year of Replacement (from occupancy or 'NA')  __      __      __      __
Init Cost of Replacement (unadjusted)         _______ _______ _______ _______
Expected Replacement Life (years)             __      __      __      __
Resale Value (% of replacement cost)          ____    ____    ____    ____
```

B.6.5 Operational & Maintenance (FIOMCSDT)

```
FBLCC INPUT
OPERATING AND MAINTENANCE COSTS                                  LCC FILE:
--------------------------------------------------------------------------------
Annually Recurring Costs
 Annual Recurring Cost (Base-Year Dollars)                         ________
 Average Annual Rate of Increase (%)                               _____
Non-Annually Recurring Costs
 Number of Non-Annually Recurring Costs                            __
 Average Annual Rate of Increase (%)                               _____

              Non-Annually Recurring Costs (Base Year Dollars)
             (Note: Years begin with Occupancy; e.g. 1,2,...50)
--------------------------------------------------------------------------------
No Year  Amt     No Year  Amt     No Year  Amt     No Year  Amt     No Year  Amt
 1  __  ______   11  __  ______   21  __  ______   31  __  ______   41  __  ______
 2  __  ______   12  __  ______   22  __  ______   32  __  ______   42  __  ______
 3  __  ______   13  __  ______   23  __  ______   33  __  ______   43  __  ______
 4  __  ______   14  __  ______   24  __  ______   34  __  ______   44  __  ______
 5  __  ______   15  __  ______   25  __  ______   35  __  ______   45  __  ______
 6  __  ______   16  __  ______   26  __  ______   36  __  ______   46  __  ______
 7  __  ______   17  __  ______   27  __  ______   37  __  ______   47  __  ______
 8  __  ______   18  __  ______   28  __  ______   38  __  ______   48  __  ______
 9  __  ______   19  __  ______   29  __  ______   39  __  ______   49  __  ______
10  __  ______   20  __  ______   30  __  ______   40  __  ______   50  __  ______
```

B.6.6 Energy Cost (FIENECDT)

```
FBLCC INPUT
ENERGY COST DATA                                                 LCC FILE:
--------------------------------------------------------------------------------
Number of Energy Types                                              _
Cumulative General Inflation from Mid-1987 to Date (%)              _____
  (For DOE Escalation Rates ONLY)

                                                        Energy Type
                                                   1         2         3
                                               --------- --------- ---------
Energy Type Code                               _         _         _
 1=Electricity        2=Distillate Fuel Oil
 3=Residual Fuel Oil          4=Natural Gas
 5=Liquified Petroleum Gas (LPG)   6 = Coal

Annual Consumption (MBTU)                      ________  ________  ________
Price per MBTU (Use F8 for DOE default)        ______    ______    ______
Demand (or other) Charge                       ______    ______    ______
Price Escalation Method                        _         _         _
 1 = User Entered
 2 = Defaulted
Average Annual Rate of Increase (%)            _____     _____     _____
  During Plan/Construction
```

B.6.7 Energy Escalation (FIENEEDT)

```
FBLCC INPUT
ENERGY ESCALATION                                             LCC FILE:
--------------------------------------------------------------------------------
Fuel Type 1   -  Electricity

Number of Discrete
Time Intervals    __

 # Dur Annual    # Dur Annual    # Dur Annual    # Dur Annual    # Dur Annual
   Yrs Rate %      Yrs Rate %      Yrs Rate %      Yrs Rate %      Yrs Rate %
 ------------    ------------    ------------    ------------    ------------
 1  __  ______   11  __  ______  21  __  ______  31  __  ______  41  __  ______
 2  __  ______   12  __  ______  22  __  ______  32  __  ______  42  __  ______
 3  __  ______   13  __  ______  23  __  ______  33  __  ______  43  __  ______
 4  __  ______   14  __  ______  24  __  ______  34  __  ______  44  __  ______
 5  __  ______   15  __  ______  25  __  ______  35  __  ______  45  __  ______
 6  __  ______   16  __  ______  26  __  ______  36  __  ______  46  __  ______
 7  __  ______   17  __  ______  27  __  ______  37  __  ______  47  __  ______
 8  __  ______   18  __  ______  28  __  ______  38  __  ______  48  __  ______
 9  __  ______   19  __  ______  29  __  ______  39  __  ______  49  __  ______
10  __  ______   20  __  ______  30  __  ______  40  __  ______  50  __  ______
```

B.7 Abbreviated Input Forms

The following pages contain an abbreviated listing of the input questions for the loads, systems, plant, NBSLCC and FBLCC input programs.

The input forms are also found on Source Diskette #2 under the following filenames.

LDINPUT.FRM	-	Loads Input
SYSINPUT.FRM	-	Systems Input
PLTINPUT.FRM	-	Plant Input
FBLCCINP.FRM	-	FBLCC Input
NBSLCINP.FRM	-	NBSLCC Input

ASEAM2.1 LOADS INPUT FORMS (ABBREVIATED)

Bldg/Project	Building File Name	______
Bldg/Project	Building Name	______
Bldg/Project	Project Number	______
Bldg/Project	Building Address	______
Bldg/Project	Building Type	______
Bldg/Project	Building Gross Floor Area	______ ft²
Bldg/Project	Building Net Conditioned Area	______ ft²
Bldg/Project	Number of Zones	__

Bldg/Project	North Latitude (Use '-' for South Lat)	______ deg
Bldg/Project	West Longitude (Use '-' for East Long)	______ deg
Bldg/Project	Typical weekday occupancy starting hour	__
Bldg/Project	Typical weekday operating hours per day	__
Bldg/Project	Summer thermostat schedule beginning month number	__
Bldg/Project	Summer thermostat schedule ending month number	__
Bldg/Project	Time Zone Number	__
Bldg/Project	Daylight Savings Time Used (Y/N)	_

Bldg/Project	Operating Schedules	Weekdays	from	____	to	____
Bldg/Project	Operating Schedules	Saturdays ...	from	____	to	____
Bldg/Project	Operating Schedules	Sundays	from	____	to	____

(The following two screens apply to the entire building)

Shading	Window Model Name (or 'NA')	______	______	______
Shading	Window Width	______	______	______
Shading	Window Height	______	______	______
Shading	Overhang Depth	______	______	______
Shading	Top of Window to Overhang	______	______	______
Shading	Overhang extension beyond left edge of window	______	______	______
Shading	Overhang extension beyond right edge of window	______	______	______
Shading	Depth of vert projection at end of overhang	______	______	______
Shading	Depth of left fin	______	______	______
Shading	Left fin extension above top of window	______	______	______
Shading	Distance from left edge of window to left fin	______	______	______
Shading	Dist from left fin bottom to bottom of window	______	______	______
Shading	Depth of right fin	______	______	______
Shading	Right fin extension above top of window	______	______	______
Shading	Dist from right edge of window to right fin	______	______	______
Shading	Dist from right fin bottom to bottom of window	______	______	______

Month Sch	Month	Mon Sch 1	Mon Sch 2	Mon Sch 3	Mon Sch 4
Month Sch	January	__	__	__	__
Month Sch	February	__	__	__	__
Month Sch	March	__	__	__	__
Month Sch	April	__	__	__	__
Month Sch	May	__	__	__	__
Month Sch	June	__	__	__	__
Month Sch	July	__	__	__	__
Month Sch	August	__	__	__	__
Month Sch	September	__	__	__	__
Month Sch	October	__	__	__	__
Month Sch	November	__	__	__	__
Month Sch	December	__	__	__	__

ASEAM2 LOADS INPUT FORMS (ABBREVIATED) Zone # ____

Zone	Zone label	________			
Zone	Zone function (Opt)			________	
Zone	Zone area			________	ft²
Zone	Zone volume			________	ft3
Zone	(or) Floor to ceiling height			__ ft	
Zone	Summer occupied temperature setpoint			____ °F	
Zone	Winter occupied temperature setpoint			____ °F	
Zone	Winter unoccupied temperature setpoint			____ °F	
Lighting	Function name (or 'NA')	________	________	________	________
Lighting	Average function area (ft²)	________	________	________	________
Lighting	Installed watts/ft²	_____	_____	_____	_____
Lighting	(times) Percent of function area	___	___	___	___
Lighting	(or) Total installed watts	________	________	________	________
Lighting	Daylighting (Y/N)	_	_	_	_
Lighting	Controlite filename (if appl)	________	________	________	________
Lighting	Lighting system type (Opt)	________	________	________	________
Lighting	Percent light heat to space (%)	___	___	___	___
Lighting	'A' classification	___	___	___	___
Lighting	'B' classification	_	_	_	_
Lighting	Diversity Factor Occupied	___	___	___	___
Lighting	Diversity Factor Unoccupied	___	___	___	___
Lighting	Monthly Diversity Factor Table #	_	_	_	_
Daylighting	Function name (or 'NA')	________	________	________	________
Daylighting	Window orientation (N,NW,etc)	__	__	__	__
Daylighting	Ground reflectance (%)	___	___	___	___
Daylighting	Typical room window area (ft2)	_____	_____	_____	_____
Daylighting	Glass visible transmittance (%)	___	___	___	___
Daylighting	Room depth from window (ft)	__	__	__	__
Daylighting	Room length (ft)	__	__	__	__
Daylighting	Ceiling height (ft)	__	__	__	__
Daylighting	Wall reflectance (%)	___	___	___	___
Daylighting	Present footcandles in space	___	___	___	___
Daylighting	Design footcandles for space	___	___	___	___
Daylighting	Sensor location	_	_	_	_
Daylighting	Percent of lights controlled	___	___	___	___
Daylighting	Control type ('D'im or 'S'tep)	_	_	_	_
Dayl-Controls	Function name (or 'NA')	________	________	________	________
Dayl-Controls	For Dimming Control Only				
Dayl-Controls	Minimum FC maintained by lights	___	___	___	___
Dayl-Controls	% of total power at min FC (%)	___	___	___	___
Dayl-Controls	For Stepped Control Only				
Dayl-Controls	Number of Steps (max=4)	_	_	_	_
Dayl-Controls	Step 1 artificial FC	___	___	___	___
Dayl-Controls	Step 1 lighting watts	___	___	___	___
Dayl-Controls	Step 2 artificial FC	___	___	___	___
Dayl-Controls	Step 2 lighting watts	___	___	___	___
Dayl-Controls	Step 3 artificial FC	___	___	___	___
Dayl-Controls	Step 3 lighting watts	___	___	___	___
Dayl-Controls	Step 4 artificial FC	___	___	___	___
Dayl-Controls	Step 4 lighting watts	___	___	___	___

People	Number of people in zone		____		
People	(or) Square feet per person		____		
People	BTUH load per person	Sensible	____	Latent	____
People	Diversity Factor Occupied ___	Unoccupied	____	Table #	____

ASEAM2 LOADS INPUT FORMS (ABBREVIATED)   Zone # ____

Misc Elect	Electric equipment name (or 'NA')		________	________	
Misc Elect	Installed watts/ft²		_____	_____	
Misc Elect	(times) Percent of zone area		___	___	
Misc Elect	(or) Total installed watts		_______	_______	
Misc Elect	Hooded (Y/N)		_	_	
Misc Elect	Diversity Factor Occupied		___	___	
Misc Elect	Diversity Factor Unoccupied		___	___	
Misc Elect	Monthly Diversity Factor Table Number		_	_	
Misc Sens	Load source name (or 'NA')		________	________	
Misc Sens	Installed BTUH/ft²		_____	_____	
Misc Sens	(times) Percent of zone area		___	___	
Misc Sens	(or) Total installed BTUH		_____	_____	
Misc Sens	Hooded (Y/N)		_	_	
Misc Sens	Diversity Factor Occupied		___	___	
Misc Sens	Diversity Factor Unoccupied		___	___	
Misc Sens	Monthly Diversity Factor Table Number		_	_	
Wall	Name (or 'NA')	________	________	________	________
Wall	Wall Orient (N,NE,etc)	__	__	__	__
Wall	Area (ft²)	______	______	______	______
Wall	U-Factor (BTUH/ft²-°)	_____	_____	_____	_____
Wall	Wall Construction Group	_	_	_	_
Wall	Color Correction	___	___	___	___
Roof	Name (or 'NA')	________	________		
Roof	Area (ft²)	______	______		
Roof	U-Factor (BTUH/ft²-°)	_____	_____		
Roof	Roof Construction Code	__	__		
Roof	Color Correction	___	___		
Roof	Susp Ceil Plenum (Y/N)	_	_		
Window	Name (or 'NA')	________	________	________	________
Window	Window orient (N,NE,etc)	__	__	__	__
Window	Fenestration area (ft²)	______	______	______	______
Window	Shading coefficient	___	___	___	___
Window	U-Factor (BTUH/ft²-°)	____	____	____	____
Window	Space mass code	_	_	_	_
Window	Crack length (lin ft)	______	______	______	______
Window	Leakage coefficient	__	__	__	__
Window	Window shading model #	_	_	_	_
Window	Percent window area	___	___	___	___
Door	Name (or 'NA')	________	________		
Door	Area (ft²)	______	_____		
Door	U-Factor (BTUH/ft²-°)	_____	_____		
Door	Crack length (lin ft)	______	_____		
Door	Leakage coefficient	___	___		
Infiltration	Occupied air change rate	____	air changes per hour		
Infiltration	Unoccupied air change rate	____	air changes per hour		
Misc Conduct	Name (or 'NA')		________	________	
Misc Conduct	Area (ft²)		______	______	
Misc Conduct	U-Factor (BTUH/ft²-°)		_____	_____	
Misc Conduct	Reference temperature at design summer (°F)		_____	_____	
Misc Conduct	Reference temperature at design winter (°F)		_____	_____	

ASEAM2 SYSTEMS INPUT FORM (ABBREVIATED)

Total number of systems __

System #	System Label	System Type
1	______________________________	__
2	______________________________	__
3	______________________________	__
4	______________________________	__
5	______________________________	__
6	______________________________	__
7	______________________________	__
8	______________________________	__
9	______________________________	__
10	______________________________	__

System Types

1=DDMZ 2=CVRH 3=VAVR 4=CBVAV 5=SZRH 6=FCU 7=WSHP 8=AAHP
9=BB 10=FURN 11=UH 12=HV 13=WAC

Zone Number	Zone Label	Heating Cooling System #	Heating ONLY System #	Cooling ONLY System #
	NOTE - THE ZONE NUMBERS AND LABELS (AS DEFINED IN LOADS INPUT) WILL BE PRINTED HERE	__	__	__
		__	__	__
		__	__	__
		__	__	__
		__	__	__
		__	__	__
		__	__	__
		__	__	__
		__	__	__
		__	__	__

ASEAM2 SYSTEMS INPUT FORM (ABBREVIATED) System # ___

Heading coil plant type (Use Codes Below) _
0=None 1=Boiler 2=Elect Resist 3=Dist Heat 4=DB Chiller 5=Furn
Outside temperature above which heating is off ___ °F
Heating available beginning month # __
Heating available ending month # __
Design heating coil discharge temperature ___ °F
Discriminator Control (Y/N) (DDMZ ONLY) _
Outside temperature at maximum hot deck temperature (DDMZ ONLY) ___ °F
Maximum hot deck temperature (DDMZ ONLY) ___ °F
Outside temperature at minimum hot deck temperature (DDMZ ONLY) ___ °F
Minimum hot deck temperature (DDMZ ONLY) ___ °F

Cooling coil plant type (see codes below) _
0=None 1=DX 2=Centrifugal 3=Absorption 4=District Cooling
5=Double Bundle 6=Cooling Tower (WSHP only) 7=Reciprocating
Outside temperature below which cooling is off ___ °F
Cooling available beginning month # __
Cooling available ending month # __
Design cooling coil discharge temperature ___ °F
Discriminator control (Y/N) _
Maximum cooling coil discharge temperature ___ °F

Preheat coil plant type (Use Heating Codes 0 - 3) _
Outside temperature above which preheat is off ___ °F
Preheat available beginning month # __
Preheat available ending month # __
Design preheat coil discharge temperature ___ °F

Humidification plant type (Use Heating Codes 0 - 3) _
Outside temperature above which humidification is off ___ °F
Humidification available beginning month # __
Humidification available ending month # __
Humidification available during unoccupied cycle (Y/N) _
Minimum relative humidity maintained __ % RH

Baseboard plant type (Use Heating Codes 0 - 3) _
Outside temperature above which baseboard is off ___ °F
Baseboard available beginning month # __
Baseboard available ending month # __
Baseboard control type (1=thermostatic 2=OA reset) _
Percent of design heating load satisfied at design winter ___ %
Percent of design heating load satisfied at balance temp ___ %

Total supply fan power required (blank=default) ___ KW
(or) Supply fan power per 1000 CFM ____ KW/KCFM
Supply fan temperature rise (blank=default) ____ °F
Total return fan power required (blank=default) ___ KW
(or) Return fan power per 1000 CFM ____ KW/KCFM
Return fan temperature rise (blank=default) ____ °F
(VAV) Minimum percent of design air volume when heating ___ %
(VAV) Air volume control method (1=Speed 2=Discharge 3=Inlet) _
Occupied cycle fan control method (1=On Continuously 2=Cycles) _
Unoccupied cycle fan control method (1=On Continuously 2=Cycles) _

	Occup	Unocc
Outside air damper control method (see codes below)	_	_
1=No Outside Air 2=Fixed Dampers 3=Dry Bulb 4=Enthalpy		
Minimum percent outside air intake	___ %	___ %
Dry bulb switchover temperature	___ °F	___ °F

ASEAM2 SYSTEMS INPUT FORM (ABBREVIATED) System # ____

(Heat Pump and Window Air Conditioner only)
Zonal total cooling capacity method (1=User Entered 2=Autosized) _
(if autosized) Percent of design total load satisfied ___ %
Zonal sensible cooling capacity method (1=User Entered 2=Autosized) _
(if autosized) Percent of design sensible load satisfied ___ %
Design coefficient of performance ____
Outside temperature at minimum fluid loop temperature ___ °F
Minimum fluid loop temperature ___ °F
Outside temperature at maximum fluid loop temperature ___ °F
Maximum fluid loop temperature ___ °F

Zonal heating capacity method (1=User Entered 2=Autosized) _
(if autosized) Percent of max heat pump load satisfied ___ %
AAHP backup heating source (1=Furnace 2=Electric Resistance) _
Outside temperature below which backup heating is on ___ °F
Zonal electric resistance backup heating capacity method _
(1=Capacities Entered by Zone 2=Autosized)
(if autosized) Percent of design heating load satisfied ___ %
Design heating coefficient of performance ____

Furnace fuel source (see codes below) _
1=Electric 2=Natural Gas 3=#2 Oil 4=#4 Oil 5=#6 Oil
Furnace capacity (blank=autosize) _____ KBTUH
(if autosized) Percent of design load satisfied ___ %
Furnace efficiency at design load ___ %
Losses as percent of design load (at design load) ___ %
Losses as percent of design load (at no load) ___ %
Pilot gas annual consumption ___ therms

Zonal air volume method (1=User Entered 2=Autosized) _
(if autosized) Percent of design default air flow ___ %
Zonal fan power method (1=User Entered 2=Autosized) _
(if autosized) Percent of design default fan KW ___ %

DX total cooling capacity (blank=autosized) _____ tons
(if autosized) Percent of design total load satisfied ___ %
Design coefficient of performance ____
Minimum unloading ratio (% of capacity) ___ %
Minimum hot gas bypass ratio (% of capacity) ___ %
Condenser fan KW (blank=default) ___ KW
Outside temperature below which condenser fan is off ___ °F

Loads Zone #	Zone Name or Label	Zone CFM	Zone Fan KW	Zone Tot Clg Cap (Tons)	Zone Sen Clg Cap (Tons)	Zone HP Htg Cap (Tons)	Zone HP Bkup Htg Cap (KW)
NOTE - THE ZONE NUMBER AND LABEL FOR EACH ZONE ASSIGNED TO THIS SYSTEM IS PRINTED HERE		____	____	____	____	____	____
		____	____	____	____	____	____
		____	____	____	____	____	____
		____	____	____	____	____	____
		____	____	____	____	____	____
		____	____	____	____	____	____
		____	____	____	____	____	____
		____	____	____	____	____	____
		____	____	____	____	____	____
		____	____	____	____	____	____

ASEAM2 PLANT INPUT FORMS (ABBREVIATED)

Fuel Type	Energy Units	Unit Cost \$ / Unit	Conversion Factors (BTU/Unit) Site	Source
Electricity	KWH	____	____	____
Natural Gas	Therms	____	____	____
#2 Oil	Gallons	____	____	____
#4 Oil	Gallons	____	____	____
#6 Oil	Gallons	____	____	____
Dist Heating	MBTU	____	____	____
Dist Cooling	MBTU	____	____	____

Label for Miscellaneous Energy Consumption	Fuel Units (See Codes Below)	Annual Consumption in Energy Units
________________	_	________
________________	_	________
________________	_	________
________________	_	________
________________	_	________

Fuel Code	Fuel Type	Energy Units
1	Natural Gas	therms
2	Oil	gallons
3	Electricity	KWH
4	Dist Heating	MBTU
5	Dist Cooling	MBTU

ASEAM2 PLANT INPUT FORMS (ABBREVIATED)

	Type 1	Type 2	
Centrifugal chiller cooling capacity (per chiller)	______	______	tons
(or) Percent design load satisfied per chiller	___	___	%
Number of chillers of this capacity	_	_	
Design coefficient of performance	____	____	
Minimum unloading ratio (% of capacity)	__	__	%
Minimum part load ratio (% of capacity)	__	__	%
Load management/operation (1=always on 2=as needed)	_	_	
Chilled water temperature at design load	___	___	°F
Chilled water temperature at minimum load	____	____	°F
Chilled water flow (blank=autosized)	____	____	gpm
Chilled water pump KW (blank=autosized)	____	____	KW

	Type 1	Type 2	
Absorption chiller cooling capacity (per chiller)	______	______	tons
(or) Percent design load satisfied per chiller	___	___	%
Number of chillers of this capacity	_	_	
Heat input energy source (1=Boiler 2=Dist Heat)	_	_	
Design coefficient of performance	____	____	
Minimum part load ratio (% of capacity)	__	__	%
Number of absorption stages	_	_	
Load management/operation (1=always on 2=as needed)	_	_	
Chilled water temperature at design load	___	___	°F
Chilled water temperature at minimum load	____	____	°F
Chilled water flow (blank=autosized)	____	____	gpm
Chilled water pump KW (blank=autosized)	____	____	KW

	Type 1	Type 2	
Double Bundle chiller cooling capacity (per chiller)	______	______	tons
(or) Percent design load satisfied per chiller	___	___	%
Number of chillers of this capacity	_	_	
Design coefficient of performance	____	____	
Minimum unloading ratio (% of cap - clg mode)	__	__	%
Minimum unloading ratio (% of cap - htg mode)	__	__	%
Minimum part load ratio (% of capacity)	__	__	%
Load management/operation (1=always on 2=as needed)	_	_	
Chilled water temperature at design load	____	____	°F
Chilled water temperature at minimum load	____	____	°F
Chilled water flow (blank=autosized)	____	____	gpm
Chilled water pump KW (blank=autosized)	___	___	KW
Design heat recovery temperature	___	___	°F
Heat recovery backup (1=Boiler 2=Dist Htg)	_	_	

	Type 1	Type 2	
Reciprocating chiller cooling capacity (per chiller)	____	____	tons
(or) Percent design load satisfied per chiller	___	___	%
Number of chillers of this capacity	_	_	
Design coefficient of performance	____	____	
Minimum unloading ratio (% of capacity)	__	__	%
Minimum part load ratio (% of capacity)	__	__	%
Load management/operation (1=always on 2=as needed)	_	_	
Chilled water temperature at design load	____	____	°F
Chilled water temperature at minimum load	____	____	°F
Chilled water flow (blank=autosized)	____	____	gpm
Chilled water pump KW (blank=autosized)	___	___	KW

ASEAM2 PLANT INPUT FORMS (ABBREVIATED)

Cooling tower total heat rejection capacity	_____	tons
(or) Percent of design heat rejection load satisfied	___	%
Number of tower cells (blank=autosized)	_	
Fan KW per cell (blank=autosized)	___	KW
Number of fan speeds (1 or 2)	_	
Approach temperature	__	°F
Condenser water temperature at design load	___	°F
Condenser water temperature at minimum load	___	°F
Condenser water flow rate (blank=autosized)	___	gpm
Condenser water pump KW (blank=autosized)	___	KW

DHW Energy Source (0=None 1=Elec 2=Gas 3=Oil 4=Blr 5=Dist)	_	
(if oil) Oil Type (2 or 4 or 6)	_	
(if gas) Annual pilot consumption	___	therms
Domestic Hot Water Heating Capacity (blank=autosized)	____	KBTUH
(if autosized) Peak hourly DHW usage	____	gal/hour
Average hourly DHW usage - occupied cycle	____	gal/hour
Average hourly DHW usage - unoccupied cycle	____	gal/hour
Domestic hot water supply temperature	___	°F
DHW inlet temperature - design summer	__	°F
DHW inlet temperature - design winter	__	°F
Circulating pump KW - occupied cycle	___	KW
Circulating pump KW - unoccupied cycle	___	KW
Design DHW heating efficiency	___	%
DHW losses - occupied cycle	_____	BTUH
DHW losses - unoccupied cycle	_____	BTUH

	Type 1	Type 2	
Boiler Energy Source (1=Elect 2=Nat Gas 3=Oil)	_	_	
(if oil) Oil type (2 or 4 or 6)	_	_	
(if gas) Annual pilot consumption	____	____	therms
Boiler heating capacity (per boiler)	______	______	KBTUH
(or) % max heating load satisfied (per boiler)	___	___	%
Number of boilers with this capacity	_	_	
Load management/operation (1=always on 2=as needed)	_	_	
Boiler efficiency method (1=user entered 2=calc)	_	_	
Design boiler efficiency (if user entered)	____	____	%
(if calc) Combustion air temperature	___	___	°F
(if calc) Stack temperature	___	___	°F
(if calc) Air-Fuel ratio	____	____	Lb/Lb
Minimum part load operating ratio (% of capacity)	__	__	%
Boiler pump KW (blank=autosized)	___	___	KW
Boiler losses - percent of capacity	__	__	%
Boiler losses - percent of load	__	__	%

FBLCC Input Forms

PROJECT INFORMATION

Project Title: ______________

LCC Analysis Type _
  1 = Energy Conservation or Renewable Energy Projects (NBS 135)
  2 = Non-Energy Related Projects (OMB Circular A-94)

Study Period (Years) ___
Occupancy Year (e.g. 1987) _____
DOE Region (1-11) ___
Building Type _
  1 = Residental 2 = Commercial 3 = Industrial

CAPITAL COMPONENTS DATA

Capital Component   Component # ___ (repeat for each capital component)

Component Name (or 'NA') ____________
Initial Cost of Component (dollars) ________
Initial Conservation-Related Cost ________
Expected Component Life (Years) - Use '999' for Land ___
Average Escalation Rate During Planning/Construction Period ___
Average Escalation Rate During Occupancy ___
Resale Value Factor (Percent of Initial Cost) ___

COST PHASING SCHEDULE BY YEAR OF PLANNING/CONSTRUCTION PERIOD AND AT OCCUPANCY

Capital Component   Component # ___ (repeat for each capital component)

Enter Percentage of Cost for Each Year

Planning/Construction Year 1	(1987)	_____	%
Planning/Construction Year 2	(1988)	_____	%
At Occupancy	(1989)	100.00	

REPLACEMENTS TO CAPITAL COMPONENTS

Capital Component   Component # ___ (repeat for each capital component)

	Replacements to Capital Component 1	2	3	4
Year of Replacement (from occupancy or 'NA')	__	__	__	__
Init Cost of Replacement (unadjusted)	_______	_______	_______	_______
Expected Replacement Life (years)	__	__	__	__
Resale Value (% of replacement cost)	____	____	____	____

FBLCC Input Forms

OPERATING AND MAINTENANCE COSTS

Annually Recurring Costs

Annual Recurring Cost (Base-Year Dollars) ________

Average Annual Rate of Increase (%) _____

Non-Annually Recurring Costs

Number of Non-Annually Recurring Costs __

Average Annual Rate of Increase (%) _____

Non-Annually Recurring Costs (Base Year Dollars)
(Note: Years begin with Occupancy; e.g. 1,2,...50)

No	Year	Amt	No	Year	Amt	No	Year	Amt	No	Year	Amt	No	Year	Amt
1	__	______	11	__	______	21	__	______	31	__	______	41	__	______
2	__	______	12	__	______	22	__	______	32	__	______	42	__	______
3	__	______	13	__	______	23	__	______	33	__	______	43	__	______
4	__	______	14	__	______	24	__	______	34	__	______	44	__	______
5	__	______	15	__	______	25	__	______	35	__	______	45	__	______
6	__	______	16	__	______	26	__	______	36	__	______	46	__	______
7	__	______	17	__	______	27	__	______	37	__	______	47	__	______
8	__	______	18	__	______	28	__	______	38	__	______	48	__	______
9	__	______	19	__	______	29	__	______	39	__	______	49	__	______
10	__	______	20	__	______	30	__	______	40	__	______	50	__	______

ENERGY COST DATA

Number of Energy Types _

Cumulative General Inflation from Mid-1987 to Date (%) _____
(For DOE Escalation Rates ONLY)

	Energy Type 1	Energy Type 2	Energy Type 3
Energy Type Code 1=Electricity 2=Distillate Fuel Oil 3=Residual Fuel Oil 4=Natural Gas 5=Liquified Petroleum Gas (LPG) 6 = Coal	_	_	_
Annual Consumption (MBTU)	________	________	________
Price per MBTU (Use F8 for DOE default)	______	______	______
Demand (or other) Charge	______	______	______
Price Escalation Method 1 = User Entered 2 = Defaulted	_	_	_
Average Annual Rate of Increase (%) During Plan/Construction	_____	_____	_____

ENERGY ESCALATION

Fuel Type # ___ (repeat for each fuel type)

Number of Discrete Time Intervals __

#	Dur Yrs	Annual Rate %	#	Dur Yrs	Annual Rate %	#	Dur Yrs	Annual Rate %	#	Dur Yrs	Annual Rate %	#	Dur Yrs	Annual Rate %
1	__	______	11	__	______	21	__	______	31	__	______	41	__	______
2	__	______	12	__	______	22	__	______	32	__	______	42	__	______
3	__	______	13	__	______	23	__	______	33	__	______	43	__	______
4	__	______	14	__	______	24	__	______	34	__	______	44	__	______
5	__	______	15	__	______	25	__	______	35	__	______	45	__	______
6	__	______	16	__	______	26	__	______	36	__	______	46	__	______
7	__	______	17	__	______	27	__	______	37	__	______	47	__	______
8	__	______	18	__	______	28	__	______	38	__	______	48	__	______
9	__	______	19	__	______	29	__	______	39	__	______	49	__	______
10	__	______	20	__	______	30	__	______	40	__	______	50	__	______

NBSLCC Input Form

LCC PROJECT DATA

Project Title	______	
Study Period	__	years
Construction Period	__	years
Base Year (e.g.1987)	___	
Tax Status Code (see reference manual page 84) (1=for profit 2=owner-occupied 3=non-profit)	____	
Discount Rate Type (1=Real (non-profit only), 2=Nominal)	____	
General Inflation Rate (%/Year Average over Study Period)	____	%
Discount Rate	____	%
Marginal Federal Income Tax Rate	____	%
Marginal State Income Tax Rate	____	%
Property Tax Rate	____	%
Capital Gains Adjustment Factor	____	%
Depreciation Recapture Code (see reference manual page 91) (0=none 1=capital gain 2=ordinary income 3=combination)	_	
Depreciation Basis Adjustment Factor	____	%
Sales Tax Rate	____	%
DOE Region (for Default Energy Prices)	__	
Building Type (1=Residential 2=Commercial 3=Industrial)	_	

CAPITAL COMPONENTS DATA

Capital Component Data for Component # ___ (repeat for each capital component)

Component Name (or 'NA')	______
Initial Cost of Component (dollars)	_____
Percent Subject to Sales Tax	____
Expected Component Life (Years - Use '999' for Land)	___
Depreciation Method Code 0 = no depreciation calculated 1 = straight line 2 = declining balance (accelerated) 3 = sum of years digits 4 = depreciation table (user entered)	_
Depreciation Life (years)	__
Depreciation Acceleration Rate (%) (Code 2 only)	___
Depreciation Salvage Value (Percent of Initial Cost)	___
Additional First Year Depreciation Factor	___
Average Escalation Rate During Planning/Construction Period	___
Average Escalation Rate During Occupancy	___
Property Tax Assessment Factor (%)	___
Tax Credit Rate (Percent of Initial Cost)	___
Resale Value Factor (Percent of Initial Cost)	___

COST PHASING SCHEDULE BY YEAR OF PLANNING/CONSTRUCTION PERIOD AND AT OCCUPANCY

Capital Component Data for Component # ___ (repeat for each capital component)

Enter Percentage of Cost for Each Year

Planning/Construction Year 1	(1987)	____
Planning/Construction Year 2	(1988)	____
Planning/Construction Year 3	(1989)	____
At Occupancy	(1990)	100.00

NBSLCC Input Form

REPLACEMENTS TO CAPITAL COMPONENTS

Capital Component Data for Component # ___ (repeat for each capital component)

	Replacements to Capital Component 1	2	3	4
Year of Replacement (or 'NA') (from occupancy year e.g. '2')	__	__	__	__
Init Cost of Replacement (Unadjusted)	________	________	________	________
Percent Subject to Sales Tax	____	____	____	____
Expected Replacement Life (years)	__	__	__	__
Depr Salv Val Factor (% of repl cost)	____	____	____	____
Depreciation Life (years)	__	__	__	__
Resale Value (% of replacement cost)	____	____	____	____
Property Tax Assessment Factor (%)	____	____	____	____

DEPRECIATION

Capital Component Data for Component # ___ (repeat for each capital component)

Year		Year		Year		Year		Year	
1	_____	11	_____	21	_____	31	_____	41	_____
2	_____	12	_____	22	_____	32	_____	42	_____
3	_____	13	_____	23	_____	33	_____	43	_____
4	_____	14	_____	24	_____	34	_____	44	_____
5	_____	15	_____	25	_____	35	_____	45	_____
6	_____	16	_____	26	_____	36	_____	46	_____
7	_____	17	_____	27	_____	37	_____	47	_____
8	_____	18	_____	28	_____	38	_____	48	_____
9	_____	19	_____	29	_____	39	_____	49	_____
10	_____	20	_____	30	_____	40	_____	50	_____

MORTGAGE LOAN

	Constrt Loan	Permanent Loans 1	2	3	4
% of Total Cost Borrowed (or 'NA')	_____	_____	_____	_____	_____
Loan Type Code 1=fully amortized (equal payments) 2=interest only (principal at end) 3=interest and principal at end	_	_	_	_	_
Annual Interest Rate (%)	_____	_____	_____	_____	_____
Life of Loan (years)	__	__	__	__	__
Number of Payments per Year	__	__	__	__	__
Points Paid (% of loan amount)	_____	_____	_____	_____	_____

NBSLCC Input Form

OPERATING AND MAINTENANCE COSTS
Annually Recurring Costs
 Annual Recurring Cost (Base-Year Dollars) ________
 Average Annual Rate of Increase (%) _____
Non-Annually Recurring Costs
 Number of Non-Annually Recurring Costs __
 Average Annual Rate of Increase (%) _____

Non-Annually Recurring Costs (Base Year Dollars)
(Note: Years begin with Occupancy; e.g. 1,2,...50)

No	Year	Amt	No	Year	Amt	No	Year	Amt	No	Year	Amt	No	Year	Amt
1	__	______	11	__	______	21	__	______	31	__	______	41	__	______
2	__	______	12	__	______	22	__	______	32	__	______	42	__	______
3	__	______	13	__	______	23	__	______	33	__	______	43	__	______
4	__	______	14	__	______	24	__	______	34	__	______	44	__	______
5	__	______	15	__	______	25	__	______	35	__	______	45	__	______
6	__	______	16	__	______	26	__	______	36	__	______	46	__	______
7	__	______	17	__	______	27	__	______	37	__	______	47	__	______
8	__	______	18	__	______	28	__	______	38	__	______	48	__	______
9	__	______	19	__	______	29	__	______	39	__	______	49	__	______
10	__	______	20	__	______	30	__	______	40	__	______	50	__	______

ENERGY COST DATA
Number of Energy Types _
Cumulative General Inflation from Mid-1987 to Date (%) _____
 (For DOE Escalation Rates ONLY)

	Energy Type 1	Energy Type 2	Energy Type 3
Energy Type Code 1=Electricity 2=Distillate Fuel Oil 3=Residual Fuel Oil 4=Natural Gas 5=Liquified Petroleum Gas (LPG) 6 = Coal	_	_	_
Annual Consumption (MBTU)	________	________	________
Price per MBTU (Use F8 for DOE default)	______	______	______
Demand (or other) Charge	______	______	______
Price Escalation Method 1 = User Entered 2 = Defaulted	_	_	_
Average Annual Rate of Increase (%) During Plan/Construction	_____	_____	_____

ENERGY ESCALATION
Fuel Type ____ (repeat for each fuel type)
Number of Discrete Time Intervals __

#	Dur Yrs	Annual Rate %	#	Dur Yrs	Annual Rate %	#	Dur Yrs	Annual Rate %	#	Dur Yrs	Annual Rate %	#	Dur Yrs	Annual Rate %
1	__	______	11	__	______	21	__	______	31	__	______	41	__	______
2	__	______	12	__	______	22	__	______	32	__	______	42	__	______
3	__	______	13	__	______	23	__	______	33	__	______	43	__	______
4	__	______	14	__	______	24	__	______	34	__	______	44	__	______
5	__	______	15	__	______	25	__	______	35	__	______	45	__	______
6	__	______	16	__	______	26	__	______	36	__	______	46	__	______
7	__	______	17	__	______	27	__	______	37	__	______	47	__	______
8	__	______	18	__	______	28	__	______	38	__	______	48	__	______
9	__	______	19	__	______	29	__	______	39	__	______	49	__	______
10	__	______	20	__	______	30	__	______	40	__	______	50	__	______

APPENDIX C - CHANGING INPUT SCREEN PARAMETERS

C.1 Introduction

The ASEAM2.1 input screens on which you enter data are configured by screen input data files. These files determine both the appearance of the screens (i.e. wording of the questions), and the input parameters for each input question (i.e. default values, error checking procedures, help messages, etc.). Because these files are external to ASEAM2.1, you can edit the files, thereby changing any of the parameters mentioned above and hence the input screens themselves, without having to recompile the program.

This section describes the various codes used in the input screen files and how to change the appearance of the screens and the input parameters.

C.2 Modifying Input Screens

To modify the input screens, you will need to know the filenames of the screen(s) you want to change (see section C.3) and the input screen file format (see section C.4). The filenames of each input screen can be found printed above the input screens in Chapters 5 through 11, or in Appendix B.

You can make changes to these files using any text editor or word processor which can write out a standard ASCII file. To modify an input screen, follow these steps:

1. Make sure you have an original copy of the input screen file to be changed. If you have "backed" up your diskettes as outlined in Chapter 2, you should already have a copy. It is IMPERATIVE that you do this, because you may need to copy these original files to run ASEAM2.1 if your changes are unsuccessful.

   To make back-up copies of all original screen input files, you will need two blank, formatted diskettes. Insert the ORIGINAL Input, FBLCC, NBSLCC and Supplemental Diskette in drive 'A' and the blank, formatted diskettes (which you will use for your backup original screen input files) in drive 'B'. Refer to the list of copy commands below and copy all input screen files from the appropriate disk to your backup disk.

   On the first blank diskette:

   'copy a:*.lis b:' (CR) [Loads screens from Input Disk]
   'copy a:*.sis b:' (CR) [Systems screens from Input Disk]
   'copy a:*.pis b:' (CR) [Plant screens from Input Disk]
   'copy a:*.mis b:' (CR) [Specify Analysis screens from Input Disk]

   On the second blank diskette

   'copy a:*.fis b:' (CR) [FBLCC screens from FBLCC Disk]
   'copy a:*.fis b:' (CR) [NBSLCC screens from NBSLCC Disk]
   'copy a:*.lsd b:' (CR) [Weather/Solar, ECO, and Quick Input screens from Supplemental Disk]

Store these backup disks in a safe place. If at any point you have trouble with your modified screen input files, you will need to retrieve these files.

Note that when you modify the input screen files, the filename may not be changed. ASEAM2.1 identifies the files by the names given only.

2) Enter your text editor (or word processor) and retrieve the file to be modified on the original working copy diskette. The EDLIN program on your DOS diskette will work just fine. Note that all screen input files are in ASCII format - a DOS text file.

3) Edit the data for the portions of the screen that you want to change. (See Section C.3 for descriptions of the effects of the data values in the various fields.)

4) After all the changes have been made with your text editor, save the file. Be sure to save the file as a DOS text file!

   BEWARE - Many word processors have their own format for saving text and data files - complete with margin settings, page control keys, etc. It is ABSOLUTELY NECESSARY that all ASEAM2.1 editing done on ASCII files be saved in an ASCII or DOS TEXT file format. ASEAM2.1 will abort if you fail to do this since the file format will be different.

5) Exit your text editor. You may check to see if the file was saved in the proper format by "typing" the file (e.g.: 'type a:liwalldt.lis' (CR)). If non-ASCII characters (symbols - not numbers or characters) are displayed on the screen, you have NOT saved the file in the proper format!

C.3 Input Screen File Format

Each input screen has a unique file which determines the way the screen appears, the help messages, default values, and error checking routines. When changing any of these parameters, you must first find the proper file. A listing of files is provided in Appendix E.

The following filename convention is used:

LI------.LIS - loads input screen file (input disk)
SI------.SIS - systems input screen file (input disk)
PI------.PIS - plant input screen file (input disk)
MI------.MIS - specify analysis screen file (input disk)
OI------.LSD - ECO input screen file (supplemental disk)
QI------.LSD - quick input screen file (supplemental disk)
WI------.LSD - weather input screen file (supplemental disk)
--------.FIS - NBSLCC and FBLCC input screen files (on LCC diskettes)

(Note: the '-' refers to any alphabetic character)

Find the names of the files you want to modify. Each file must be changed using a text editor or word processor, as described in Section C.2, one file after another.

C.3.1 Sample Files and Screens

The format of the input screen files will be described line by line. Two example files will be used: LIPEOPDT.LIS (people input screen, from loads) which demonstrates single column input screens, and LIWALLDT.LIS (wall input screen, from loads) which demonstrates multiple column input screens. The files and the screens created using them are shown on the following pages. Refer to them when reading the line-by-line file descriptions.

File: LIPEOPDT.LIS

```
AS2 LOADS INPUT SCREEN/DATA FILE - PEOPLE ('LIPEOPDT.LIS')
6,"LOAD DATA: INTERNAL LOADS FOR ZONE:"
7,PEOPLE
3
5,1,1,PEOPLE
2
4,1,1,Number of people in zone
4,1,3,(or) Square feet per person
4,2,1,Sensible load per person,58,BTUH per person
4,2,1,Latent load per person,58,BTUH per person
2
2
997
2
996
999
1,4
i r  c s e  lo   hi h        d dft$
1,6,52,4,1,  0, 999,0,       0
2,7,52,4,3,  1, 999,0,       0
3,8,52,4,3,100,2000,3,"26.21",1,230
4,9,52,4,3,100,2000,3,"26.21",1,190
```

```
ASEAM2 LOADS INPUT: ZONE
PEOPLE                                                        LOAD FILE:
-----------------------------------------------------------------------------
PEOPLE

Number of people in zone                                ____
  (or) Square feet per person                           ____
Sensible load per person                                ____   BTUH per person
Latent load per person                                  ____   BTUH per person


F3 - Delete Entry          F8 - Default          F9 - Help              F10 - Menu

Use Cursor Control Keys & PgUp or PgDn     -     Alt  'x' to Copy Zone 'x' Data
```

File: LIWALLDT.LIS

```
AS2 LOADS INPUT SCREEN/DATA FILE - WALLS ('LIWALLDT.LIS')
6,"LOAD DATA: EXTERNAL LOADS FOR ZONE:"
7,"WALLS"
3
5,5,1,WALLS,35,Wall 1,46,Wall 2,57,Wall 3,68,Wall 4
4,1,1,Name (or 'NA')
2
4,1,1,"Wall Orient (N,NE,etc)"
4,1,1,Area (ft²)
4,1,1,U-Factor (BTUH/ft²-°)
2
4,1,1,Wall Construction Group
4,1,1,Color Correction
2
3
2
4,1,12,Wall Construction Groups - see page F26.9 ('A' through 'G')
4,1,12,Color Correction Codes     1=Dark   .83=Medium   .65=Light
2
3
998
2
996
999
4,6
11
 r   c  s e lo  hi h  msg$                            d dft$
 5, 35,10,4,10,    0,                                 1,NA
 7,-35, 2,4, 6,    0,                                 0
 8, 35, 6,3, 1,999,0,                                 0
 9, 35, 5,3, 0,  2,1,"See Chapter 23, Fundamentals",0
11,-35, 1,4, 9,    1,"See Table 6, page F26.9",      1,D
12, 35, 3,3, 0,  1,1,"See Note 2b, page F26.10",     1,.83
```

File: LIWALLDT.LIS

```
ASEAM2 LOADS INPUT: ZONE
WALLS                                                         LOAD FILE:
------------------------------------------------------------------------------
WALLS                               Wall 1     Wall 2     Wall 3     Wall 4
Name (or 'NA')                      __________ __________ __________ __________

Wall Orient (N,NE,etc)              __         __         __         __
Area (ft²)                          ______     ______     ______     ______
U-Factor (BTUH/ft²-°)               _____      _____      _____      _____

Wall Construction Group             _          _          _          _
Color Correction                    ___        ___        ___        ___

------------------------------------------------------------------------------

           Wall Construction Groups - see page F26.9 ('A' through 'G')
           Color Correction Codes     1=Dark   .83=Medium   .65=Light

------------------------------------------------------------------------------
F3-Del Entry  F4-Del Col  F5-Ins Col  F6-Copy Col  F8-Deflt  F9-Help  F10-Menu

Use Cursor Control Keys & PgUp or PgDn     -    Alt  'x' to Copy Zone 'x' Data
```

C.3.2 Screen Appearance

The first portion of the input screen file determines the screen appearance only. This portion of the file ends with the entry '999' on a line by itself (line 16 in LIPEOPDT.LIS and line 24 in LIWALLDT.LIS). The second portion of the file determines the help messages, default values, and error checking routines, and is discussed in section C.3.3.

The screen appearance portions of the two example screens are reprinted below, with line numbers for your reference. The first line is a dummy line. All the other lines correspond to lines on the screen, offset by one line. That is, line 2 of the file describes what will be printed on line 1 of the screen, line 10 of the file describes what will be printed on line 9 of the screen, etc. The code '999' terminates this portion of the program. Subsequent lines after the '999' code do not correspond to screen lines in this manner.

File: LIPEOPDT.LIS

```
1   AS2 LOADS INPUT SCREEN/DATA FILE - PEOPLE ('LIPEOPDT.LIS')
2   6,"LOAD DATA: INTERNAL LOADS FOR ZONE:"
3   7,PEOPLE
4   3
5   5,1,1,PEOPLE
6   2
7   4,1,1,Number of people in zone
8   4,1,3,(or) Square feet per person
9   4,2,1,Sensible load per person,58,BTUH per person
10  4,2,1,Latent load per person,58,BTUH per person
11  2
12  2
13  997
14  2
15  996
16  999
```

File: LIWALLDT.LIS

Line #	Contents of Line (as appear in file)
1	AS2 LOADS INPUT SCREEN/DATA FILE - WALLS ('LIWALLDT.LIS')
2	6,"LOAD DATA: EXTERNAL LOADS FOR ZONE:"
3	7,"WALLS"
4	3
5	5,5,1,WALLS,35,Wall 1,46,Wall 2,57,Wall 3,68,Wall 4
6	4,1,1,Name (or 'NA')
7	2
8	4,1,1,"Wall Orient (N,NE,etc)"
9	4,1,1,Area (ft=)
10	4,1,1,U-Factor (BTUH/ft=-°)
11	2
12	4,1,1,Wall Construction Group
13	4,1,1,Color Correction
14	2
15	3
16	2
17	4,1,12,Wall Construction Groups - see page F26.9 ('A' through 'G')
18	4,1,12,Color Correction Codes 1=Dark .83=Medium .65=Light
19	2
20	3
21	998
22	2
23	996
24	999

Line 1 - This line is not used by ASEAM2.1. It contains a description of the input file and filename. There is no reason to change this line.

Line 2 - header code, header text. The code '6' tells ASEAM2.1 that the line is a header line. The program will print the header, followed by some additional information (in this, case, the zone number). The exact words printed out may be seen by referring to the example screens. The code '6' is defined in the individual screen input segments of the ASEAM2.1 code and may only be changed by recompiling the program. Header text should be enclosed within quotation marks (").

Line 3 - header code, header text. The code '7' tells ASEAM2.1 that the text that follows is also a header. The header is printed, again followed by some additional information (in this case, the loads input filename). The code '7' is defined in the individual screen input segments of the ASEAM2.1 code and may only be changed by recompiling the program. Header text should be enclosed within quotation marks (").

Line 4 - '3'. The code '3' prints a line of dashes.

Line 5...24 - The next lines, up to at most line 24, contain the text to be printed on the screen. There are also some format codes (single numbers) which may be used.

To print text, the format is '#,#,#,text,#,text,#,text, etc.

This line contains several pieces of data, delimited by commas. The first number is a code, '5' meaning that the text will be highlighted, '4' meaning that the text will be printed normally. The second number indicates the number of text entries to be printed on the line. Following the second number are '#,text' pairs, for as many pairs as there are text entries. The number indicates the column at which the text is to be printed and the text is the text string to be printed.

Example: 5,1,1,PEOPLE

The first number, '5', indicates that the text on this line is to be highlighted

The second number, '1', indicates that one set of '#,text' strings are to be printed.

The third number, '1', indicates that the first (and only) text string to be printed begins in column 1 of this line.

The fourth string, 'PEOPLE', is the text to be printed.

Example: 5,5,1,WALLS,35,Wall 1,46,Wall 2,57,Wall 3,68,Wall 4

The above example line for walls would be printed as:

WALLS   Wall 1 Wall 2 Wall 3 Wall 4

Other codes, besides the '4', '5', '6', and '7' codes described above , may also be used in formatting the screen:

'2' - blank line
'3' - line of dashes across the screen
'998' - function key menu (multiple column screens)
'997' - function key menu (single column screens)
'996' - description of alt-x for copying data

Text strings may be added or changed but be aware of the following:

- All screen text must fit on the 24 line screen. That is, the '999' code must be located on or before line 25 of the input file. ASEAM2.1 will abort with an "illegal function call" if you fail to do this.

- If you add or delete lines, you will have to adjust the second portion of the file (discussed below) to account for the change in location of the input cursor (smiley face). If you add a line, for example, and do not change the location of the cursor for the input questions (described in C.3.3), the smiley face will not appear adjacent to the proper question - it will appear one row above. The second portion of the file actually locates the placement of the data entry area and cursor.

- Make sure you leave room for the data entry. That is, if you change or add additional text on a line (using most of the 80 columns), the data entry area may overwrite your text.

The code ‘999’ signals the end of the screen format portion of the file. Again, this code MUST appear on or before line 25 of the screen input file.

> CAUTION - Certain characters are interpreted by BASIC as delimiters or "separators" between entries. Examples include the comma and colon. It is a always good idea to enclose all text strings in quotes; then, if the text string does include a delimiter, it will simply be printed as part of the text string. Be sure to include the quotation marks (") at the very beginning and ending of each text string.

Note that this portion of the file determines only the appearance of the input screen. The position and length of the data entry field for each question is determined in the second part of the file, described below.

C.3.3 Default Values, Help Messages, and Error Checking.

All input parameters for each question (e.g., default values, help messages, and error checking routines) are determined in the second part of the file, beginning with the line immediately following the line which contains ‘999’. This will be on or before line 26. (In the sample files, this part starts on line 17 for people and line 25 for walls. These portions of the files are reprinted, with line numbers, below.)

File: LIPEOPDT.LIS

Line #	Contents of Line (as appear in file)							
17	1,4							
18	i	r	c	s	e	lo	hi	h	d dft$
19	1,	6,	52,	4,	1,	0,	999,	0,	0
20	2,	7,	52,	4,	3,	1,	999,	0,	0
21	3,	8,	52,	4,	3,	100,	2000,	3,"26.21",	1,230
22	4,	9,	52,	4,	3,	100,	2000,	3,"26.21",	1,190

File: LIWALLDT.LIS

Line #	Contents of Line (as appear in file)								
25	4,6								
26	11								
27	r	c	s	e	lo	hi	h	msg$	d dft$
28	5,	35,	10,	4,	10,		0,		1,NA
29	7,	-35,	2,	4,	6,		0,		0
30	8,	35,	6,	3,	1,	999,	0,		0
31	9,	35,	5,	3,	0,	2,	1,	"See Chapter 23, Fundamentals",	0
32	11,	-35,	1,	4,	9,		1,	"See Table 6, page F26.9",	1,D
33	12,	35,	3,	3,	0,	1,	1,	"See Note 2b, page F26.10",	1,.83

The first line after '999' contains two numbers. The first of these is the number of columns in which data is entered. The second number on this line is the number of input questions in each column. If there is more than one column, the next line (line 26 in the wall screen) indicates the spacing between columns. The actual input parameters for each question begins after these lines.

Example: Line 17 of LIPEOPDT.LIS reads "1,4"

> This means there is one column of data with four entries. Data specification begins on Line 18.

Example: Line 25 of LIWALLDT.LIS reads "4,6."
Line 26 of LIWALLDT.LIS reads "11."

> This means there are four columns of data with six entries each. The columns have 11 spaces from the beginning of one column to the beginning of the next. Data specification begins on Line 27.

WARNING: You should NEVER change either the number of columns, or the number of questions in a column. If you do, ASEAM2.1 will abort since the data is stored in predefined arrays. If you want to add or delete input questions, you will have to make substantial changes in several ASEAM2.1 programs - not just the input programs.

The next line contains headers which are used to line up the data in the rows below. The data in this line is not used by ASEAM2.1. The line looks like this:

```
i r   c   s e lo    hi h      msg$                                    d dft$
```

Each of these letters corresponds to a data field, where:

- i - question number (1,2,3...see note below)
- r - row number on screen where question appears
- c - column number on screen where question appears
- s - number of spaces for data entry
- e - error checking code
- lo - error checking low limit
- hi - error checking high limit
- h - help message code
- msg$ - help message text string (also printed as "hlp$" in some screens)
- d - default value code
- dft$ - default value text string

NOTE - The multiple column screens do not have the "i" for the question number. The question numbers are automatically inserted by ASEAM2.1.

Following the header line are data lines, one for each input question. Some of the data fields requir an entry, others are "conditional". Each data field is separated from other data fields by commas. All the commas line up down the screen, making it easy to see what entries are in which fields. It is suggested that when you modify files you adhere to this convention. Some fields may be left blank (for example, when there is no help message). If you omit an entry for a field, then you must also omit the comma (delimiter) that goes with it - there should NEVER be two commas in a row.

The fields are defined as follows:

i - question number

This field, which is used only for single column screens, defines the question number for which this line of data is used. It begins with 1 and goes on, in increments of 1, until all questions have been defined.

r - row number

This field defines the row number (on the screen) on which the input question is asked. If you are working in a word processor which shows you the line number you are on, the screen row number will be one less than the line number on which you define the question text (in the first portion of the file) because the first dummy line is not printed to the screen. This value should be between 4 and 24 (the first three rows contain header information).

c - column number

This field defines the column number where the data entry should begin. If there is more than one column, the columns will be evenly spaced, the first column starting at this number and subsequent columns beginning at increments as specified in the line prior to the header.

NOTE - if the column number is negative, ASEAM2.1 will convert all lower case letters to upper case letters.

s - field length

This field defines the allowable length of the data entry string. This number of blank underlines will be printed for the data entry. If you try to enter more characters than this on the line, they will not be accepted - the last character will be overwritten.

Examples: '40' will limit a string to 40 characters. '3' will limit a string to 3 characters. If you want to be able to enter a value less than 100 with two decimal places, the field length must be '5' (xx.xx). A field length of four would limit you to values under 10 with two decimal places (x.xx) or values between 10 and 100 with one decimal place (xx.x).

e - error checking code

This field indicates the type of error checking to be done for the input question. The type of error checking also determines the entries for the next two fields. Five codes are used in ASEAM2.1:

0 - no error checking (used for names, descriptions)

1 - numeric entry required, a blank is acceptable, however; low and high limits are used.

2 - special check (entry must be from list of values), see note below

3 - numeric entry required, forced entry. Blank entries are NOT permitted with this code; low and high limits are used.

4 - special check (entry must be from list of values), forced entry. Blank entries are not permitted.

NOTE: Error check codes '2' and '4' are used when you are required to enter only certain values (e.g.: only 'D' or 'S' for the lighting control type; only 'A' through 'G' for a wall type; only 'Y' or 'N'; etc.). You should have no reason to modify these types of error checks. The list of specific values acceptable are imbedded within the ASEAM2.1 code at GOSUB 26000 in each input program.

lo - low limit error check

The entry in this field depends on the error check code used for e, described above. In contrast to all the above data fields, data may or may not be entered in this field.

error check code	entry
0	leave blank (no error checking)
1,3	low limit, '-999' for any negative number
2,4	DO NOT CHANGE THE EXISTING CODE. This is another code which refers to a specific error check for this entry.

hi - high limit error check

The entry in this field depends on the error check code used for e, described above.

error check code	entry
0	leave blank (no error checking)
1,3	high limit, '999' for any positive number
2,4	leave blank

h - help message code

This field determines the type of help message available for the question. It also determines what form the help message text string, next entry, should take.

0 - no help message (a message stating that there is no help for this message will print if the F9 (help) key is pressed).

1 - prints the help message string defined in the next data field verbatim.

2 - prints "See ASEAM2.1 User's Manual, Section " and the help message string defined in the next data field.

3 - prints "See 1985 ASHRAE Handbook of Fundamentals, page " and the help message string defined below.

msg$ - help message text string

This field is the help message which will be printed. The form of the text string depends on the help message code entered previously. Text strings should be surrounded by quotation marks.

help code	entry
0	leave blank (no help message)
1	help message. ASEAM2.1 prints this text string verbatim.
2	ASEAM2.1 prints "ASEAM2.1 User's Manual, Section " plus this text string. Make sure the text string is less than 10 characters.
3	Prints "ASHRAE 1985 Handbook of Fundamentals, page " plus this text string. Make sure the text string is less than 10 characters.

d - default code

This field indicates whether there is a default message.

0 - no default value
1 - default value

This field is also used to print a listing of available files in the AS2MENU program for specifying analyses. If the default code is a '0' or a '1' you may change it. If the default code is any other number, do NOT make any changes.

dft$ - default message text string

This field contains the value which will be entered on the data entry line when the F8 (default) key is pressed. This value is only used if the default code is '1'. If there is no default and you want to add one, first change the default code to '1' and then enter the default value.

C.3.4 Examples

The original second part of the screen input file for the people screen is shown below:

Line #	Contents of Line (as appear in file)							
17	1,	4						
18	i	r	c	s	e	lo	hi	h	d dft$
19	1,	6,	52,	4,	1,	0,	999,	0,	0
20	2,	7,	52,	4,	3,	1,	999,	0,	0
21	3,	8,	52,	4,	3,	100,	2000,	3,"26.21",	1,230
22	4,	9,	52,	4,	3,	100,	2000,	3,"26.21",	1,190

Explanation (beginning on line 17)

There will be one column of entries with four questions.

The data entry for the first question is on row 6 of the screen (text is defined in row 7 of the input file) and begins on column 52. The data entry length is four-characters and is a numeric entry. A blank is acceptable. If a value is entered, it must be any positive number. There is no help message or default value.

The second question is on row 7 of the screen (text is defined in row 8 of the input file). The answer blank starts at column 52 and allows a four-character numeric entry. A blank is not acceptable. (Note: within the program there is another error check which skips this second question if the first is answered. This is often done when there are two questions, such as number of people and people per square foot, one of which must be entered.) If a value is entered, it must be a positive number greater than one. There is no help message or default value.

The third question is on row 8 of the screen (row 9 of the input file). The answer blank starts at column 52 and allows a four-character numeric entry. A value must be entered - a blank is not acceptable. The value must be between 100 and 2000. The help message available by pressing F9 key reads "See 1985 ASHRAE Handbook of Fundamentals, page 26.21". The default value for this entry is 230.

The fourth question is on row 9 of the screen (row 10 of the input file). It is just like the third question except that the default value is 190.

The original second part of the screen input file for the walls screen is shown below:

Line #	Contents of Line (as appear in file)							
25	4,6							
26	11							
27	r	c	s	e	lo	hi	h	msg$	d dft$
28	5,	35,	10,	4,	10,		0,		1,NA
29	7,	-35,	2,	4,	6,		0,		0
30	8,	35,	6,	3,	1,	999,	0,		0
31	9,	35,	5,	3,	0,	2,	1,	"See Chapter 23, Fundamentals",	0
32	11,	-35,	1,	4,	9,		1,	"See Table 6, page F26.9",	1,D
33	12,	35,	3,	3,	0,	1,	1,	"See Note 2b, page F26.10",	1,.83

Explanation (beginning on line 25)

There will be four columns of entries with six questions in each column.

The columns will be eleven spaces apart.

The first question is on row 5 of the screen (row 6 of the input file). The first column data entry begins at column 35 and allows a ten-character entry. Data entries for columns 2, 3, and 4 begin at columns 46,57, and 68, respectively. Each column has the same number of spaces, error checks, help message, and default - only the beginning column number is different. An entry must be made for this entry. There is no help message. The default entry is "NA".

The second question is on row 7 of the screen (row 8 of the input file). The answer blanks are at columns 35,46,57, and 68. A two-character entry from a designated list must be made. If you examine the source code beginning at line 26000, you will find that only valid orientations are permitted. The entry will be made in capital letters. There is no help message or default value.

The third question is on row 8 of the screen (row 9 of the input file). The answer blanks are at columns 35,46,57, and 68. A numeric entry of up to six-characters must be made. Any positive number greater than one is acceptable. There is no help message or default value.

The fourth question is on row 9 of the screen (row 10 of the input file). The answer blanks are at columns 35,46,57, and 68. A numeric entry between 0 and 2 must be made. The help message is "See Chapter 23, Fundamentals". There is no default value.

The fifth question is on row 11 of the screen (row 12 of the input file). The answer blanks are at columns 35,46,57, and 68. A one-character entry must be made from a specified list. The entry will be made in capital letters. The help message is "See Table 6, page F26.9". The default value is "D".

The sixth question is on row 12 of the screen (row 13 of the input file). The answer blanks are at columns 35,46,57, and 68. An up to three-character numeric entry between 0 and 1 must be made. The help message is "See Note 2b, page F26.10". The default value is ".83".

APPENDIX D - CHANGING ASEAM2.1 SOURCE CODE

D.1 Introduction

This Appendix contains information on changing the source code of ASEAM2.1. The source code of ASEAM2.1 is written in BASIC, therefore, you will need to know how to program in this language to make meaningful changes to the existing code. Since ASEAM2.1 will not run in the BASIC interpreted mode, you will need to know how to "compile" the changed source code in order to make "executable" program files. The steps in compiling are discussed in Section D.3 below.

D.2 Warnings

Changing the source code of ASEAM2.1 is relatively easy if you understand BASIC programming and compiling. The following "warnings", however, should be considered:

1. As outlined in Section 2.1.3, you will need the IBM (tm) Version 1.0 BASIC Compiler if you are using floppy diskettes to run ASEAM2.1. Note that this compiler was used to generate the executable program files of ASEAM2.1. Although this is an older compiler that does not recognize many of the later features of DOS (e.g., sub-directories) or advanced BASIC commands, it does generate smaller executable code than later version compilers. Unfortunately, the newer BASIC compilers which have added features generate executable program code that is too large to fit on floppy diskettes. If you will be using ASEAM2.1 on a hard disk, the size of the code is generally of little concern and you can use later version compilers. If you are using any other compiler, you will have to compile ALL of the BASIC source code of ASEAM2.1 with your compiler - you cannot mix executable ASEAM2.1 code generated with different compilers.

2. The present ASEAM2.1 working copy floppy diskettes are relatively full and do not contain much "free space". That is, do not attempt to add major changes to ASEAM2.1, especially in the calculation diskette - the additional code may not fit on floppy diskettes!

3. It will be very difficult, if not impossible, for the authors to support your version of ASEAM2.1.

4. ALWAYS save the original version of any source code on a separate diskette before changing any program. If your changed version does not work properly, you will at least have the original working program code to rely on.

5. Since the source code is an ASCII file, you may use any of several means to change the program code: BASIC, text editors (e.g., EDLIN on your DOS diskette), or word processors. When using word processors to change the code, however, please note the following:

   a. Many program and data files in ASEAM2.1 have lines extending beyond the normal 80 column right margins for word processors. You may have to set your right margins to 254 before retrieving the file, otherwise some word processors may automatically reformat the file.

   b. Always retrieve and save the source code as a DOS Text File, or in standard ASCII format.

BEWARE - Many word processors have their own format for saving text and data files - complete with margin settings, page control keys, etc. It is ABSOLUTELY NECESSARY that all editing done on ASEAM2.1 source code files be saved in an ASCII or DOS TEXT file format. The compiler may will abort if you fail to do this since the file may contain statements or codes not recognized by the compiler.

You may check to see if the file was saved in the proper format by "typing" the file (e.g., 'type b:as2menu.bas' (CR)). If non-ASCII characters (symbols - not numbers or characters) are displayed on your screen, you have NOT saved the file in the proper format!

6. There are special "parameters" or codes that must be entered when compiling ASEAM2.1 source code to indicate the existence of error checking, event trapping (use of function keys for program control), etc. If you fail to use these codes, the compiler will issue error messages. The batch file 'BATCHCOM.BAT', stored on the Supplemental diskette, contains a listing of all the ASEAM2.1 BASIC source code file names and compiler parameters.

   In brief, three different compiler parameters are used in ASEAM2.1:

   /E - denotes error trapping
   /W - denotes event trapping or function key use
   /S - optimizes string space on several of the larger ASEAM2.1 programs.

   If a program file needs more than one compiler parameter, you must indicate all of the parameters required (e.g., '/E/W/S').

   Outlined below are the BASIC source code filenames and the compiler parameters you must use with each. Consult Appendix E to determine the diskette where the source code for these programs are stored.

Executable Program Files on the INPUT DISKETTE

Source Code Filename	Compiler Parameters	Source Diskette
AS2MENU	/E/W/S	3
AS2LDINP	/E/W	3
AS2SYINP	/E/W/S	3
AS2PLINP	/E/W	3

Executable Program Files on the SUPPLEMENTAL DISKETTE

Source Code Filename	Compiler Parameters	Source Diskette
AS2LDREP	/E/S	2
AS2SYREP	/E	2
AS2PLREP	/E	2
AS2WDREP	/E	2
AS2ECOIN	/E/W	4
AS2WDINP	/E/W	4
AS2QKIND	/E/W/S	3

Executable Program Files on the CALCULATION DISKETTE

Source Code Filename	Compiler Parameters	Source Diskette
AS2PROCR		1
AS2PROCL	/E	1
AS2LOADC	/E/W/S	1
AS2COMLS		1
AS2PROCS	/E	1
AS2UNITC	/E/W/S	2
AS2CENTR	/E/W/S	1
AS2COMSP		1
AS2PROCP	/E/W	4
AS2PLANT	/E/W/S	1
AS2REPRT	/E	2
AS2ECON	(See Section 10.3.2 AS2ECON is a copy of either AS2PECON (NBSLCC Version) or AS2FECON (FBLCC Version). Both programs require the /E/S compiler parameters.	

Executable Program Files on the NBSLCC DISKETTE

Source Code Filename	Compiler Parameters	Source Diskette
AS2PECON	/E/S	4 (AS2PECON)
PLCCDATA	/E/W/S	NBSLCC Source
PPRNTBCF	/E	NBSLCC Source
PPRNTLCC	/E	NBSLCC Source
PLCCMAIN	/E	NBSLCC Source
PCOMPARE	/E	NBSLCC Source

Executable Program Files on the FBLCC DISKETTE

Source Code Filename	Compiler Parameters	Source Diskette
AS2FECON	/E/S	1 (AS2FECON)
FLCCDATA	/E/W/S	FBLCC Source
FPRNTBCF	/E	FBLCC Source
FPRNTLCC	/E	FBLCC Source
FLCCMAIN	/E	FBLCC Source
FCOMPARE	/E	FBLCC Source

D.3 Steps in Compiling

The following steps should be used as a guide for making changes in the ASEAM2.1 source code and for compiling your changes. Note that the compiling steps discussed below assume you are using the IBM (tm) Version 1.0 BASIC Compiler. If you are using a different compiler, you will need to consult the manual for the compiler. All ASEAM2.1 source code files have the BASIC extension '.BAS'. These are the only programs you should change.

1. Format a diskette. The operating system is not necessary.

2. Copy the original source code file onto the blank diskette. IT IS IMPERATIVE TO KEEP A COPY OF THE ORIGINAL SOURCE CODE. All changes and compiling will be made on the blank diskette.

3. Make changes to the original source code on the blank diskette ONLY. See the warnings (#5) in Section D.2 above if you are using a word processor. If you are using BASIC to make changes, be sure to save the file in an ASCII format (e.g., SAVE "B:AS2MENU.BAS",A). You MUST use the same filename as the original to store your changes since ASEAM2.1 only recognizes these particular filenames.

4. Insert your IBM (tm) BASIC Compiler in drive 'B:' and your diskette with the changes in drive 'A:'. Drive 'A:' should be the default drive.

5. Type 'B:BASCOM' followed by CR. This will load in the compiler on drive 'B:' and you will be asked to supply information about the program to be compiled.

6. The first compiler prompt will ask for the program filename and any special parameters associated with the file. Since drive 'A:' is the default drive, you need to type in only the filename of the program to be compiled, a space, and all the compiler parameters for the file (see Warning message #6, above, for the compiler parameters). For example, to compile the program AS2MENU, enter the following:

   'AS2MENU /E/W/S' followed by CR (DO NOT TYPE THE SINGLE QUOTATION MARKS)

   To compile programs without any special parameters (e.g., AS2COMLS), type

   'AS2COMLS' followed by CR

7. Several more compiler prompts will appear, but you can ignore these and the compiler will supply the appropriate default values. To use the default values, just enter CR for the remaining prompts.

8. After the last compiler prompt, the compilation starts and the disk drives will start storing the object module (the first step in compiling). The object code will be stored with the same filename, but with the extension '.OBJ'. Note that this step may take several minutes, depending on the program size.

9. During the compilation, any errors will be printed on the screen. Errors are classified as either 'severe' or 'warning'. If 'severe' errors are found, you must go back to step 3 above and correct the errors before proceeding with step 10. Steps 3 through 9 must be repeated until you have no 'severe' errors.

10. The second and final step in compiling is linking. Type 'B:LINK' followed by CR. This will load in the link program on drive 'B:' and you will be asked to supply information about the program to be linked.

11. The first linker prompt will ask for the object module (filename) to be linked and you need to type in only the filename of the program just compiled - without any parameters. For example, type the following:

    'AS2MENU' followed by CR

12. Several more linker prompts will appear, but you can ignore these and the linker will supply the appropriate default values. To use the default values, just enter CR for the remaining linker prompts.

13. After the last prompt, the linking process starts and the disk drives will create the executable code. The executable code will be stored with the same filename as the source and object code, but with the extension '.EXE'. This step also may take several minutes, depending on the program size.

14. The compiling of your changed source code is now complete. You now need to store the newly created executable code on the working diskettes. To do this, first insert the

    proper executable working disk into drive 'B:' and then use the DOS COPY command. For example, 'COPY A:AS2MENU.EXE B:' followed by CR

15. If you have followed these instructions, you will see three files are stored on the original blank diskette - each with the same first eight characters, but with different extensions (.BAS, .OBJ, and .EXE). The object module can be deleted from the diskette, if desired. Be sure to save your new source code in a safe place. Since all three files are required to be on the same diskette, it may not be possible to compile more than one program on the blank diskette from step 1, depending on the size of the program.

APPENDIX E - ASEAM2.1 FILES

The ASEAM2.1 program comes on sixteen diskettes. Five of these contain compiled code (three for ASEAM2.1 itself and two for life-cycle costing) and the program is run from these disks. Source code is contained on six disks (four for ASEAM2.1 and two for life-cycle costing), which will be used only if you want to examine or change the program. A data disk with demonstration files is also included. The remaining four diskettes contain bin weather and solar data files for forty-six stations across the United States.

The contents of each disk are described briefly below. For each file, the filename (first eight characters), filename extension (three characters), and file size (bytes) are listed.

The filename (first eight characters) generally describes the function of the program (e.g., 'AS2MENU' is the main menu program).

The filename extension (last three characters) generally describes the file type. The following extensions are used in ASEAM2.1:

Program Files

.BAS - basic source code. There is a corresponding .EXE (compiled) file for each basic source code program.

.EXE - executable program. These are compiled programs and there is a corresponding .BAS program for each executable program.

Data Files

.DAT - data file. These files contain data that are read by the programs.

.PRN - data file in LOTUS (tm) compatible form.

.RAN - random data file. These files are "random access" data files that are read by the programs.

.TMP - temporary data files. These files contain calculation results that is passed between calculation programs

.TXT - text data file. These data files contain primarily text.

.FRM - input form text files. These contain the abbreviated input forms found in Appendix B.7.

Input Screen Files

The input screen files contain data for formatting the screen appearance, setting field lengths, help messages, error limits, default values, etc. These are covered in more detail in Appendix C.

There are several extensions used for the input screen files:

.LIS - loads input screen (used with AS2LDINP)
.SIS - systems input screen (used with AS2SYINP)
.PIS - plant input screen (used with AS2PLINP)
.MIS - menu input screen (used with AS2MENU)
.FIS - financial input screen (used with FLCCDATA and PLCCDATA)
.LSD - this extension is used for several input programs: Weather/Solar data input, ECO input, and Quick Input.

Bin Temperature Weather Data Files

The weather files containing the bin temperature data can have three different extensions depending on the type of bin data used:

.AWD - ASHRAE weather data (bin data stored in six 4 hour blocks)
.BWD - Battelle weather data (bin data stored in eight 3 hour blocks)
.DWD - DOD weather data (bin data stored in three 8 hour blocks)

See Appendix A for a description of these files.

Solar Data Files

.NSD - solar data files. See Appendix A for a description of these files

Input Data Files (User Entered Data)

The data files you create in the various input programs each have different extension:

.LID - loads input data (created in AS2LDINP)
.SID - system input data (created in AS2SYINP)
.PID - plant input data (created in AS2PLINP)
.QID - quick input data (created in AS2QKINP)
.EID - economic input data FBLCC (created in FLCCDATA)
.NID - economic input data NBSLCC (created in PLCCDATA)
.LEC - loads eco input data (created in ASECOIN)
.SEC - systems eco input data (created in ASECOIN)
.PEC - plant eco input data (created in ASECOIN)

Specify Analysis Data Files

.SRC - single run mode specification data file
.BRC - batch run mode specification data file
.PRC - parametric run mode specification data file
.ERC - single eco run mode specification data file
.MRC - multiple eco run mode specification data file

Batch Files

.BAT - batch file. These contain DOS commands that are executed in sequence. These are used for installing ASEAM2.1 on a hard disk and for automatically executing ASEAM2.1 when booting up.

ASEAM2.1 INPUT DISK

filename.ext	description
AS2LDINP.EXE	loads input program
AS2MENU.EXE	main menu program
AS2PLINP.EXE	plant input program
AS2SYINP.EXE	systems input program
AUTOEXEC.BAT	boot-up batch file and instructions
BASRUN.EXE	required to run compiled BASIC code (MicroSoft)
HDINSTAL.BAT	hard disk install program (for disk 1 only)
HDYESNO.DAT	indicates whether a hard disk is being used
HDYES.DAT	used to install hard disk
LIDAYCDT.LIS	loads input - daylighting control screen
LIDAYLDT.LIS	loads input - daylighting screen
LIDIVRDT.LIS	loads input - diversity factors screen
LIDOORDT.LIS	loads input - doors screen
LIELECDT.LIS	loads input - electrical equipment screen
LIINFLDT.LIS	loads input - infiltration screen
LILITEDT.LIS	loads input - lighting screen
LIMCONDT.LIS	loads input - miscellaneous conduction screen
LIMONDDT.LIS	loads input - monthly diversity factors screen
LIMSENDT.LIS	loads input - miscellaneous sensible loads screen
LIOCCSDT.LIS	loads input - occupancy hours screen
LIPEOPDT.LIS	loads input - people screen
LIPRJ2DT.LIS	loads input - building/project 2 screen
LIPROJDT.LIS	loads input - building/project 1 screen
LIROOFDT.LIS	loads input - roofs screen
LISHADDT.LIS	loads input - external shading screen
LIWALLDT.LIS	loads input - walls screen
LIWNDODT.LIS	loads input - windows screen
LIZONEDT.LIS	loads input - zone screen
MICONDAT.MIS	specify analyses - configuration screen
MIECO2DT.MIS	specify analyses - single eco specification screen
MIECODAT.MIS	specify analyses - eco base case screen
MIMECO2D.MIS	specify analyses - multiple eco screen
MIMECO3D.MIS	specify analyses - multiple eco specification screen

filename.ext	description
MIOUT1DT.MIS	specify analyses - output screen (loads)
MIOUT2DT.MIS	specify analyses - output screen (systems/plant)
MIPAR1DT.MIS	specify analyses - parametric base case screen
MIPAR2DT.MIS	specify analyses - parametric input variable screen
MIPAR3DT.MIS	specify analyses - parametric output variable screen
MIRUNDAT.MIS	specify analyses - single/batch files screen
PIABCDAT.PIS	plant input-absorption chiller screen
PIBLRDAT.PIS	plant input-boiler screen
PICENDAT.PIS	plant input-centrifugal chiller screen
PIDBCDAT.PIS	plant input-double bundle chiller screen
PIDHWDAT.PIS	plant input-domestic hot water screen
PIENEDAT.PIS	plant input-energy cost and conversion screen
PIMECDAT.PIS	plant input-miscellaneous energy consumption screen
PIRECDAT.PIS	plant input-reciprocating chiller screen
PITOWDAT.PIS	plant input-cooling tower screen
SIAIRDAT.SIS	systems input-zone air screen
SIBBDAT.SIS	systems input-baseboard screen
SICLGDAT.SIS	systems input-cooling screen
SIDXDAT.SIS	systems input-direct expansion screen
SIFANDAT.SIS	systems input-fan screen
SIFURDAT.SIS	systems input-furnace screen
SIHPCDAT.SIS	systems input-heat pump cooling screen
SIHPHDAT.SIS	systems input-heat pump heating screen
SIHTGDAT.SIS	systems input-heating screen
SIHUMDAT.SIS	systems input-humidification screen
SIOACDAT.SIS	systems input-outside air screen
SIPRHDAT.SIS	systems input-preheat screen
SISYSDAT.SIS	systems input-system type screen
SIZONDAT.SIS	systems input-zone-system assignment screen
PVINPDES.TXT	parametric variable input descriptions
PVOUTDES.TXT	parametric variable output descriptions

ASEAM2.1 CALCULATION DISK

filename.ext	description
AS2CENTR.EXE	central system calculation program
AS2COMLS.EXE	common block deletion between loads and systems programs
AS2COMSP.EXE	common block deletion between systems and plant programs
AS2ECON.EXE	compares runs - performs economic analysis
AS2LOADC.EXE	load calculation program
AS2PLANT.EXE	plant calculation program
AS2PROCL.EXE	loads pre-processor
AS2PROCP.EXE	plant pre-processor
AS2PROCR.EXE	run pre-processor
AS2PROCS.EXE	systems pre-processor
AS2REPRT.EXE	report generator program
AS2UNITC.EXE	unitary systems calculation program
HDINSTAL.BAT	hard disk install program (disk 2 only)
HDYESNO.DAT	indicates whether a hard disk is available
IESDAYL.DAT	data file for daylighting calculations
HOURLYDT.RAN	data file for load calculations
ORIENTDT.RAN	data file for load calculations

SUPPLEMENTAL DISK

filename.ext	description
BATCHCOM.BAT	file for compiling ASEAM2.1
HDINSTAL.BAT	hard disk install program (disk 3 only)
HDYESNO.DAT	indicates whether a hard disk is available
QIFILES.DFT	contains listing of quick input default files
QIBLDGDF.PRN	building default data file for quick input
QICLIMDF.PRN	climate default data file for quick input
QINONDDF.PRN	miscellaneous default data file for quick input
QISPCEDF.PRN	space default data file for quick input
QIZONEDF.PRN	zone default data file for quick input
AS2ECOIN.EXE	eco input program
AS2LDREP.EXE	load report (data echo) program
AS2PLREP.EXE	plant report (data echo) program
AS2QKINP.EXE	quick input program
AS2SYREP.EXE	system report (data echo) program
AS2WDINP.EXE	weather and solar data input program
AS2WDREP.EXE	weather and solar report program
OIBBDAT.LSD	systems eco - baseboard screen
OICLGDAT.LSD	systems eco - cooling screen
OIDAYCDT.LSD	loads eco - daylighting control screen
OIDAYLDT.LSD	loads eco - daylighting screen
OIDIVRDT.LSD	loads eco - diversity factors screen
OIDOORDT.LSD	loads eco - doors screen
OIDXDAT.LSD	systems eco - direct expansion screen
OIFANDAT.LSD	systems eco - fan screen
OIFURDAT.LSD	systems eco - furnace screen
OIHPCDAT.LSD	systems eco - heat pump cooling screen
OIHPHDAT.LSD	systems eco - heat pump heating screen
OIHTGDAT.LSD	systems eco - heating screen
OIHUMDAT.LSD	systems eco - humidification screen
OIINFLDT.LSD	loads eco - infiltration screen
OILITEDT.LSD	loads eco - lighting screen
OIMCONDT.LSD	loads eco - miscellaneous conduction screen
OIMELEDT.LSD	loads eco - electrical equipment screen
OIMSENDT.LSD	loads eco - miscellaneous sensible load screen
OIOACDAT.LSD	systems eco - outside air screen
OIOCCSDT.LSD	loads eco - occupied hours screen
OIPRHDAT.LSD	systems eco - preheat screen
OIPRJ2DT.LSD	loads eco - project/building screen #2
OIROOFDT.LSD	loads eco - roofs screen
OIWALLDT.LSD	loads eco - walls screen
OIWNDODT.LSD	loads eco - windows screen
OIZONEDT.LSD	loads eco - zone thermostat screen
OIABCDAT.LSD	plant eco - absorption chiller screen
OIDHWDAT.LSD	plant eco - domestic hot water screen
OIMECDAT.LSD	plant eco - miscellaneous energy consumption screen
OICENDAT.LSD	plant eco - centrifugal chiller screen
OIDBCDAT.LSD	plant eco - double bundle chiller screen
OIRECDAT.LSD	plant eco - reciprocating chiller screen

filename.ext	description
OITOWDAT.LSD	plant eco - cooling tower screen
OIENEDAT.LSD	plant eco - energy cost screen
OIBLRDAT.LSD	plant eco - boiler screen
ECODESCR.LSD	eco description screen
LOADECOS.LSD	loads eco - types of loads ecos screen
LDSRESET.LSD	loads eco - zone loads reset screen
SYSTECOS.LSD	system eco - types of systems ecos screen
SYSRESET.LSD	systems eco - plant loads reset screen
PLNTECOS.LSD	plant eco - types pf plant ecos screen
QIPLTADT.LSD	quick input system-plant assignment screen
QIPLTDAT.LSD	quick input plant data screen
QIPROJDT.LSD	quick input building data screen
QIQZDFDT.LSD	quick input building shape and orientation screen
QISYS1DT.LSD	quick input zone-system assignment screen
QISYSDAT.LSD	quick input system type screen
WISOLDAT.LSD	weather data input solar screen
WITMPDAT.LSD	weather data input bin temperature screen
DEFLTPLT.PID	plant default input data - quick input
DEFALTBB.SID	system baseboard default data - quick input
DEFALTHV.SID	system heating/ventilating default data - quick input
DEFALTUH.SID	system unitary heater default data - quick input
DEFLTCVR.SID	system constant volume reheat default data - quick input
DEFLTFCU.SID	system fan coil unit default data - quick input
DEFLTWAC.SID	system window air conditioner default data-quick input
DFLTAAHP.SID	system air source heat pump default data - quick input
DFLTDDMZ.SID	system dual duct multizone default data - quick input
DFLTFURN.SID	system furnace default data - quick input
DFLTSZRH.SID	system single zone reheat default data - quick input
DFLTVAVR.SID	system variable air volume default data - quick input
DFLTWSHP.SID	system water source heat pump default data - quick input
DFTCBVAV.SID	system ceiling-bypass VAV default data - quick input

ASEAM2.1 DATA DISK

The data disk contains many "DEMO" files for the input programs and output reports. The Chicago bin temperature and solar files are also found on this diskette.

All the ASEAM2.1 diskettes (except the data and weather diskettes) should have the same date and time stamp for each file. If the date and times are not the same, YOU DO NOT HAVE AN ORIGINAL COPY OF ASEAM2.1.

NBSLCC DISK (EXECUTABLE)

filename.ext	description
BASRUN.EXE	required to run compiled BASIC code (MicroSoft)
HDINSTAL.BAT	hard disk install program (disk 5 only)
HDYESNO.DAT	indicates whether a hard disk is available
FIPROJDT.FIS	economic input - project data screen
FIDEPRDT.FIS	economic input - depreciation data screen
FIMORTDT.FIS	economic input - mortgage data screen
FIENECDT.FIS	economic input - energy cost data screen
FIENEEDT.FIS	economic input - energy escalation data screen
FICAPCDT.FIS	economic input - capital component data screen
FIREPLDT.FIS	economic input - replacement data screen
FIOMCSDT.FIS	economic input - operation & maintenance cost screen
AS2PECON	contains integrated NBSLCC calculations for ASEAM2.1 analysis
PLCCDATA.EXE	input program for LCC
PPRNTBCF.EXE	data echo for building characteristic file
PPRNTLCC.EXE	report program for LCC calculation output
PLCCMAIN.EXE	LCC calculation program
PCOMPARE.EXE	calculation program - compares different LCC files
EDOERG01.PRN	contains DOE energy escalation data - Region 1
EDOERG02.PRN	contains DOE energy escalation data - Region 2
EDOERG03.PRN	contains DOE energy escalation data - Region 3
EDOERG04.PRN	contains DOE energy escalation data - Region 4
EDOERG05.PRN	contains DOE energy escalation data - Region 5
EDOERG06.PRN	contains DOE energy escalation data - Region 6
EDOERG07.PRN	contains DOE energy escalation data - Region 7
EDOERG08.PRN	contains DOE energy escalation data - Region 8
EDOERG09.PRN	contains DOE energy escalation data - Region 9
EDOERG10.PRN	contains DOE energy escalation data - Region 10
EDOERG11.PRN	contains DOE energy escalation data - Region 11

FBLCC DISK (EXECUTABLE)

filename.ext	description
BASRUN.EXE	required to run compiled BASIC code (MicroSoft)
HDINSTAL.BAT	hard disk install program (disk 6 only)
HDYESNO.DAT	indicates whether a hard disk is available
FIENECDT.FIS	economic input - energy cost data screen
FIENEEDT.FIS	economic input - energy escalation data screen
FIOMCSDT.FIS	economic input - operation & maintenance screen
FLCCCAPC.FIS	economic input - capital component data screen
FLCCPROJ.FIS	economic input - project data screen
FLCCREPL.FIS	economic input - replacement data screen
AS2FECON.EXE	contains integrated FBLCC calculations for ASEAM2.1 analysis
FLCCDATA.EXE	input program for LCC
FPRNTBCF.EXE	data echo for building characteristic file
FPRNTLCC.EXE	report program for LCC calculation output
FLCCMAIN.EXE	LCC calculation program
FCOMPARE.EXE	calculation program - compares different LCC files
EDOERG01.PRN	contains DOE energy escalation data - Region 1
EDOERG02.PRN	contains DOE energy escalation data - Region 2
EDOERG03.PRN	contains DOE energy escalation data - Region 3
EDOERG04.PRN	contains DOE energy escalation data - Region 4
EDOERG05.PRN	contains DOE energy escalation data - Region 5
EDOERG06.PRN	contains DOE energy escalation data - Region 6
EDOERG07.PRN	contains DOE energy escalation data - Region 7
EDOERG08.PRN	contains DOE energy escalation data - Region 8
EDOERG09.PRN	contains DOE energy escalation data - Region 9
EDOERG10.PRN	contains DOE energy escalation data - Region 10
EDOERG11.PRN	contains DOE energy escalation data - Region 11

ASEAM2.1 SOURCE DISK #1

filename.ext	description
AS2CENTR.BAS	central system types calculation program
AS2COMLS.BAS	common block deletion between loads and systems programs
AS2COMSP.BAS	common block deletion between systems and plant programs
AS2FECON.BAS	compares runs - performs FBLCC economic analysis
AS2LOADC.BAS	load calculation program
AS2PLANT.BAS	plant calculation program
AS2PROCL.BAS	load pre-processor program
AS2PROCR.BAS	run pre-processor program
AS2PROCS.BAS	system pre-processor program

ASEAM2.1 SOURCE DISK #2

filename.ext	description
AS2LDREP.BAS	load report generator program
AS2PLREP.BAS	plant report generator program
AS2REPRT.BAS	report generator program
AS2SYREP.BAS	systems report generator program
AS2UNITC.BAS	unitary system types calculation program
AS2WDREP.BAS	weather data report generator
AS23DIMG.BAS	three dimensional graphics output for loads reports
LDINPUT.FRM*	abbreviated Loads Input Forms
SYSINPUT.FRM*	abbreviated Systems Input Forms
PLTINPUT.FRM*	abbreviated Plant Input Forms
FBLCCIND.FRM*	abbreviated FBLCC Input Forms
NBSLCIND.FRM*	abbreviated NBSLCC Input Forms

* Since these files may be used frequently, you may want to copy these to your hard disk, if available.

ASEAM2.1 SOURCE DISK #3

filename.ext	description
AS2LDINP.BAS	loads input program
AS2MENU.BAS	main menu program
AS2PLINP.BAS	plant input program
AS2QKINP.BAS	quick input program
AS2SYINP.BAS	systems input program

ASEAM2.1 SOURCE DISK #4

filename.ext	description
AS2WDINP.BAS	weather data input program
AS2PECON.BAS	compares runs - performs NBSLCC economic analysis
QIFILES.DFT	contains default filenames for quick input
QIBLDGDF.PRN	quick input - building default data
QICLIMDF.PRN	quick input - climate type default data
QINONDDF.PRN	quick input - miscellaneous default data
QISPCEDF.PRN	quick input - space type default data
QIZONEDF.PRN	quick input - zone type default data
AS2TEMPL.WKS*	Lotus template for formatting output reports
AS2PROCP.BAS	plant pre-processor program
AS2ECOIN.BAS	eco input program
AS23DIMG.EXE*	executable three dimensional graphics program
QIDEFALT.WKS	template for reading quick input default files

* Since these files may be used frequently, you may want to copy these to your hard disk, if available.

NBSLCC SOURCE DISK

filename.ext	description
HDYESNO.DAT	indicates whether a hard disk is available
FIPROJDT.FIS	economic input - project data screen
FIDEPRDT.FIS	economic input - depreciation data screen
FIMORTDT.FIS	economic input - mortgage data screen
FIENECDT.FIS	economic input - energy cost data screen
FIENEEDT.FIS	economic input - energy escalation data screen
FICAPCDT.FIS	economic input - capital component data screen
FIREPLDT.FIS	economic input - replacement data screen
FIOMCSDT.FIS	economic input - operation & maintenance cost screen
PLCCDATA.BAS	input program for LCC
PPRNTBCF.BAS	data echo program for building characteristic file
PPRNTLCC.BAS	report program for LCC calculation output
PLCCMAIN.BAS	LCC calculation program
PCOMPARE.BAS	calculation program - compares different LCC files
EDOERG01.PRN	contains DOE energy escalation data - Region 1
EDOERG02.PRN	contains DOE energy escalation data - Region 2
EDOERG03.PRN	contains DOE energy escalation data - Region 3
EDOERG04.PRN	contains DOE energy escalation data - Region 4
EDOERG05.PRN	contains DOE energy escalation data - Region 5
EDOERG06.PRN	contains DOE energy escalation data - Region 6
EDOERG07.PRN	contains DOE energy escalation data - Region 7
EDOERG08.PRN	contains DOE energy escalation data - Region 8
EDOERG09.PRN	contains DOE energy escalation data - Region 9
EDOERG10.PRN	contains DOE energy escalation data - Region 10
EDOERG11.PRN	contains DOE energy escalation data - Region 11

FBLCC SOURCE DISK

filename.ext	description
HDYESNO.DAT	indicates whether a hard disk is available
FIENECDT.FIS	economic input - energy cost data screen
FIENEEDT.FIS	economic input - energy escalation data screen
FIOMCSDT.FIS	economic input - operation & maintenance screen
FLCCCAPC.FIS	economic input - capital component data screen
FLCCPROJ.FIS	economic input - project data screen
FLCCREPL.FIS	economic input - replacement data screen
FLCCDATA.BAS	input program for LCC
FPRNTBCF.BAS	data echo program for building characteristic file
FPRNTLCC.BAS	report program for LCC calculation output
FLCCMAIN.BAS	LCC calculation program
FCOMPARE.BAS	calculation program - compares different LCC files
EDOERG01.PRN	contains DOE energy escalation data - Region 1
EDOERG02.PRN	contains DOE energy escalation data - Region 2
EDOERG03.PRN	contains DOE energy escalation data - Region 3
EDOERG04.PRN	contains DOE energy escalation data - Region 4
EDOERG05.PRN	contains DOE energy escalation data - Region 5
EDOERG06.PRN	contains DOE energy escalation data - Region 6
EDOERG07.PRN	contains DOE energy escalation data - Region 7
EDOERG08.PRN	contains DOE energy escalation data - Region 8
EDOERG09.PRN	contains DOE energy escalation data - Region 9
EDOERG10.PRN	contains DOE energy escalation data - Region 10
EDOERG11.PRN	contains DOE energy escalation data - Region 11

BIN TEMPERATURE WEATHER DATA (ALL ASHRAE FORMAT)

filename.ext	bin temperature data for
ALBUQRNM.AWD	Albuquerque, New Mexico
AMARLOTX.AWD	Amarillo, Texas
ATLNTAGA.AWD	Atlanta, Georgia
BIRMHMAL.AWD	Birmingham, Alabama
BISMRKND.AWD	Bismarck, North Dakota
BOISE-ID.AWD	Boise, Idaho
BOSTONMA.AWD	Boston, Massachusetts
BRNSVLTX.AWD	Brownsville, Texas
CHEYNEWY.AWD	Cheyenne, Wyoming
CHICGOIL.AWD	Chicago, Illinois
CHRLTNSC.AWD	Charleston, South Carolina
CLEVLNOH.AWD	Cleveland, Ohio
DALLASTX.AWD	Dallas, Texas
DAYTONOH.AWD	Dayton, Ohio
DENVERCO.AWD	Denver, Colorado
DESMONIA.AWD	Des Moines, Iowa
DETROTMI.AWD	Detroit, Michigan
DODGCTKN.AWD	Dodge City, Kansas
ELPASOTX.AWD	El Paso, Texas
GRTFALMT.AWD	Great Falls, Montana
INDAPLIN.AWD	Indianapolis, Indiana
KANCTYMO.AWD	Kansas City, Missouri
LASVEGNV.AWD	Las Vegas, Nevada
LITLRKAR.AWD	Little Rock, Arkansas
LKCHASLA.AWD	Lake Charles, Louisiana
LOSANGCA.AWD	Los Angeles, California
MADISNWS.AWD	Madison, Wisconsin
MEDFRDOR.AWD	Medford, Oregon
MIAMI-FL.AWD	Miami, Florida
MINAPLMN.AWD	Minneapolis, Minnesota
NASHVLTN.AWD	Nashville, Tennessee
NEWYOKNY.AWD	New York City, New York
OKHMCTOK.AWD	Oklahoma City, Oklahoma
OMAHA-NB.AWD	Omaha, Nebraska
PHOENXAZ.AWD	Phoenix, Arizona
PITSBRPA.AWD	Pittsburgh, Pennsylvania
PORTLNME.AWD	Portland, Maine
PORTLNOR.AWD	Portland, Oregon
RALEGHNC.AWD	Raleigh, North Carolina
SALTLCUT.AWD	Salt Lake City, Utah
SANANTTX.AWD	San Antonio, Texas
SEATTLWA.AWD	Seattle, Washington
STLOUSMO.AWD	St. Louis, Missouri
TALHASFL.AWD	Tallahassee, Florida
TAMPA-FL.AWD	Tampa, Florida
WASHNTDC.AWD	Washington, District of Columbia
WEAFILES.WKS	LOTUS (tm) worksheet file for weather station database

SOLAR DATA DISK #1 - ALBUQUERQUE TO DENVER

filename.ext	solar data files for
ALBUQRNM.NSD	Albuquerque, New Mexico
AMARLOTX.NSD	Amarillo, Texas
ATLNTAGA.NSD	Atlanta, Georgia
BIRMHMAL.NSD	Birmingham, Alabama
BISMRKND.NSD	Bismarck, North Dakota
BOISE-ID.NSD	Boise, Idaho
BOSTONMA.NSD	Boston, Massachusetts
BRNSVLTX.NSD	Brownsville, Texas
CHEYNEWY.NSD	Cheyenne, Wyoming
CHICGOIL.NSD	Chicago, Illinois
CHRLTNSC.NSD	Charleston, South Carolina
CLEVLNOH.NSD	Cleveland, Ohio
DALLASTX.NSD	Dallas, Texas
DAYTONOH.NSD	Dayton, Ohio
DENVERCO.NSD	Denver, Colorado

SOLAR DATA DISK #2 - DES MOINES TO NASHVILLE

filename.ext	solar data files for
DESMONIA.NSD	Des Moines, Iowa
DETROTMI.NSD	Detroit, Michigan
DODGCTKN.NSD	Dodge City, Kansas
ELPASOTX.NSD	El Paso, Texas
GRTFALMT.NSD	Great Falls, Montana
INDAPLIN.NSD	Indianapolis, Indiana
KANCTYMO.NSD	Kansas City, Missouri
LASVEGNV.NSD	Las Vegas, Nevada
LITLRKAR.NSD	Little Rock, Arkansas
LKCHASLA.NSD	Lake Charles, Louisiana
LOSANGCA.NSD	Los Angeles, California
MADISNWS.NSD	Madison, Wisconsin
MEDFRDOR.NSD	Medford, Oregon
MIAMI-FL.NSD	Miami, Florida
MINAPLMN.NSD	Minneapolis, Minnesota
NASHVLTN.NSD	Nashville, Tennessee

SOLAR DATA DISK #3 - NEW YORK CITY TO WASHINGTON DC

filename.ext	solar data files for
NEWYOKNY.NSD	New York City, New York
OKHMCTOK.NSD	Oklahoma City, Oklahoma
OMAHA-NB.NSD	Omaha, Nebraska
PHOENXAZ.NSD	Phoenix, Arizona
PITSBRPA.NSD	Pittsburgh, Pennsylvania
PORTLNME.NSD	Portland, Maine
PORTLNOR.NSD	Portland, Oregon
RALEGHNC.NSD	Raleigh, North Carolina
SALTLCUT.NSD	Salt Lake City, Utah
SANANTTX.NSD	San Antonio, Texas
SEATTLWA.NSD	Seattle, Washington
STLOUSMO.NSD	St. Louis, Missouri
TALHASFL.NSD	Tallahassee, Florida
TAMPA-FL.NSD	Tampa, Florida

APPENDIX F - REFERENCES

The following references may prove helpful when using ASEAM2.1. Every attempt has been made when writing and documenting the code to have the program and user's manual be self-contained. No additional references are required to execute ASEAM2.1. However, the documents listed in this section may increase your understanding of some of the program algorithms. This manual is a user's manual; it is geared toward teaching you to run ASEAM2.1 and not toward explaining the calculations. Many of the references, listed below, do explain the calculations performed. In addition, an ASEAM2.1 Engineer's Manual, which will document the algorithms, is planned as a companion document to the user's manual.

1) ASHRAE 1985 Handbook of Fundamentals

Published by: American Society of Heating, Refrigerating, and Air-Conditioning Engineers (1985)

Available from: ASHRAE Publication Sales
1791 Tullie Circle, NE
Atlanta, GA 30329
404/636-8400

This handbook is an essential reference. The calculation methodologies for the loads program can, in large part, be found here. (References 4 and 5, below, go into more detail about "bin" and systems/plant calculations though.) All of the cooling load factor, solar heat gain factor, etc. tables used by ASEAM2.1 come from this volume. In addition, many other useful items are to be found here: latitudes and longitudes of cities, U-factor tables for building constructions, etc.

2) IES Lighting Handbook 1984 Reference Volume

Available from: Illuminating Engineering Society

This is the general reference handbook for the lighting community. The section on Daylighting (Chapter 7) describes the calculation methodology used by ASEAM2.1 for daylighting analysis. Also, recommended lighting levels for various space types and tasks are given in this volume.

3) DOE2 Engineers Manual Version 2.1A

Authors: Energy and Environment Division
Building Energy Simulation Group

Published by: Lawrence Berkeley Laboratory (1982)
LBL-11353 DE83004575

Available from: National Technical Information Service
U.S. Department of Commerce
Springfield, VA 22161

The DOE2 Engineers Manual is a reference manual for the hourly simulation program, DOE2. Many of the ASEAM2.1 system and plant calculation algorithms are taken directly from DOE2. Included as comments in the ASEAM2.1 code are the corresponding equation numbers and pages from the DOE2 Engineers Manual. If you will be examining and/or modifying the systems or plant calculations, this reference will be extremely helpful.

4) Simplified Energy Analysis Using the Modified Bin Method

Author: David E. Knebel, Principal Investor

Published by: American Society of Heating, Refrigerating, and Air-Conditioning Engineers (1983) ISBN 0-910110-39-5

Available from: ASHRAE Publication Sales
1791 Tullie Circle, NE
Atlanta, GA 30329
404/636-8400

This book covers the methodology of the modified bin method. The bin method discussed here is an annual method. ASEAM2.1 differs, however, in many of the procedures explained in this book (e.g., systems/plant algorithms, extensions for monthly analysis, peak loads calculations, etc.)

5) Cooling and Heating Load Calculation Manual

Authors: Dr. William Rudoy, Project Director
Joseph F. Cuba, Principal Investigator

Published by: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (1979)

Available from: ASHRAE Publication Sales
1791 Tullie Circle, NE
Atlanta, GA 30329
404/636-8400

This book describes the ASHRAE algorithms for calculating design heating and cooling loads. Much of the information duplicates that contained in the ASHRAE Handbook of Fundamentals load calculation chapters, however this manual goes into much more detail and contains more examples. If you are interested in the methods used for calculating peak loads, it is suggested that you refer to this book.

The crack length method of calculating infiltration rates for windows and doors is used in ASEAM2.1 and comes from this book. It may also be found in older versions of the ASHRAE Handbook of Fundamentals. The 1985 Handbook of Fundamentals, however, explains a new method of calculating infiltration rates by specific leakage area (which ASEAM2.1 does not use).

6) Recommended Practice for the Calculation of Daylight Availability

Author: IES Calculation Procedures Committee

Published by: Journal of IES (July, 1984) pp. 381-392.

This article describes the calculation of daylight availability. Some of these algorithms are used by ASEAM2.1 in generating the solar data files. (Note: this data is quite similar to that found the IES Reference Handbook and the booklet "How to Predict Interior Daylight Illumination". However, where the latter two references use tables of values and interpolate within them, this article provides equations for use in calculating values.)

7) How to Predict Interior Daylight Illumination

Published by: Libby-Owens-Ford Company (1976)

This booklet describes the methodology used by ASEAM2.1 for calculating daylight availability in a room. The methodology is the same as that in the IES Lighting Handbook 1984 Reference Volume, but contains more detailed and somewhat less technical descriptions and examples.

8) Controlite 1.0 Lighting Control systems and Daylighting Analysis Program: User's Manual

Author: Lighting Technologies, Boulder, CO

Published by: Lawrence Berkeley Laboratory (January, 1985)
LBL-17444
EEB-L 84-02
L-84

Available from: Lighting Systems Research
Lawrence Berkeley Laboratory
University of California
Berkeley, CA 94720

The User's Manual and diskettes for Controlite should be used if you want to take advantage of ASEAM2.1's capability of using Controlite output files for the daylighting analysis. Controlite uses much more sophisticated algorithms than ASEAM2.1 for calculating the contribution of daylighting. You must first run Controlite and then specify the output filename for ASEAM2.1 to use in its calculations. You must use Controlite version 1.0.

9) Bindata Users Guide for Microcomputers
ASHRAE Research Project 385-RP

Author: Larry O. Degelman

Published by: American Society of Heating, Ventilating, and Air-Conditioning Engineers, Inc. (1979)

Available from: ASHRAE Publication Sales
1791 Tullie Circle, NE
Atlanta, GA 30329
404/636-8400

This manual describes the use of ASHRAE bin weather data and programs. The bin data in these files were converted for use by ASEAM2.1, and are included in the set of bin weather diskettes you have received. These diskettes can be ordered from ASHRAE at the above address. The bin format is six four-hour blocks. See Appendix A for a listing of these stations.

10) Weather Data for Simplified Energy Calculation Methods (4 volumes)

Authors: A.R. Olsen, S. Moreno, J. Deringer, and C.R. Watson

Published by: Battelle Pacific Northwest Laboratory (August, 1984)
PNL-5143 UC-95d

Available from: National Technical Information Service
United States Department of Commerce
5285 Port Royal Road
Springfield, VA 22161

This four-volume set contains bin weather data in eight three-hour bin format for many locations in the U.S. If the site you need is not included in the weather library provided, you can enter the bin data from these volumes into the ASEAM2.1 Weather Input Program to create weather files for use with ASEAM2.1. See Appendix A for a listing of these stations.

11) Engineering Weather Data

Published by: Departments of the Air Force, the Army, and the Navy (July, 1978) AFM 88-29

Available from: Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

This book contains bin data in three eight-hour block format for many locations in the U.S. and also a few abroad. This volume has many more stations than either of the above two volumes (See Appendix A). You may enter this bin data with the ASEAM2.1 Weather Input Program to create weather files for use with ASEAM2.1.

12) A User's Guide to the Federal Building Life-Cycle Cost (FBLCC) Computer Program [NBS Technical Note 1222]

Author: Stephen R. Petersen

Available from: Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

This book describes the FBLCC Life-Cycle Cost Program. It should be obtained for Federal projects. A discussion of the FBLCC input questions and calculation methodology is contained in this reference.

13) Comprehensive Guide for Least-Cost Energy Decisions [NBS Special Publication 709]

Authors: Rosalie T. Ruegg and Stephen R. Petersen

Available from: Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

This manual describes the input questions and calculation methodology for the NBSLCC computer program. This book should be used for all private sector (non-Federal) LCC analyses.

Appendix G Changing Quick Input Default Values

G.1 Quick Input Default Usage

Quick Input uses several different files of default values. These are called "dynamic defaults" in the sense that inputs made to the program determine the values of later defaults.

In order to change the default values in Quick Input, it is necessary to have an understanding of how the Quick Input program works. Only the Loads portion of Quick Input uses dynamic defaults. That is, there are five data files of loads default values, and the values selected is dependent on your response to input questions in Quick Input. For example, the number of people per square foot depends on the space type selected. The Systems and Plant portions do not use the same type of dynamic defaults. Instead, there is a complete set of default files for each system type and plant component. Within Quick Input, you specify only the system type and energy source for the systems loads; the appropriate system or plant default values are then used for the remainder of the input.

The names of all the default files used in Quick Input are stored in a file named "QIFILES.DFT." That is, it is possible to create and use different default files for Quick Input it is not necessary to continually modify the original default files or re-compile Quick Input to access different files. The file structure of each default file, however, cannot be changed without re-compiling Quick Input.

Each of the default files contain different values. For the loads portion of Quick Input, these files may be classified in the following manner:

QICLIMDF.PRN Climate Default File

> This file contains default values for thirty different climate types. Based on the climate type entered in Quick Input, the wall, roof, and window U-factors and the summer beginning and ending month numbers are defined.

QIBLDGDF.PRN Building Default File

> This file contains default values for fourteen different building types. You select a building type in the Quick Input routine. Default values for occupancy starting and ending hours and diversity factors for people, equipment, and lights are read from this file. Also, the building type determines the typical zone types.

QIZONEDF.PRN Zone Default File

> This file contains default values for up to 55 zone types. You select the predominate zone type for each zone in the Quick Input routine. Default values for thermostat setpoints and whether or not there is a ceiling plenum are then read from this file. Also, the zone type determines the typical space types.

QISPCEDF.PRN Space Default File

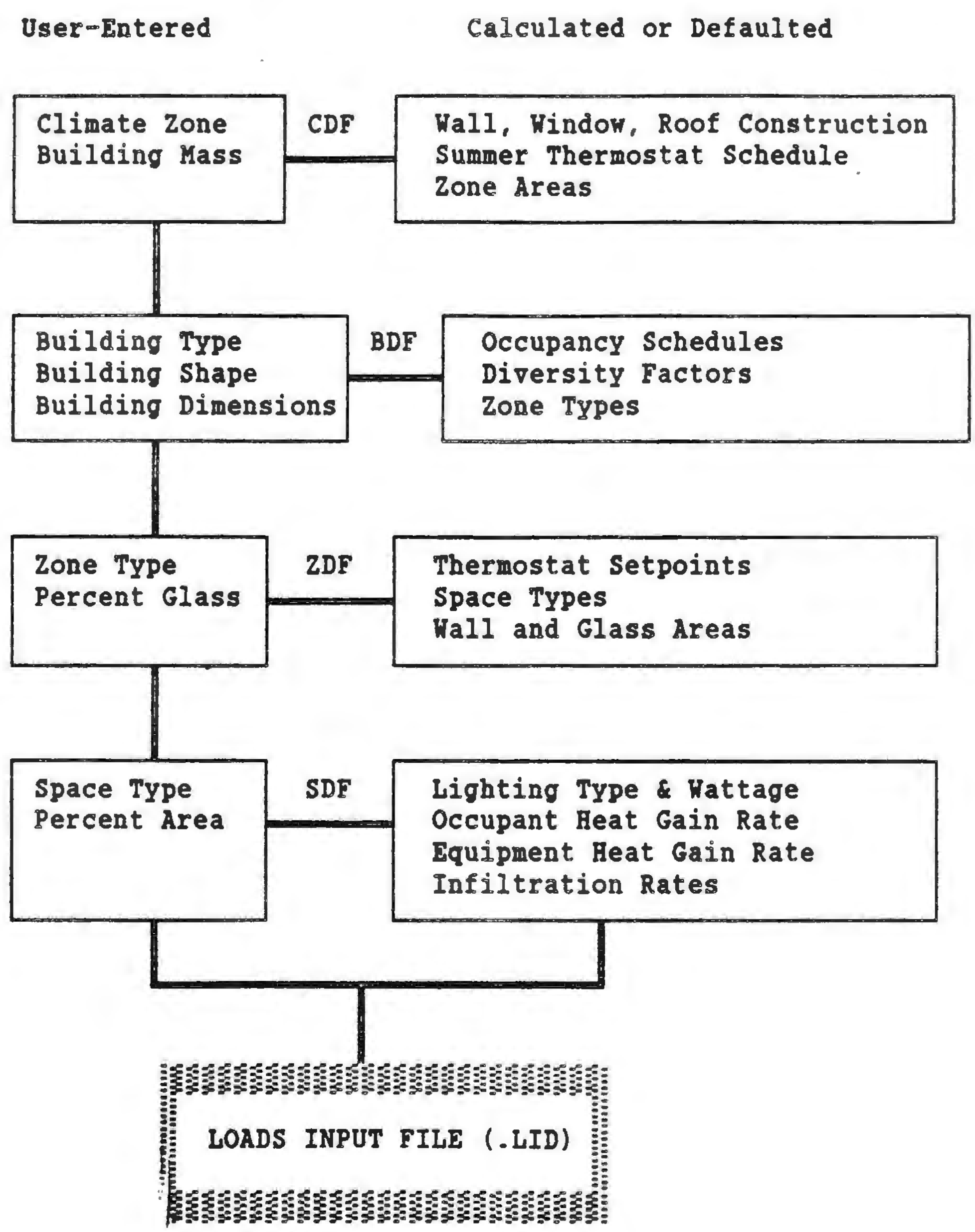
> This file contains default values for up to 95 space types. You select space types in the Quick Input routine. Default values for lighting type and wattage, occupancy density and heat gain rate, equipment density and heat gain rate, and infiltration are read from this file.

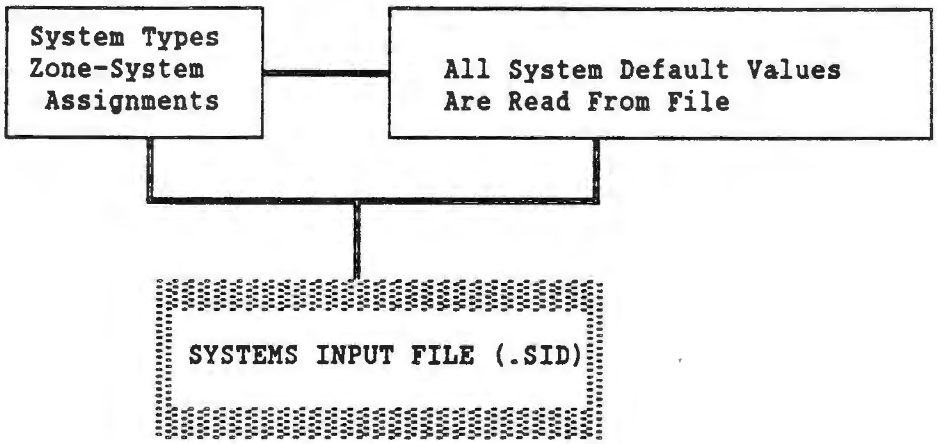
QINONDDF.PRN Non Dynamic Default File

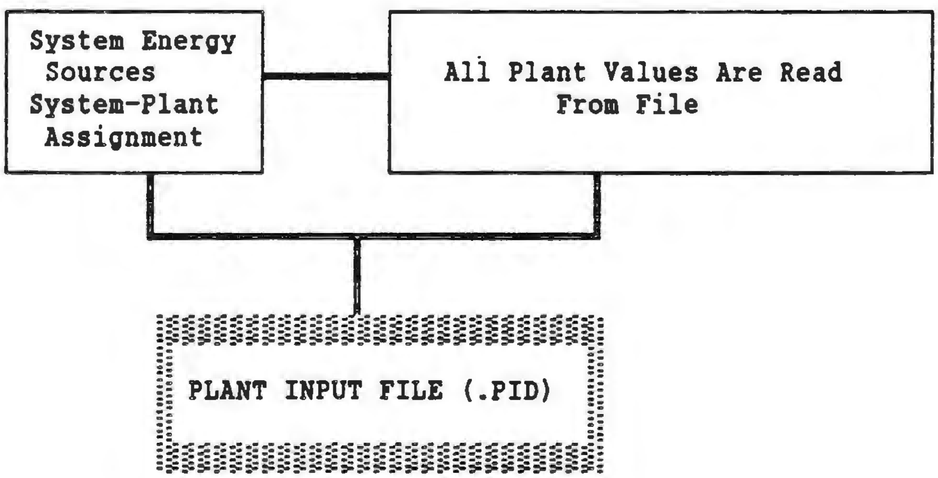
This file contains default values that are not dependent on the climate, building, zone, or space type. Examples of these include ground reflectance, daylighting control methods, etc.

The diagram below shows which inputs are entered by the user and which are selected, based on the user inputs, from the default files. Between the blocks printed below are the abbreviations for the default files:

CDF Climate Default File
BDF Building Default File
ZDF Zone Default File
SDF Space Default File


User-Entered
Calculated or Defaulted
Climate Zone
Building Mass
CDF
Wall, Window, Roof Construction
Summer Thermostat Schedule
Zone Areas
Building Type
Building Shape
Building Dimensions
BDF
Occupancy Schedules
Diversity Factors
Zone Types
Zone Type
Percent Glass
ZDF
Thermostat Setpoints
Space Types
Wall and Glass Areas
Space Type
Percent Area
SDF
Lighting Type & Wattage
Occupant Heat Gain Rate
Equipment Heat Gain Rate
Infiltration Rates
LOADS INPUT FILE (.LID)


System Types
Zone-System
Assignments
All System Default Values
Are Read From File
SYSTEMS INPUT FILE (.SID)


System Energy
Sources
System-Plant
Assignment
All Plant Values Are Read
From File
PLANT INPUT FILE (.PID)

G.2 Loads Dynamic Default Files

If you want to change any of the loads default values, you can do so by editing the appropriate default files with a word processor or line editor. Follow all the same rules for changing screen input files, listed in Appendix C. Samples of each of the default file types are shown below. Note that the filenames used for all the different default files are accessed in the file "QIFILES.DFT." This file MUST be stored on the Supplemental Disk. For clarity, the filenames for the default files supplied with ASEAM2.1 are used below. Quick Input "reads" this file first to retrieve the filenames for all the default files. Section G.5 describes how you may view the loads default values.

G.2.1 QIFILES.DFT

This file contains nineteen lines. Each line contains the filename for different default files as outlined below. The first five define the loads default filenames as outlined above. Following these are default filenames for the different systems and one for the plant default values.

QICLIMDF.PRN	Climate Default File
QIBLDGDF.PRN	Building Default File
QINONDDF.PRN	Non Dynamic Default File
QIZONEDF.PRN	Zone Default File
QISPCEDF.PRN	Space Default File
DFLTDDMZ.SID	Dual Duct/Multizone System Default File
DEFLTCVR.SID	Constant Volume Reheat System Default File
DFLTVAVR.SID	VAVR System Default File
DFTCBVAV.SID	Ceiling Bypass VAV System Default File
DFLTSZRH.SID	Single Zone Reheat System Default File
DEFLTFCU.SID	Fan Coil Unit System Default File
DFLTWSHP.SID	Water Source Heat Pump System Default File
DFLTAAHP.SID	Air/Air Heat Pump System Default File
DEFALTBB.SID	Baseboard System Default File
DFLTFURN.SID	Furnace System Default File
DEFALTUH.SID	Unit Heater System Default File
DEFALTHV.SID	Heat & Vent System Default File
DEFLTWAC.SID	Window Air Conditioner System Default File
DEFLTPLT.PID	Plant Default File

The systems and plant default files (extensions ."SID" and ."PID") can be changed with the normal ASEAM2.1 Systems and Plant input programs. The Loads default files (extension ."PRN") must be changed with an editor or word processor as described below.

These files must be located on the default drive disk (Supplemental Disk or hard disk) if you do not add a drive designator. If you wish to use a floppy diskette for default file storage, you must add the drive designator before the filename (e.g., B:QISPCEDF.NEW). DO NOT ADD A "\" TO THE FILENAME THE IBM VERSION 1.0 COMPILER DOES NOT RECOGNIZE DOS 2.0 OR LATER ROOT DIRECTORIES OR PATHS.

G.2.2 Climate Default File

The Climate defaults supplied with ASEAM2.1 are located in a file named "QICLIMDF.PRN" (the first filename in "QIFILES.DFT").

> IMPORTANT: Each loads default file contains the exact same number "fields" or default values for each climate (or building, zone, and space). Therefore, when making changes in these files, make sure that the new or changed values replace the original values. If you accidentally delete or add a "field" or value, Quick Input will not read in the default values properly. It is always advisable to check the input files through the normal input programs, or by using the data echo program.

Outlined below is the file structure of the Climate default file. The numbers printed as column headers below are defined underneath the sample file. The actual default file read by Quick Input has no column headers. There are thirty different climate types in the climate default file. Only four are shown below.

1	2	3	4	5	6	7	8	9	10	11	12
1	0.480	0.580	0.740	0.800	1.15	0.69	0.81	0.55	0.092	1	12
2	0.480	0.580	0.740	0.800	1.15	0.69	0.81	0.55	0.061	1	12
3	0.100	0.110	0.130	0.150	0.68	0.55	0.45	0.55	0.071	4	11
4	0.150	0.230	0.390	0.550	1.15	0.69	0.81	0.55	0.094	4	11

etc.

column	contents
(1)	climate number
(2)	wall U-factor, wall category G (BTU/hr-sf-F)
(3)	wall U-factor, wall category E,F (BTU/hr-sf-F)
(4)	wall U-factor, wall category D (BTU/hr-sf-F)
(5)	wall U-factor, wall category A,B,C (BTU/hr-sf-F)

NOTE: the wall categories listed above correspond to mass or construction groups outlined in the ASHRAE Handbook of Fundamentals.

column	contents
(6)	window U-factor (BTU/hr-sf-F)
(7)	window shading coefficient
(8)	window U-factor (BTU/hr-sf-F)
(9)	window shading coefficient
(10)	roof U-factor (BTU/hr-sf-F)
(11)	summer beginning month number (1=Jan,...,12=Dec)
(12)	summer ending month number (1=Jan,...,12=Dec)

G.2.3 Building Default File

The building default values supplied with ASEAM2.1 are originally located in a file named "QIBLDGDF.PRN" (the second filename listed in "QIFILES.DFT"). The values in this file are separated only by commas, therefore, the values do not necessarily line up with each other. For example, the third entry will not always be found at a certain column number. A few sample lines are printed below. Underneath these lines is a description of what each entry contains. (For example, (3) describes the entry in the third field on each line.) When making changes in this file, make sure that the order of entries remains the same and that all fields are separated by commas.

The building default file stores default values for the fourteen building types. Each building type or line has 34 default values.

```
1,"Auditorium",9,8,900,1700,900,1700,0,0,33,0,80,2,2,36,16,12,37,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
2,"Clinic",8,16,800,2200,800,1900,900,1600,46,0,65,4,14,16,12,19,11,22,32,37,33,0,0,0,0,0,0,0,0,0,-
0,0
3,"Community
Center",7,16,700,2200,800,2200,800,2200,43,1,68,4,7,28,13,10,17,30,35,23,25,37,18,6,22,12,2,36,2-
9,20,0,0
4,"Gymnasium/Health
Club",7,16,700,2200,800,2200,800,2200,43,1,68,4,17,30,35,7,28,13,10,23,25,22,0,0,0,0,0,0,0,0,0,0
...
```

field	contents
(1)	Building Number (1 to 14)
(2)	Building Type (must be within double quotation marks)
(3)	Occupancy Starting Hour
(4)	Number of Occupied Hours per Day
(5)	Weekdays Occupied From Hour
(6)	Weekdays Occupied To Hour
(7)	Saturdays Occupied From Hour
(8)	Saturdays Occupied To Hour
(9)	Sundays Occupied From Hour
(10)	Sundays Occupied To Hour
(11)	People and Equipment Diversity Factor, Occupied Period
(12)	People and Equipment Diversity Factor, Unoccupied Period
(13)	Lighting Diversity Factor, Occupied Period
(14)	Lighting Diversity Factor, Unoccupied Period
(15)	Zone Type #1
(16)	Zone Type #2
...	
(34)	Zone Type #20

Up to twenty typical zone types are allowed for each building type. These zone type numbers correspond to the zone default file (see Section G.2.4 below). A "0" entry for the zone type indicates no assignment, however the "0" must still be present.

G.2.4 Zone Default File

The zone default values originally supplied with ASEAM2.1 are contained in a file named "QIZONEZDF.PRN." The values in this file are also separated only by commas, therefore the values do not necessarily line up with each other. A few sample lines are printed below. Underneath these lines is a description of what each entry contains. (For example, (3) describes the entry in the third field on each line.) When making changes in this file, make sure that the order of entries remains the same and that all fields are separated by commas.

The zone default file contains default values for up to 55 different zone types. Each zone or line has 26 default values.

```
1,"ASSEMBLY RM",75,70,60,"Y",6,8,16,18,31,47,49,50,63,0,0,0,0,0,0,0,0,0,0,0
2,"AUDITORIUMS",78,70,60,"Y",6,8,16,18,31,47,49,50,63,0,0,0,0,0,0,0,0,0,0,0
3,"AUTO REP WKRM",80,60,55,"N",69,43,48,73,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
4,"BARS",75,70,60,"Y",8,9,22,32,38,57,66,0,0,0,0,0,0,0,0,0,0,0,0,0
5,"BEDROOM",78,70,60,"N",12,13,11,34,66,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
...
39,"WAITING ROOM",75,70,60,"Y",8,11,16,18,40,42,55,57,63,71,0,0,0,0,0,0,0,0,0,0
40,"WAREHOUSE",80,60,55,"N",45,66,67,51,53,64,1,11,19,29,30,33,36,41,42,0,0,0,0,0
```

field	contents
(1)	Zone Type Number (1 to 55)
(2)	Zone Type Description (enclosed in double quotations)
(3)	Summer Occupied Period Thermostat Setpoint
(4)	Winter Occupied Period Thermostat Setpoint
(5)	Winter Unoccupied Period Thermostat Setpoint
(6)	Ceiling Plenum (enclosed in double quotations)
(7)	Space Type #1
(8)	Space Type #2
...	
(26)	Space Type #20

Up to twenty typical space types are allowed for each zone type. These space type numbers correspond to the space default file (see Section G.2.5 below). A "0" entry for the space type indicates no assignment, however the "0" must still be present.

G.2.5 Space Default Values

The space default values originally supplied with ASEAM2.1 are stored in a file named "QISPCEDFT.PRN." Up to 95 different space types can be defined. Each space type or line has 19 default values.

```
1,"Acntg/Low Part",2.1,2,80,.65,"B",20,8.5,70,75,100,255,255,.75,.3,.3,.5,1
2,"Acntg/Med Part",2.4,2,80,.65,"B",20,8.5,70,75,100,255,255,.75,.3,.3,.5,1
3,"Acntg/High Part",2.7,2,80,.65,"B",20,8.5,70,75,100,255,255,.75,.3,.3,.5,1
...
```

column	contents
(1)	Space Type Number
(2)	Space Type Name (enclosed in double quotations)
(3)	Lighting Watts/Square Foot
(4)	Lighting Type Code (used only for description) 1 = Suspended Fluorescent 2 = Recessed Fluorescent (vented) 3 = Recessed Fluorescent (vented) 4 = Incandescent 5 = Recessed Fluorescent (not vented)
(5)	Percent Heat to Space
(6)	"A" Classification for lighting
(7)	"B" Classification for lighting
(8)	Room-Length (for daylighting), ft
(9)	Floor-Ceiling Height, ft
(10)	Wall Reflectance (percent)
(11)	Footcandles (design and present)
(12)	Square Feet per Person
(13)	BTU per Person Sensible
(14)	BTU per Person Latent
(15)	Equipment Watts per Square Foot
(16)	Occupied Period Infiltration Rate (air changes per hour)
(17)	Unoccupied Period Infiltration Rate (air changes per hour)
(18)	Space diversity factor for people and equipment (decimal)
(19)	Space diversity factor for lighting (decimal)

G.2.6 Non-Dynamic Default Values

Quick Input stores default values that are unrelated to climate location, building, zone or space type in a file named "QINONDDF.PRN." Many of these default values are associated with daylighting defaults.

There are 18 default values or lines in this file.

```
.83
.5
3
20
2
100
D
20
30
...
```

Described below are the contents of the file.

(1) wall color correction (1, .83, .65)
(2) roof color correction (1, .5)
(3) infiltration leakage coefficient for windows and doors

Lines 4 through 18 are default values for daylighting only

(4) ground reflectance
(5) sensor location
(6) percent controlled
(7) daylighting control method ('D'im or 'S'tep)
(8) minimum footcandles maintained by artificial lighting (dimming control)
(9) percent of total power at minimum lighting (dimming control)
(10) number of steps (stepped control)
(11) step #1 artificial lighting footcandles
(12) step #1 artificial lighting watts
(13) step #2 artificial lighting footcandles
(14) step #2 artificial lighting watts
(15) step #3 artificial lighting footcandles
(16) step #3 artificial lighting watts
(17) step #4 artificial lighting footcandles
(18) step #4 artificial lighting watts

G.3 Systems Default Values

The systems default values are not assigned dynamically. There is a separate file of default values for each system type. You choose only the system type and the energy source and/or plant component which meets the system load. All the data for this system is then retrieved from the appropriate system default file.

To change system default values, enter the Systems Input program, and change the data using the standard procedure for editing a file. If you save the file under a different name, be sure to change the filename in the "QIFILES.DFT" file. You may want to make a backup copy of the original system default files first, for later use.)

The default system files are:

DFLTDDMZ.SID	Double Duct or Multizone	(System #1)
DEFLTCVR.SID	Constant Volume Reheat	(System #2)
DFLTVAVR.SID	Variable Air Volume Reheat	(System #3)
DFTCBVAV.SID	Ceiling Bypass Variable Air Volume	(System #4)
DFLTSZRH.SID	Single Zone Reheat	(System #5)
DEFLTFCU.SID	Fan Coil Unit	(System #6)
DFLTWSHP.SID	Water Source Heat Pump	(System #7)
DFLTAAHP.SID	Air-to-Air Heat Pump	(System #8)
DEFALTBB.SID	Baseboard Heaters	(System #9)
DFLTFURN.SID	Furnace	(System #10)
DEFALTUH.SID	Unitary Heater	(System #11)
DEFALTHV.SID	Heating and Ventilating Unit	(System #12)
DEFLTWAC.SID	Window Air Conditioner	(System #13)

G.4 Plant Default Values

All plant default values are contained in the file named "DEFLTPLT.PID." This file has default values for all possible plant types. Those plant types not required (i.e.: not specified as an energy source in systems) will also have data, but will not be used during the calculations.

To change default values for the plant, use the standard procedure for editing a file in the Plant Input program. If you save the file under a different name, be sure to change the filename in the "QIFILES.DFT" file. You may want to make a backup copy of the original plant default files first, for later use.

G.5 Viewing the Loads Default Values

Since the loads default files (and other "data" files) contain many values, and the numbers are not "lined up" for easy comprehension, it is sometimes difficult (at best) to discern what is actually in the file.

For this reason, the loads defaults files have been "stored" in a Lotus (tm) compatible file format. That is, you may "import" the loads default values into Lotus (tm) by using the "File/Import/Numbers" command.

For your convenience, a Lotus (tm) worksheet "template" is supplied with ASEAM2.1 (filename "QIDEFALT.WKS"). This file contains the column headers for the climate, building, zone, and space default files. Once you have loaded the spreadsheet, first retrieve the "QIDEFALT.WKS" template using the "File/Retrieve" command. You will notice that this file contains four sets of column headers across the top of the worksheet one for each default file (Climate -> Building -> Zone -> Space). The column headers are stored in the file.

To view the default values for a particular default file, first you must locate the cursor at the top left VALUE under the column headings. DO NOT PLACE THE CURSOR IN THE HEADINGS YOU WILL LOAD THE DATA VALUES IN ON TOP OF THE HEADINGS. With the cursor properly located, use the "File/Import/Numbers" command to load in the appropriate default file.

> WARNING - THIS TEMPLATE IS USEFUL ONLY IN VIEWING THE DEFAULT VALUES. DO NOT ATTEMPT TO USE THE TEMPLATE TO CHANGE AND SAVE NEW DEFAULT FILES. THEY MAY NOT BE "READABLE" BY QUICK INPUT. YOU MUST MAKE CHANGES TO THE DEFAULT VALUES USING A WORD PROCESSOR OR EDITOR!

This template can be very useful especially when creating or modifying new default files. For example, if one of the 34 default values per line is accidentally omitted from the building default file, this will be readily apparent when viewing the data in Lotus (tm), since one line will only have 33 values.

Index

Set Environment Variable

[illegible] = [*value*]]

Defines an environment variable name and its value. (An environment variable associates a value consisting of filenames, pathnames, or other data with a short symbolic name that can be easily referenced by programs.)

string is the name of the environment variable.

value is the string of characters, pathnames, or filenames that defines the current value of *string*.

If you omit *value*, DOS deletes the environment variable name from the environment. If you omit all parameters, DOS displays all the variables in the environment.

Example:

To inform the Microsoft C Compiler that it can find *include* files in the \INCLUDE directory on drive B, type:

```
set include=b:\include
```

Share

share [/f:*space*][/L:*locks*]

Loads into the system's memory a module that supports file sharing and locking in a networking environment.

/f:*space* specifies memory allocation, in bytes, for holding [illegible] information (default = 2048).

[illegible] specifies the number of file region locks (default = 2[illegible]).

This command is available only for versions 3.0 and later.

Examples:

To load Share into memory using the default values, simply type:

```
share
```

To adjust the memory to 4096 bytes and the file region locks to 40, type:

```
share /f:4096 /L:40
```

Sort

sort [*drive:*][*pathname*] [/r][/ + *n*]

Sorts lines you enter at the keyboard and sends them to the display or can be used with redirection characters as a filter to sort the contents of a file or the output of another program.

drive:pathname is the name and location of a file to be sorted and must be preceded by the < redirection character. If you omit *drive:*, DOS assumes the current drive. If you omit *drive:pathname*, keyboard input will be sorted. [illegible]board input must be terminated with F6 or Ctrl-Z.)

/r sorts lines in reverse order (Z to A).

/ + *n* sorts lines starting with the contents in column *n* (default = 1).

Sort does not distinguish between upper- and lowercase.

Examples:

To sort a file called PHONE.TXT in drive B in ascending order based on the character in column 37, type:

```
sort < b:phone.txt /+37
```

To sort a directory listing in reverse alphabetical order, type:

```
dir | sort /r
```

Substitute

subst [*drive1: drive2:path*]
or
subst *drive1:* /d

Lets you access a directory by a drive letter. After the substitution, DOS will automatically replace any reference to *drive1:* with *drive2:path*.

drive1: is the letter to be used instead of *drive2:path*.

drive2:path is the drive and path that you want to refer to.

/d cancels any substitution in effect for *drive1:*.

If you enter Subst without any parameters, DOS displays a list of substitutions in effect.

This command is available only for versions 3.1 and later.

Examples:

To reference the path \MPLAN\SALES\FORECAST on drive C by the drive letter D, type:

```
subst d: c:\mplan\sales\forecast
```

To cancel the substitution, type:

```
subst d: /d
```

System

sys *drive:*

Transfers the DOS system files from the disk in the default drive to the disk in the specified drive.

drive: is the drive containing the disk to be copied to. The disk must be formatted but completely empty. (See *Format*.)

After completion of the Sys operation, you can make the disk a bootable disk by copying the file COMMAND.COM to the new disk.