Primary Documentation for the Pacific Northwest Non-Residential/Commercial Energy Survey (PNNonRES)

• Volume 1: Introduction/Concordance
• Volume 2: PNNonRES-I Documentation
• Handbook for First Stage Data Collection
Energy Resources Development and Implementation Process

The flow chart below illustrates how the Energy Resources Program works. Broadly speaking, the program has two primary functions—resource planning and resource management. The first three blocks in the chart cover most of the planning tasks.

What Are the Needs of Our Customers?
To define the overall situation, BPA first assesses what the energy needs of customer utilities are likely to be over a 20-year planning horizon. Projections are developed and published jointly with the Northwest Power Planning Council. Also part of this initial step are forecasts of how much energy is available from existing Federal resources. BPA then compares demand and supply estimates in a regional Loads and Resources Study, also known as the "White Book.

Define Picture/Situation

What Choices Do We Have to Meet those Needs?
The second step is to identify all the available alternatives for meeting customer needs. BPA develops Resource Supply Forecasts for both generation and conservation resources. These studies also consider such factors as environmental and regulatory constraints, new technologies, and public opinion. Other efforts include examining opportunities for coordinating hydro system operations with Canada and arranging power purchases and transfers with Canadian and Southwest utilities.

Identify Alternatives

How Can We BEST Meet those Needs?
Step three involves weighing the available alternatives and their consequences to arrive at the most appropriate and cost-effective resource mix for the short-term. Developing the Resource Program is a public review process in which BPA's customer utilities and other interested parties have an opportunity to influence resource decisions. The process focuses on a 2-year planning period—i.e., the 1990 Resource Program covers 1992-1993.

Select Strategies

How Are We Doing to Meet Customer Needs?
From planning and strategy BPA then moves to step four—meeting customer power needs. Based upon the policies and directives in the Resource Program, managers draw up an overall plan to capture the conservation available in the region's homes, factories, and offices. This results in many programs and projects, ranging from about 25 to 40 in any year. In the past, BPA teams have designed and managed most conservation programs. Now utilities and other power producers are sponsoring their own programs with BPA support.

Bonneville is responsible for planning and acquiring generating resources—both conventional and renewable resources. Another part of step four is BPA's oversight function—seeing that BPA gets value from contracts for generated power.

Implement Strategies

How Well Did We Meet those Needs?
Finally, in step five BPA looks at how well it is doing its job. It is agency policy to evaluate all programs. Evaluation provides a means of comparing initial objectives with actual results. It is essential for verifying the energy savings from conservation programs and understanding the quality of our actions to acquire the energy.

Evaluate Performance
PREFACE

This material constitutes a portion of the primary documentation for the Pacific Northwest Non-Residential/Commercial Energy Survey (PNNonRES). The complete set of primary documentation is designed to provide the information needed by analysts and interpreters of the planning, the execution, the data collection, and the data management of the PNNonRES process.

PNNonRES was a two-phased, five-year data-collection activity conducted by the Bonneville Power Administration between 1986 and 1990. The over-arching goal of PNNonRES was to satisfy the basic requirements for a variety of information about the characteristics of the commercial building stock in the Bonneville service region through a survey of the region's non-residential buildings.

The first phase, designated PNNonRES-I, was an enumeration of all non-residential buildings in a stratified sample of ZIP-code geographic areas in the region. These buildings were then used in the second phase, PNNonRES-II, to form the frame for a selection of a stratified sample of buildings for which detailed information (including building and tenant characteristics and energy consumption data) were collected.

In order to provide a record of intention and of achievement, five coordinated volumes were prepared at the conclusion of the survey. They are:

**Volume 1:** Introduction/Concordance provides background and overview of PNNonRES, including the Concordance which serves as an index to all PNNonRES documents.

**Volume 2:** PNNonRES-I Documentation gives detailed discussion of the sample design, survey implementation, and data processing and preparation as they pertain to Phase I.

**Volume 3:** PNNonRES-II Documentation gives detailed discussion of the sample design, survey implementation, and data processing and preparation as they pertain to Phase II.
Volume 4: PNNonRES Weights: Methodology and Issues contains a detailed explanation of the issues and the methodology used to develop case weights for both Phase I and Phase II.

Volume 5: Analyst's Guide to PNNonRES is intended to serve as a handbook for users of PNNonRES data, whether from Phase I or Phase II, and includes the Concordance to provide an index to all PNNonRES documentation.

Three other volumes, two written as procedures handbooks for the two phases and the third devoted to Phase II data management, are pertinent to effective use and understanding of PNNonRES. They are:

Handbook for First Stage Data Collection was used by surveyors in the field and contains the Phase I survey instrument as well as detailed data-collection procedures.

Procedures Handbook for Phase II was used by surveyors in the field and contains the Phase II survey instrument as well as detailed data-collection procedures.

Data Management Plan for Phase II was the document that established the relational database system required to store and retrieve the information assembled during Phase II.

Together, these eight documents make up the "Primary Documentation" for PNNonRES. They are the sources to which an analyst would turn for information about any aspect of PNNonRES. Even more specifically, the beginning analyst would start with the Concordance that appears in Volume 1 (and is repeated for convenience in Volume 5).

During the design and implementation of PNNonRES, a number of specialized documents were produced. As described in Section 2.3 of Volume 1, they are collectively designated as "Secondary Documentation" for PNNonRES. They are particularly helpful if one is interested in capturing the "sense of the issue while it was hot" and not as it became sweetened or smoothed by the passage of time and passion.

As an adjunct to the preparation of the 5-volume portion of the Primary Documentation for PNNonRES, a report of a "first-look" at the data was assembled. Called the Phases I and II Descriptive Data Analysis Report, this document was intended to be a stand-alone report for those seeking an overview of the survey’s results. At the same time, however, this document serves well as an introduction to the values and the quantities found in the survey and provides a starting point for more specific and/or in-depth analyses. This report can be obtained from the Bonneville Power Administration by calling or writing the Public Information Office, (503) 230-3055, and requesting Report Number DOE/BP-10392-1.
INTRODUCTION/CONCORDANCE

This document provides an overview of all documentation that pertains to the Pacific Northwest Non-Residential Survey (PNNonRES). The document includes:

- background information on the goals, format and history of PNNonRES
- a brief overview of the contents and organization of the entire body of PNNonRES documentation
- a concordance, which enables readers to locate specific information within the entire body of documentation.
INTRODUCTION/CONCORDANCE

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Background

The Pacific Northwest Non-Residential Survey (PNNonRES) was conducted by the Bonneville Power Administration over a five year period from 1986 to 1990. This section provides some background information about PNNonRES, addressing the study's goals, format and history.

1.1 STUDY GOALS

The commercial sector represents a large and rapidly growing component of the Pacific Northwest's electricity load. Surprisingly, there has been little investment in the collection of basic data until recently. As a result, our knowledge concerning the commercial sector and its characteristics has been quite limited. The absence of reliable information about the sector has hampered marketing and forecasting efforts alike. The absence of reliable and comprehensive measures of the region's commercial building stock has been particularly problematic because these measures constitute the underpinning of the models used to forecast and model demand-side management options. In response to this problem, BPA initiated the design and implementation of the Pacific Northwest Non-Residential Energy Survey (PNNonRES), which is the first comprehensive examination of the region's commercial building stock.

The goal of PNNonRES is to satisfy the basic requirements for information about the characteristics of the commercial building stock through a survey of the region's non-residential buildings. In particular, PNNonRES provides detailed information from a statistically representative sample of the Pacific Northwest's commercial buildings. This information will be used to support load forecasting and energy conservation assessment and planning efforts for the region's...
commercial sector. In addition, the data collected will be used to extend the very detailed information available from BPA's End-use Load and Consumer Assessment Project (ELCAP) to the region's commercial sector. The information collected in PNNonRES includes:

- number of buildings and amount of floor area by building type (economic activity) and by functional use category
- energy use per square foot by building type and by functional use
- fuel type market shares (saturations) by end use
- operation schedules by building type
- equipment saturations for heating, ventilating and air-conditioning (HVAC), lighting, and other types of equipment
- building and tenant characteristics

1.2 OVERVIEW OF PNNonRES

While the goal of PNNonRES was to obtain detailed information for a statistically representative sample of the region's commercial buildings, no list of the region's buildings was available from which to draw a sample. PNNonRES was therefore designed to be implemented in two phases.

In the first phase (Phase I), a list of non-residential buildings was developed to be used as a sampling frame for Phase II. This was accomplished by selecting a sample of ZIP areas from the region, listing all non-residential buildings in those sampled ZIP areas, and collecting basic information about those buildings. Information such as primary economic activity, estimated floor area, and number of tenants was collected in a "walk-by" survey of each building. Because hospitals and post-secondary education institutions could not be adequately represented in a ZIP area sample, separate sampling frames were developed for these two building types, and the sampled facilities were surveyed via mail. Roughly 14,000 buildings were enumerated in Phase I.

In Phase II, a sample of 644 buildings was selected from the list developed in Phase I; the information obtained during Phase I (building floor area, vintage and economic activity) was used to improve the efficiency of the Phase II sample. Detailed information (including building and tenant characteristics and energy consumption data) was collected during an on-site survey of 644 Phase II buildings.

1.3 HISTORY OF PNNonRES

The design and implementation of PNNonRES has stretched over five years. Figure 1.1 shows a timeline of key events in the implementation of PNNonRES.
FIGURE 1.1

PNNonRES Timeline

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>January, 1986</td>
<td>Phase I sample selected</td>
</tr>
<tr>
<td>April, 1986</td>
<td>Phase I field work begun</td>
</tr>
<tr>
<td>December, 1986</td>
<td>Phase I field work completed</td>
</tr>
<tr>
<td>May, 1987</td>
<td>Data from Phase I available</td>
</tr>
<tr>
<td>August, 1987</td>
<td>Phase II sample selected</td>
</tr>
<tr>
<td></td>
<td>Phase II field work begun</td>
</tr>
<tr>
<td>July, 1988</td>
<td>Phase II field work halted</td>
</tr>
<tr>
<td></td>
<td>Field verification study</td>
</tr>
<tr>
<td></td>
<td>conducted</td>
</tr>
<tr>
<td>October, 1989</td>
<td>Phase II field work resumed</td>
</tr>
<tr>
<td>October, 1990</td>
<td>Phase II field work completed</td>
</tr>
<tr>
<td>December, 1990</td>
<td>Raw data from Phase II available</td>
</tr>
<tr>
<td>June, 1991</td>
<td>Phase II Analytic Database</td>
</tr>
<tr>
<td></td>
<td>available</td>
</tr>
</tbody>
</table>
Numerous documents pertaining to PNNonRES have been written during the design and implementation of the survey. These documents address a variety of facets of PNNonRES, and they were written at various stages of the project. In order to guide the reader to the appropriate sources, this section provides a brief overview of the contents and intended use of these various PNNonRES documents. Readers are also encouraged to use the Concordance (which follows this section) to locate specific information within the PNNonRES documentation.

2.1 PRIMARY DOCUMENTATION

The primary PNNonRES documentation consists of five volumes written specifically to summarize the design and implementation of PNNonRES, along with the procedures handbooks for the two phases of PNNonRES and the Phase II Data Management Plan. Since these documents (with the exception of the procedures handbooks and the Phase II Data Management Plan) were written after the conclusion of PNNonRES, they contain the clearest presentation of the design and implementation of the survey, and therefore should be considered the primary sources of information about PNNonRES. The primary documentation includes:

- Volume 1: Introduction/Concordance, Bonneville Power Administration, 1991. This document provides a very brief background and overview of PNNonRES. It also contains an overview of all documents pertaining to PNNonRES, and a Concordance that serves as an index to all the PNNonRES documents.
Volume 2: PNNonRES-I Documentation, Bonneville Power Administration, 1990. This document focuses on Phase I. It contains a detailed discussion of sample design, survey implementation, and data processing and preparation, as they pertain to Phase I. The sample design section also includes a discussion of the rationale for using a two phase sample design.

Handbook for First Stage Data Collection, Bonneville Power Administration, 1987. This document, used by surveyors in the field, contains detailed procedures for Phase I data collection and the Phase I survey instrument.

Volume 3: PNNonRES-II Documentation, Bonneville Power Administration, 1991. This document focuses on Phase II. It contains a detailed discussion of sample design, survey implementation, and data processing and preparation, as they pertain to Phase II.

Procedures Handbook for Phase II, ADM Associates, Inc., 1987. This three volume document, used by surveyors in the field, contains detailed procedures for Phase II data collection and the Phase II survey instrument.

Volume 4: PNNonRES Weights: Methodology and Issues, Bonneville Power Administration, 1991. This document contains the most detailed explanation of the methodology used to develop case weights for both Phase I and Phase II.

Volume 5: Analyst's Guide to PNNonRES, Bonneville Power Administration, 1991. This document is intended to serve as a handbook for analysts who are using the PNNonRES data. It therefore addresses both Phase I and Phase II, providing brief overviews of the sample design, survey implementation, data processing, and weighting for each phase. Throughout, references are included to guide the analyst to more detailed documentation. This document also includes data dictionaries for the Phase I analytic dataset and for the three summary datasets in the Phase II analytic database, along with specific information useful only to people working with these datasets. Finally, the Concordance, which provides an index to all of the PNNonRES documentation, is included.

PNNonRES Data Management Plan for Phase II, ADM Associates, Inc., 1988. This document summarizes the data structure of the raw Phase II data. It contains the best documentation of the variables and codes used in the detailed datasets in the Phase II analytic database, and will be useful for analysts looking at the Phase II data at a very detailed level.
2.2 SECONDARY DOCUMENTATION

The secondary PNNonRES documentation includes all documents pertaining to PNNonRES that were produced during the implementation of the survey. These documents were produced by a number of contractors at various stages of the project. While these documents contain some information not available in the primary documentation, it is important to remember that information in these documents may have been superseded by later revisions to the survey data or methodology. They therefore should be used with caution. The secondary documentation includes:

- PNNonRES Phase One Descriptive Data Analysis Report, Bonneville Power Administration, 1989. This document contains summary statistics based on an intermediate version of the Phase I analytic data set. The case weights used in this report have since been revised, although the data set is otherwise effectively identical to the final (Version 4.0) Phase I analytic data set.

- Field Verification of PNNonRES Survey, United Industries Corporation, 1989. This document describes the results of a field verification study conducted on forty Phase II buildings. The goal of this study was to estimate the non-sampling error associated with certain key measurements being collected in Phase II.


- Results of First Stage of PNNonRES, Baker, Reiter and Associates, 1987. This document contains summary statistics for an early version of the Phase I analytic data set. The building type algorithm, case weights, and number of observations used in this report have since been revised. However, the Phase II sample was drawn using this version of the Phase I data.

- Technical Documentation of PNNonRES First and Second Stage Sample Selection, Baker, Reiter and Associates, 1987. This document contains brief, and somewhat outdated, discussions of the selection of the Phase I and Phase II samples, and development of Phase I weights. However, Appendix A contains printouts of the SAS jobs used to develop the early version of the Phase I analytic data set. Most of these jobs were also used during development of the final version of the analytic data set.
Concordance

The Concordance serves as an index to the documentation describing the Pacific Northwest Non-Residential Survey (PNNonRES). It has been developed to aid analysts, researchers, and others interested in PNNonRES in locating the specific information they need. In order to maximize its usefulness, the Concordance appears twice in the PNNonRES documentation: in Introduction to PNNonRES Documentation, and in Analyst's Guide to PNNonRES.

The Concordance serves as an index to both the primary and secondary PNNonRES documentation:

Primary Documentation

The primary documentation consists of the five volumes written specifically to summarize the design and implementation of PNNonRES, along with the procedures handbooks for the two phases of PNNonRES. Since these documents (with the exception of the procedures handbooks) were written after the conclusion of PNNonRES, they contain the clearest presentation of the design and implementation of the survey. The Concordance therefore focuses on these documents. The primary documentation includes:

- Volume 1: Introduction/Concordance, Bonneville Power Administration, 1991
- Volume 2: PNNonRES-I Documentation, Bonneville Power Administration, 1990
Secondary Documentation

The secondary documentation includes all documents pertaining to PNNonRES that were produced during the implementation of the survey. These documents were produced by various contractors at various stages of the project. While these documents contain some detail not available in the primary documentation, it is important to remember that information in these documents may have been superseded by later revisions to the survey data or methodology. The secondary documentation includes:

- PNNonRES Phase One Descriptive Data Analysis Report, Bonneville Power Administration, 1989
- Field Verification of PNNonRES Survey, United Industries Corporation, 1989
- Results of First Stage of PNNonRES, Baker, Reiter and Associates, 1987
- Technical Documentation of PNNonRES First and Second Stage Sample Selection, Baker, Reiter and Associates, 1987
HOW TO USE THE CONCORDANCE

The Concordance consists of a list of key words and phrases. For each key word or phrase, the PNNonRES document(s) section(s) that discuss that topic are shown.

For convenience, the titles of PNNonRES documentation have been abbreviated in the Concordance and in all references throughout the documentation. The following abbreviations have been used:

- **DDAR** - *PNNonRES Phase One Descriptive Data Analysis Report*
- **DMP** - *PNNonRES Data Management Plan for Phase II*
- **FV** - *Field Verification of PNNonRES Survey*
- **Guide** - *Volume 5: Analyst's Guide to PNNonRES*
- **I-Doc** - *Volume 2: PNNonRES-I Documentation*
- **I-Hdbk** - *Handbook for First Stage Data Collection*
- **II-Doc** - *Volume 3: PNNonRES-II Documentation*
- **II-Hdbk** - *Procedures Handbook for Phase II*
- **Intro** - *Volume 1: Introduction/Concordance*
- **PA** - *Preliminary Analysis of Phase I and Phase II Non-Residential Energy Survey Data*
- **RFS** - *Results of First Stage of PNNonRES*
- **TD** - *Technical Documentation of PNNonRES First and Second Stage Sample Selection*
- **Wts** - *Volume 4: PNNonRES Weights: Methodology and Issues*

For example, *I-Doc:2.3* indicates that the topic is discussed in section 2.3 of the document *PNNonRES-I Documentation*.

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FINAL

Pacific Northwest Non-Residential Survey (PNNonRES) Documentation

Volume 2:

PNNonRES-I Documentation

November, 1990

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BONNEVILLE POWER ADMINISTRATION
Under Contract Number DE-AC79-90BP10392
PNNonRES-I DOCUMENTATION

This document describes in detail the design and implementation of Phase I of the Pacific Northwest Non-Residential Survey (PNNonRES). It includes the following discussions:

- Sample design of PNNonRES in general, and Phase I in particular
- Implementation of the Phase I survey
- Data processing and preparation entailed in creating the Phase I analytic dataset
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Introduction

1.1 BACKGROUND

The Pacific Northwest Non-Residential Energy Survey (PNNonRES) was designed to be implemented in two phases. Phase I involved selecting a sample of ZIP areas, listing all commercial buildings in those sampled areas, and collecting basic information about those buildings. The goals of Phase I were to: 1) develop a list of buildings that could be used as a sampling frame for Phase II, and 2) collect certain information (such as floor area and economic activity) about each building, which could be used to improve the efficiency of the Phase II sample. In Phase II, a sample of buildings was selected from the list developed in Phase I, and detailed information was collected for those buildings.

This document describes Phase I of PNNonRES. A companion document, PNNonRES-II Documentation, describes Phase II.

1.2 ORGANIZATION OF THIS DOCUMENT

This document contains three chapters following this introduction.

- Chapter 2 describes the overall PNNonRES sample design, then focuses on the sample design of Phase I. It discusses the considerations that went into the sample design, explains how the sampling frames were developed, and describes how the Phase I sample was selected.

- Chapter 3 describes how the Phase I survey was implemented. It describes the minor adjustments made to the sample design to address
issues encountered in the field, and the methods for enumerating the Phase I buildings (collecting data). It also provides tabular summaries of the Phase I sample.

Chapter 4 describes the data processing and preparation that was involved in the development of the Phase I analytic dataset. It outlines the algorithms used to calculate certain key variables, such as building type and floor area, and explains how the case weights can be used to develop regional estimates of building characteristics.

1.3 OTHER SOURCES OF INFORMATION ON PNNonRES-I

Information pertaining to Phase I of PNNonRES can also be found in other volumes of the PNNonRES documentation library. Three volumes of the primary documentation (in addition to this document) contain detailed information about Phase I:

- *PNNonRES Weights: Methodology and Issues* contains the most detailed description of the algorithm used to calculate the Phase I case weights. It also contains a listing of the Phase I weights, and a critique of the methods used to develop them.

- The *Analyst's Guide to PNNonRES* provides the information necessary for an analyst who desires to use the Phase I analytic dataset. It contains overviews of such topics as sample design, survey implementation and weighting, and provides a detailed data dictionary that describes each variable in the Phase I analytic dataset.

- The *Handbook for First Stage Data Collection* is the document that was used in the field by the inspectors who collected the Phase I data. This handbook describes the procedures used in collecting the data, and includes a copy of the Phase I data collection instrument.

Other, secondary, documentation also contains discussions of various facets of Phase I. It is important to note that, unlike the documents above, the following documents were produced before the Phase I analytic dataset was finalized. Hence, they use earlier versions of the Phase I data. These secondary documents include:

- *Results of First Stage of PNNonRES* was written by Baker, Reiter and Associates, using an early version (1.0) of the analytic Phase I dataset. This early version is somewhat different from the final dataset version documented in the *Analyst's Guide* (version 4.0), but it is significant because it is the version from which the Phase II sample was drawn. The report provides weighted estimates of regional commercial characteristics (floor area, business type, etc.).

- *Technical Documentation of PNNonRES First and Second Stage Sample Selection* was written by Baker, Reiter and Associates, and
utilizes the same early version (1.0) of the Phase I dataset. This document contains a brief technical description of the development of the early version of the Phase I weights. An appendix contains hard copies of all Phase I SAS data processing jobs.

- *PNNonRES Phase I Descriptive Data Analysis Report*, published by BPA, includes summary tables of the data. These summaries used version 3.2 of the data, which is very close in content to the final version, 4.0. However, it is important to note that these summary tables use the early version of the Phase I weights.
2
Sample Design

2.1 INTRODUCTION

The PNNonRES sample design utilized a two phase sampling approach. In Phase I (PNNonRES-1), a sample of the region's ZIP code areas were selected, and buildings in the sampled areas were enumerated. As part of the enumeration process, basic information was collected about the enumerated buildings, including building location, floor area and type of economic activity. This information was used to develop a building list that could serve as the sampling frame for Phase II. In Phase II, a sample of buildings was drawn from this building list. Information collected in the Phase I enumeration of buildings, such as floor area and type of economic activity, was used to make the Phase II sample design more efficient. Detailed information was then collected for each of the buildings sampled in Phase II. An overview of the PNNonRES sampling process is presented in Figure 2.1.

This chapter discusses general PNNonRES sample design issues, and then describes the sample design developed for Phase I, the first of the two sampling phases. The discussion is organized as follows:

- Section 2.2 describes the scope and objectives of PNNonRES in general
- Section 2.3 describes the selection and development of the ZIP area sampling frame
- Section 2.4 discusses the specifics of the Phase I sample design
FIGURE 2.1
Overview of PNNonRES Sample Design

SELECTION OF A SAMPLING PROCESS

- Select area sampling approach.
- Select ZIP area as primary sampling unit.
- Use establishments as measure of ZIP area size.

PHASE I SAMPLE

- Select with certainty 7 central business district (CBS) ZIP areas located in large cities.
- Sort remaining ZIP areas by public/private utility groupings.
- Use Probability Proportional to Size (PPS) selection methods to select 66 additional ZIP areas. Measure of size is number of establishments.
- Subsample large ZIP areas using segmentation procedures.
- Construct special sampling frames for Post-Secondary Education (PSE) institutions and Hospitals, select 23 PSE institutions and 40 hospitals.
- Enumerate buildings in Phase I sample.

PHASE II SAMPLE

- Group buildings enumerated in Phase I into domains.
- Within each domain, stratify buildings by size.
- Select very large buildings with certainty.
  - Use optimal allocation procedure to determine number of buildings to select from each stratum.
- Within strata, sort buildings by ZIP code area. Select buildings using PPS selection methods, with the measure of size equal to the Phase I case weight.
- Collect Phase II data.

The items contained in the box in Figure 2.1 are discussed in this chapter. For a description of the Phase II sample design, readers should refer to Chapter 2 of PNNonRES-II Documentation.
2.2 SURVEY SCOPE AND OBJECTIVES

This section describes the issues that affected the development of a sample design for PNNonRES. It addresses the following topics:

- Survey scope
- Subclasses of commercial customers for which information is desired
- Survey objectives
- Design constraints
- Key features of an efficient survey design

2.2.1 Survey Scope

In order to determine the survey's data needs, it was necessary to identify the scope of the population to be studied. This is a much more difficult problem for BPA, an electricity wholesaler that serves a large and diverse group of retail utilities, than it would be for an individual utility. Individual utilities keep lists of all of their customers by rate class, and they can therefore limit studies to one or more customer rate classes. However, because BPA does not have access to customer lists, and because of the diversity of the rate classification schemes used by BPA's retail utility customers, it appeared that the most practical approach would be to define the study population broadly. In fact, although the basic goal of the study was to collect information on commercial buildings, it was necessary to define the survey scope to include all non-residential buildings. Given the lack of access to utility customer lists and the lack of other information to use to identify the population of commercial buildings, it was necessary to begin with a broader population group which could be clearly identified, namely, non-residential buildings. The population of commercial buildings could then be selected from the population of non-residential buildings.

Defining the population broadly provides an opportunity to develop counts of all non-residential structures in the region. Once the data base of total buildings is developed, it is relatively simple to isolate specific subclasses of the population for further study. BPA decided that the initial population of non-residential buildings should include all energy-using structures which are used either completely or in part for non-residential activity. Data collected for the broad population were to: 1) include information which could be used to identify the subsets of that population for which additional data were to be collected, and 2) provide reliable population counts for each important subclass of non-residential buildings.

Once the count of non-residential buildings is developed and data that can be used to identify building subpopulations is collected, it becomes possible to identify commercial buildings and focus the survey effort on them. Within the class of commercial buildings, BPA was interested in obtaining information for a number of subclasses of commercial buildings. These subclasses are identified in the following section.
2.2.2 Subpopulations of Commercial Customers: Domains

The commercial customer class contains a diverse set of economic activities and structure types, displaying a wide variety of energy use characteristics. In order to both develop a meaningful understanding of the energy use characteristics of commercial buildings and to provide the information needed for demand forecasting and conservation assessment and planning, it is necessary to gather information on important subpopulations of commercial buildings. These subpopulations are referred to as domains. For PNNonRES, domains were defined as unique combinations of:

1. **Building type**

   For PNNonRES, building type is defined according to the economic activity of the firms or organizations occupying the majority of the building's floor area. The primary advantage of this approach is that there exists an abundance of other data, such as employment data, which are also categorized by economic activity. The availability of such data enables one to relate information by building type to other economic measures and to use economic data to develop estimates and forecasts of floor area by building type for years in which survey data is unavailable.

   PNNonRES used the Standard Industrial Classification (SIC) system for defining its building types (Executive Office of the President, Office of Management and Budget, 1972). The SIC system classifies firms and non-profit and government organizations according to the type of economic activity in which they are involved. Using the SIC system, the following 12 commercial building type categories were defined for use in the PNNonRES survey:

   - Warehouse
   - Dry Goods Retail
   - Grocery
   - Restaurant
   - Office
   - Primary & Secondary Education (PSE)
   - Higher Education
   - Hotel & Motel
   - Hospital
   - Other Health
   - Other Commercial
   - Unknown

2. **Building vintage**

   Buildings were classified by age into one of two categories: 1) built before 1980, and 2) built during or after 1980.

In addition to the above domains, BPA also wished to gather separate information for the different types of utilities to which it sells energy. Three different approaches for obtaining this information were considered. The first was to
develop information for four separate types of utilities: investor owned (private) utilities, municipal utilities, public utility districts and cooperatives. The second option was to distinguish only between privately owned and public utilities. The final option was to make no distinctions with respect to type of utility. Due to budget limitations, it was decided to pursue the third option, and make no distinctions with respect to utility type in the definition of study domains. However, to insure that public and private utilities were given equal consideration in the survey, the initial sample was selected in such a manner that public and private utilities were represented in proportion to the share of total non-residential establishments which each serves (see Section 2.4.2).

An analysis was conducted to determine the impact of not developing information for the different types of utilities. The results of the analysis indicated that there were not significant differences between the characteristics of non-residential establishments served by public utilities and those served by private utilities.

2.2.3 Survey Objectives

After evaluating the need for non-residential buildings data and identifying the scope and domains of the survey, the objectives of the survey were defined. These objectives reflect the variety of anticipated applications of the survey data, as well as the requirement that substantial survey resources be expended in the development of a building list which can be used as a sampling frame. The survey has two major objectives.

The first major objective is to obtain measures of the number of buildings and floor area for each of the domains of the study. The measurement of floor area is central to many of BPA’s planning activities. The objective is to derive sample estimates of building counts and floor area for the following domains with the following levels of precision:

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Vintage</th>
<th>Precision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>Pre/Post-1980</td>
<td>+/- 15%</td>
</tr>
<tr>
<td>Dry Good Retail</td>
<td>Pre/Post-1980</td>
<td>+/- 15%</td>
</tr>
<tr>
<td>Grocery</td>
<td>Pre/Post-1980</td>
<td>+/- 15%</td>
</tr>
<tr>
<td>Restaurant</td>
<td>Pre/Post-1980</td>
<td>+/- 15%</td>
</tr>
<tr>
<td>Warehouse</td>
<td>Pre/Post-1980</td>
<td>+/- 15%</td>
</tr>
<tr>
<td>Elem/Sec Schools</td>
<td>All</td>
<td>Maximize</td>
</tr>
<tr>
<td>Universities</td>
<td>All</td>
<td>Maximize</td>
</tr>
<tr>
<td>Health</td>
<td>All</td>
<td>Maximize</td>
</tr>
<tr>
<td>Hotel/Motel</td>
<td>All</td>
<td>Maximize</td>
</tr>
<tr>
<td>Other</td>
<td>All</td>
<td>Maximize</td>
</tr>
</tbody>
</table>

In order to accommodate survey budget constraints, BPA decided to avoid vintage distinctions for the last five building types listed and to potentially allow precision for these building types to exceed +/- 15 percent. The levels of precision for the first five building types are to be achieved with a 95 percent
The second major objective of the study is to derive sample estimates of: 1) electrical and other fuel use per square foot of floor area, and 2) the saturation of electricity use for major energy end-uses. These estimates are to be obtained for the following ten commercial building type domains with the following levels of precision:

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Precision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warehouse</td>
<td>+/- 10%</td>
</tr>
<tr>
<td>Dry Good Retail</td>
<td>+/- 10%</td>
</tr>
<tr>
<td>Grocery</td>
<td>+/- 10%</td>
</tr>
<tr>
<td>Restaurant</td>
<td>+/- 10%</td>
</tr>
<tr>
<td>Office</td>
<td>+/- 10%</td>
</tr>
<tr>
<td>Elem/Sec Schools</td>
<td>+/- 10%</td>
</tr>
<tr>
<td>Universities</td>
<td>+/- 10%</td>
</tr>
<tr>
<td>Health</td>
<td>+/- 10%</td>
</tr>
<tr>
<td>Hotel/Motel</td>
<td>+/- 10%</td>
</tr>
<tr>
<td>Other</td>
<td>+/- 10%</td>
</tr>
</tbody>
</table>

The levels of precision are to be achieved with a 95% level of confidence.

2.2.4 Factors Important in Developing a Survey Design

Early in the planning process, it became clear that there were a number of factors which would have a major impact upon the development of a sampling design. The most important of these factors was the budget. Other important factors included:

- Geographic diversity and extent of the BPA service area
- Absence of a sampling frame for non-residential buildings
- Variability in important measures, such as mean floor area, for the population of non-residential buildings
- Complexity of building measurements

Budget Constraints

Given the highly variable nature of the building population and its broad geographic distribution, the chief constraint affecting the survey design was the total budget for the survey. It was assumed for the purposes of the proposed design that the budget could not exceed 1.5 million dollars. Achieving the objectives stated above within this budget constraint was the major factor constraining the development of a sampling design.
Size and Diversity of the Service Area

The BPA service area covers more than 250,000 square miles in the states of Washington, Oregon and Idaho, and portions of the states of Montana, Nevada, Utah, Wyoming and California. Although a significant fraction of the region's economic activity is concentrated in and near Seattle, Washington and Portland, Oregon, the remainder is distributed widely throughout the region in numerous small cities and towns. In a region of this size, a major consideration in any survey design is the cost associated with travel and administration of the data collection effort. Using a clustered sampling procedure is one way to reduce such costs. However, clustering can reduce sampling efficiency if similar economic activities tend to be clustered geographically. It is important to consider trade-offs between these two effects of clustering in developing an optimum sample design.

Absence of a Sampling Frame for Non-Residential Buildings

An ideal sampling frame for this study would include a list of all buildings in the region and information on building size and type of economic activity for each building. Unfortunately, no such list exists. A number of possible techniques for developing such a list were examined. One possible approach for developing a list of buildings would be to use a list of electric utility customer accounts. A number of recent survey designs used by different utilities have been developed based on utility customer account lists containing information on customers' electricity consumption and type of economic activity. As a wholesaler of electricity, BPA does not sell power directly to individual businesses, and, consequently, does not maintain lists of consumers. In order to assemble a list of commercial customers in the BPA service area, it would be necessary to assemble customer data from the more than 100 retail utilities which serve the region's non-residential establishments. It is likely that some of these utilities would refuse to participate in the survey effort. In addition, information recently collected from major utilities in the BPA service area indicates that the content of customer records and the form in which they are maintained is highly variable. No classification according to type of economic activity would be available for a large fraction of the customer records.

Even if it were possible to compile a list of commercial customer accounts from the region's utilities, the use of account lists would pose a number of serious sampling design and analysis problems. In some cases multiple accounts are contained in one building, while in other instances an account serves more than one building. If accounts were selected as the unit of analysis, any analysis of buildings would become confused, if not impossible. As the Pacific Gas and Electric Company (1982) observed in a report on its commercial customer mail survey, "the unit of analysis determines the unit of selection, which determines the sampling frame, which limits the unit of selection, which limits the analysis."

Other types of lists which might be assembled for the BPA service area were also examined but, none were found which were both comprehensive and contained the information required for efficient sampling of buildings. The absence of a list of buildings containing critical measures of size and building type was
perhaps the single most important factor which determined the nature of the proposed survey design.

**Diversity of the Population of Non-Residential Buildings**

Although no previous survey of non-residential buildings has been conducted for the entire BPA service area, there have been a number of studies carried out for selected urban areas. The information obtained from these studies and from studies carried out in other regions of the country indicates that the non-residential building population is remarkably diverse. Non-residential buildings vary according to the types of economic activities which they contain, such as retailing or health care, and many non-residential buildings contain more than one type of activity. Across these categories of buildings there appear to be large differences in important measures, including building size, saturation of various fuel types, composition of internal equipment and schedules of operation. These differences are the primary reason why nearly all of BPA's anticipated analyses require separate estimates for building type domains.

A high degree of variability can also be expected within any one category of buildings, especially for measures of size, such as energy consumption, floor area and number of employees. Not only is variability in measures of size large, but for most types of buildings the distributions of size are highly skewed. For some types of buildings, such as Dry Goods Retail and Office, a few extraordinary buildings can account for a significant fraction of total floor area. These skewed distributions cannot be efficiently characterized using simple random samples, even if selections are made within each separate building type domain. Strategies for stratification with respect to size for each building type must be considered in order to achieve acceptable sampling efficiencies.

A final difficulty caused by the diversity of the building population concerns data collection and measurement. Measurements of detailed characteristics of buildings within any building type domain are difficult. A number of survey techniques have been utilized in previous efforts, including mailed surveys, phone surveys, in-person interviews and direct inspections. Review of these efforts indicates that the most reliable as well as the most costly method is the use of trained observers to directly inspect building features. Other techniques rely on the knowledge of persons associated with sampled buildings, such as owners, managers or tenants. Due to the physical and organizational complexity of most buildings, these contacts often can only provide a poor description of a building. The adoption of direct inspection methods, although desirable when considering the control of measurement error, requires very efficient sampling because unit costs are high.

**2.2.5 Key Features of an Efficient Survey Design**

An analysis of the survey's scope, objectives and constraints provides a basis for identifying key features which should be incorporated, if the survey design is to be efficient. The design was highly constrained by the lack of a building list, the known variability in the population to be studied, complexity of
measurements and budget limitations. Reflecting these constraints, the following features were identified as important components of an efficient survey design:

- Since no comprehensive listing of buildings exists which can serve as a frame for sampling, it is necessary to build a sampling frame prior to conducting the survey. This frame must contain measures of building size and type of economic activity.

- Development of a building list will be an expensive component of the survey activity. In order to obtain the best use of limited funds, it should be viewed as an opportunity to assemble a preliminary data set on critical characteristics of the population, including number of buildings for each building type and preliminary estimates of floor area.

- The spatial distribution of non-residential buildings is highly skewed, with a large share of the population located in a small number of urban areas, but with significant portions distributed widely in smaller cities and towns. Any geographically based sampling design would necessarily be oriented around a size stratified, disproportional selection of primary sampling units.

- Many applications of the survey data will require building type specific estimates of building characteristics. Separating the population into building type domains will be required in order to provide precision for building type specific estimates.

- The size distribution of buildings within any building type is highly skewed, with large buildings accounting for a dominant share of total floor area and electricity consumption. Size stratification with disproportionate sampling of large buildings is a necessity to achieve reasonable precision in sample estimates.

- Any information required to stratify buildings by size and type would have to be collected as part of the process of generating the building lists and prior to conducting Phase II of the survey.

- Detailed measures of building characteristics can only be reliably gathered through direct inspection of sampled buildings by well trained observers. Considerable sampling efficiency must be achieved in order to make this type of data collection effort financially feasible.

### 2.3 SELECTION AND DEVELOPMENT OF A ZIP AREA SAMPLING FRAME

In order to select a sample of non-residential buildings, it is necessary to have a list of buildings from which to draw the sample. This building list is referred to as the sampling frame. Unfortunately, there was no comprehensive list of non-residential buildings in the BPA service area which could be used as a sampling
Sample Design

frame for PNNonRES. Consequently, the initial step in the sample design was the development of a non-residential buildings sampling frame.

A number of potential methods for developing a sampling frame were explored and evaluated. The approach which appeared to be most promising was an area sampling approach, in which the BPA service area would be subdivided into small areas and a sample of these areas would be selected. A building list would then be developed by enumerating all non-residential buildings in the sampled areas. After evaluating a number of possible area units which might be used in an area sampling frame, it was determined that ZIP codes would be the most suitable. The BPA service area was subdivided into 1415 ZIP code areas to create an area sampling frame. A variety of basic data for non-residential buildings was assembled for the set of ZIP areas. In addition to the ZIP area frame, special sampling frames were developed for hospitals and post-secondary education institutions, two building types which are not well represented by an area sampling approach.

This section describes the selection and development of the ZIP area sampling frame, and reviews the frame's attributes. It addresses the following topics:

- Required attributes of a sampling frame for non-residential buildings
- Rationale for adopting a ZIP area sampling frame
- Development of the ZIP area sampling frame
- Characteristics of the ZIP area frame
- Development and characteristics of the special sampling frame prepared for post-secondary education institutions
- Development and characteristics of the special sampling frame prepared for hospitals

2.3.1 Required Attributes of a Sampling Frame for Non-Residential Buildings

In order to satisfy the objectives of the study, it was necessary to have a sampling frame which provides more than a simple listing of the location of every non-residential building in the BPA service area. Specifically, the sampling frame must contain the following:

1. Information enabling classification of buildings by building type, such as office, warehouse, etc.

2. A reliable measure of building size

3. A means for determining which buildings are served by public utilities, and which are served by investor owned or "private" utilities

4. Either the entire stock of commercial buildings in the region, or a subset of those buildings from which a representative sample of the region's commercial buildings can be selected in a Phase II sample

It is necessary to have information which can be used to classify buildings by
building type so that buildings can be grouped into the separate study domains. The development of information for the separate domains is a critical element of the study. It is essential to have a measure of building size because the ability to stratify the Phase II sample by building size significantly increases sampling efficiency. The need for information concerning utility type results from BPA's desire to develop information for buildings served by different types of utilities.

2.3.2 Selection of a Sampling Frame

A factor which has a significant influence upon the development of a satisfactory sampling frame is the geographic size and diversity of the BPA service area. The BPA service area covers over 250,000 square miles, encompassing the states of Washington, Oregon, and Idaho, as well as parts of Montana, Nevada, Utah, Wyoming and California. Although a significant percentage of the region's population and economic activity is concentrated in the Seattle and Portland metropolitan areas, the remainder is distributed throughout the rest of the region in medium and small size cities and towns.

The region's size and distribution of economic activity are important factors in the selection of a sampling frame because of the cost associated with travel and administration of the data collection effort. Data collection costs could be minimized through the use of a sampling frame which would yield a sample of buildings which are geographically clustered in specific areas within the larger service area. Collecting data for such a geographically clustered sample would be significantly less costly than collecting data for a sample containing buildings located throughout all parts of the service area. However, if similar economic activities are geographically clustered, a clustered sampling approach would impose significant reductions in sampling efficiency.

Identification of Feasible Strategies for Developing a Sampling Frame

The process of selecting a sampling frame began with the identification of feasible strategies for developing a frame. The five most promising strategies were reviewed and evaluated. They are:

1. Develop a frame from electric utility customer account listings.
2. Develop a frame from water utility account listings.
3. Use telephone company listings of non-residential accounts to create a sampling frame.
4. Create an area based frame using an area unit such as county or ZIP code area. In this case a listing of buildings would be developed through the enumeration of all non-residential buildings located in a sample of the areas.
5. Use parcel information from county assessors to develop a frame
containing all non-residential land parcels in the BPA service area.

A brief review of the five approaches follows.

**Strategy One: Develop a Frame From Electric Utility Customer Account Listings**

This strategy involves developing a list of all non-residential customers of the region's electric utilities. Ideally, the frame would contain information on the amount of electricity used and an economic activity code, such as SIC coding. Eight utilities were contacted to gather information on the feasibility of obtaining the desired information.

It was determined that reliable SIC coding was not available for a significant fraction of the region's customer accounts. Additionally, it was apparent that significant negotiations would be required to get utilities to release the data, and it is likely that some utilities would refuse to release some of the necessary information. Another significant problem with this approach is that there is not a consistent relationship between electric utility accounts and buildings.

**Strategy Two: Use Water Utility Account Listings to Develop a Frame**

If this approach were selected, the sampling frame would be a list of all non-residential customers of the water utilities in the region. Water utility account listings have one valuable feature. Water use metering generally occurs at the building level, which means that a list of water utility accounts would closely approximate a list of buildings.

A major disadvantage of this strategy is that a large number of water utilities would need to participate in the study. Since energy planning is not a significant concern for water utilities, there would be little incentive for them to participate. Also, it is unlikely that water utilities maintain the requisite information on building size and type of economic activity.

**Strategy Three: Use Listings of Telephone Company Non-Residential Customer Accounts to Create a Sampling Frame**

This approach involves using the yellow pages to prepare a list of all non-residential telephone accounts in the BPA service area. Problems associated with this approach include the lack of a uniform system for classifying accounts by economic activity, the lack of a measure of size, and the lack of building level information. Additionally, there were serious concerns about the possibility of obtaining the information in electronic form.
Strategy Four: Build an Area Based Sampling Frame

An area based sampling approach would involve subdividing the BPA service area into a large number of small geographically defined subareas. A sample of those areas would then be drawn, and all non-residential buildings located in the sampled areas would be enumerated to develop a list of non-residential buildings. This list would then be used as the sampling frame.

To devise a viable area based sampling approach, it is necessary to find a suitable area unit. An important requirement is that for individual area units there must be information available concerning numbers of buildings, building size and building type. This information is required to develop an efficient area sampling approach.

The major difficulty associated with this approach is obtaining information on building size and the number of buildings by type of economic activity for each individual area unit. If administrative areas, such as counties or ZIP codes, were used as the area units in an area sampling frame, it is likely that the necessary information could be obtained from published sources, such as County Business Patterns. County Business Patterns provides information on number of establishments and employment by SIC for both ZIP areas and counties.

Strategy Five: Use County Assessor Parcel Records as the Sampling Frame

If this strategy were used, the sampling frame would consist of a list of all non-residential parcels of land in the BPA service area. Data collected for each parcel would include a land use classification code and the improved value. An advantage of this approach is that, for the region's larger counties, the majority of the information could be obtained in electronic form at a relatively low cost from commercial vendors.

In order for this approach to work, all counties in the region would need to participate and each would have to supply data in a comparable form. This condition could not be satisfied. There are two additional limitations to this approach. First, the improved value of the parcel would have to be used as a surrogate measure of building size. Improved value is not a very satisfactory measure of size. Second, parcel land use classification codes may not provide reliable information on type of economic activity.

Evaluation of Alternative Strategies and Selection of a Preferred Strategy

Of the five strategies that were considered, the area frame, electric utility customer account and assessor parcel approaches were determined to be the most promising. However, upon careful consideration, both the electric utility account and assessor parcel approaches were found to be unacceptable. For both of these approaches, data would have to be collected from a large number of organizations in order to assemble comprehensive lists. In addition, neither of the two strategies provides all of the measures required to support an efficient
sample design. Assessor parcel records do not provide a good measure of building size, and utility customer records often do not contain information on each customer's type of economic activity.

The only strategy determined to be acceptable was the area based sampling frame approach. However, it was necessary to further explore the feasibility of this approach to determine if it could satisfy all of the requirements of the study. As a first step, it was necessary to determine if there was an area unit which would serve as an appropriate sampling unit in an area sampling frame. The following criteria were used to make that determination:

1. The area unit must be able to provide complete and non-overlapping coverage of the entire BPA service area.

2. Given the highly variable geographic distribution of non-residential buildings, it is necessary that there be information available on the number of buildings in individual area units. A good surrogate measure for the number of buildings would be acceptable.

3. Individual area units must be small enough to allow a complete enumeration of all non-residential buildings in all units selected in a sample.

4. The areas must be small enough so that they can be used to subdivide the BPA service area into public and private utility sub-regions.

Counties and ZIP codes were the only two area units to satisfy the first two criteria. Both provide complete and non-overlapping coverage, and there are census data available for both which can be used to estimate the number of buildings in individual areas. However, counties fail to satisfy the final two criteria, because they are so large. In particular, it would be infeasible to completely enumerate some of the region's larger counties.

ZIP codes appear to be the appropriate size to serve as the sampling units in an area sampling frame. They are small enough to both permit a complete enumeration of all non-residential buildings in sampled ZIP codes, and enable the subdivision of the service area into public and private utility sub-regions. Additionally, the Census Bureau, in its County Business Patterns series, provides information on the number of establishments and employment by SIC industry for each of the region's ZIP codes. That data provides a basis for estimating the number of buildings by type of economic activity for each ZIP code.

Resolution of Remaining Issues Concerning the Suitability of a ZIP Area Sampling Frame

Although the evaluation of the alternative strategies for developing a sampling frame indicated that an area based approach using ZIP codes was the most promising, it was necessary to resolve two remaining issues regarding the suitability of using a ZIP area sampling frame. These issues were:
1. Whether or not the establishment counts available from County Business Patterns could be used as a surrogate measure of the number of buildings in a ZIP area.

2. To what extent different ZIP areas have similar distributions of buildings by size. This is an important issue because it affects the sample size, which is the primary determinant of the cost of the study.

These issues are explored below.

Relationships Between Establishments and Buildings

In order to be able to select a sample of ZIP code areas in a statistically efficient manner, it is necessary to have a measure of the number of buildings in each ZIP area. There are no direct measures of the number of non-residential buildings in each ZIP area. However, County Business Patterns provides information on the number of establishments by SIC code for each ZIP area. If establishments are a reliable surrogate measure for buildings, then the County Business Patterns data can satisfy the need for a measure of the number of buildings in a ZIP area. The basic question is whether or not there exists a consistent relationship between the number of establishments and the number of buildings across different types of ZIP areas. If there is a consistent relationship, establishments can be used as a surrogate measure for buildings.

There are no regional studies which have examined the relationship between buildings and establishments at the ZIP area level. The only data available for examining this relationship is derived from studies of urban areas. Specifically, data from BPA's commercial end-use metering study (ELCAP) for the Seattle City Light service area was used to examine the relationship between buildings and establishments. The Seattle City Light service area is made up of 34 ZIP code areas located in the City of Seattle and a few adjacent suburban communities. For the ELCAP study, a sample of over 1000 commercial buildings in the Seattle City Light service area was drawn randomly with respect to location.

Using the information in the Seattle City Light ELCAP sample along with County Business Patterns data on the number of establishments in each ZIP code area, a ZIP code level analysis was conducted to examine the relationship between number of buildings and number of establishments for the ten building types of interest. The findings of the analysis were:

- Establishment to building ratios varied significantly across the different building types.

- The establishment to building ratios for the different building types were consistent across all ZIP areas, with the exception of three central business district (CBD) ZIP areas.
If the three CBD ZIP areas were excluded, the ratio of total number of establishments to total number of buildings was close to one for the Seattle City Light Service area.

The CBD ZIP areas had significantly higher establishment to building ratios than other ZIP areas because they contain a substantial number of buildings housing a large number of establishments.

On the basis of the above findings, it was determined that number of establishments could provide an acceptable surrogate measure of the number of buildings for all ZIP areas except those located in the CBD's of large cities.

It is reasonable to question a procedure which assumes that commercial building relationships for the Seattle City Light service area are applicable to the entire BPA service area. The Seattle City Light service area is not a representative sub-area of the larger BPA service area. However, it was the only area for which the necessary information on building relationships was available. Additionally, analysis of the characteristics of commercial activity in the Seattle City Light service area indicates that the service area contains a wide range of commercial activity, which is significantly more representative of the region's commercial sector than might be expected. For example, many of the community and neighborhood level shopping districts in the Seattle area are quite similar to shopping districts found in the region's smaller cities and towns.

The Distribution of Buildings by Size Across ZIP Areas

In using an area based sampling approach, one does not directly select a random sample of buildings. Each of the areas contains a set of buildings. In an ideal situation, the set of buildings in each area would be comprised of a random sample of the buildings in the entire region. In such a situation, one would need only to select enough area units to provide the number of buildings which would be required if one were to draw a simple random sample of the region's buildings. As the distribution of buildings within the area units deviates increasingly from a random sample of all commercial buildings in the region, it becomes necessary to select an increasingly greater number of area units in the area sample. This deviation from a random distribution within areas is referred to as homogeneity. As deviation from a random distribution increases, homogeneity within area units increases. As homogeneity increases, the number of area units which must be selected in a sample increases, which begins to negate the benefits derived from using an area sampling frame.

If the level of homogeneity in the sample were high, it would be necessary to select such a large number of ZIP areas that the benefits of using an area sampling frame would be negated, and the cost of the study would become prohibitive. The ELCAP data for the Seattle City Light service area was used to make an estimate of homogeneity in the region's ZIP areas. It was found that if CBD ZIP areas were excluded, homogeneity was held to a relatively low level. Consequently, it was concluded that homogeneity considerations would not make
a ZIP area sampling approach infeasible. As explained in Section 2.4.2, the problems associated with the CBD ZIP areas were resolved by selecting with certainty all CBD ZIP areas of the region's largest cities.

2.3.3 Development of the ZIP Area Sampling Frame

Development of the ZIP area sampling frame began with the delineation of the boundaries of the BPA service area. Then, all ZIP codes located within the service area were identified, and a non-overlapping set of ZIP code areas which defined the service area was developed from the set of regional ZIP codes. County Business Patterns data on establishments and employment by ZIP code were used to determine total number of establishments in each ZIP area and to develop estimates of numbers of buildings by building type for each of the region's ZIP areas. Finally, all ZIP areas were classified as public or private, according to whether they were served by a public or private utility. Figure 2.2 illustrates the procedure followed in developing the ZIP area sampling frame.
FIGURE 2.2

Procedure For Developing the ZIP Area Sampling Frame

ASSEMBLE SET OF ZIP AREAS WHICH COMPRISOE THE BPA SERVICE AREA
- Define boundaries of BPA service area.
- Identify all ZIP codes located within the service area boundaries.
- Allocate all non-area ZIP codes to the appropriate area ZIP code. In cases where this is not feasible, remove the non-area ZIP code.
- Remove Military and Indian Reservation ZIP codes.

DEVELOP ESTIMATES OF THE NUMBER OF NON-RESIDENTIAL ESTABLISHMENTS AND BUILDINGS IN EACH ZIP AREA
- Merge County Business Patterns ZIP code level establishment and employment data with the set of regional ZIP areas.
- Calculate total number of non-residential establishments in each ZIP area.
- Allocate SIC industries to the ten study building types.
- Use SIC to building type allocation scheme to compute number of establishments in each building type for each ZIP area.
- Use ELCAP information to identify relationships between establishments and buildings for each building type.
- Use the information on number of establishments by building type and the ELCAP relationships to estimate the number of buildings by building type for each ZIP area.

CLASSIFY ZIP AREAS BY TYPE OF UTILITY
- Identify the utility serving the major share of the non-residential load in each ZIP area.
- Classify ZIP areas according to whether they are served by a public or private utility.

Determination of the Boundaries of the BPA Service Area

Before the set of ZIP code areas which make up the BPA service area could be identified, it was necessary to precisely identify the boundaries of the service area. The procedure for identifying these boundaries was based on the Northwest Power Act, and was implemented using service area maps produced by BPA. The Pacific Northwest Electric Power Planning Conservation Act defines the Pacific Northwest Region as follows:
A. The area consisting of the States of Oregon, Washington, Idaho, and the portion of the State of Montana west of the Continental Divide, and such portions of the States of Nevada, Utah, and Wyoming as are within the Columbia River drainage basin; and

B. Any contiguous areas, not in excess of seventy-five air miles from the area referred to in subparagraph A, which are a part of the service area of a rural electric cooperative customer served by the Administrator on the effective date of this Act which has a distribution system from which it serves both within and without such region.

Based on the BPA Office of Conservation's application of the above definition, private utility service areas were only included for the states of Oregon, Washington, Idaho, and Montana west of the Continental Divide. The area delineated by the above definition is comprised of the states of Oregon, Washington, Idaho, and Montana west of the Continental Divide, with a number of fingers extending outward from this area for a distance of up to 75 miles into portions of California, Nevada, Utah, and Wyoming.

Subdivision of the BPA Service Area into a Set of ZIP Areas

After the boundaries of the BPA service area had been clearly defined, the ZIP codes located within those boundaries were identified. Some ZIP codes are not associated with a specific geographic area. These ZIP codes had to be allocated to the appropriate area ZIP code, or, if that was not possible, removed from the set of regional ZIP codes.

Since some ZIP codes are associated with an identifiable geographic area and others are not, it was necessary to develop terminology which would make it possible to distinguish between the different types of ZIP codes. ZIP codes that are associated with an identifiable geographic area are called area ZIP codes, or simply ZIP areas. ZIP codes not associated with a specific geographic area are referred to as non-area ZIP codes. The term ZIP code is used to identify the entire set of ZIP codes, which includes both area and non-area ZIP codes.

Identification of ZIP Codes Located in the BPA Service Area

The starting point for identifying the set of ZIP areas that comprise the BPA service area was the U.S. Postal Service Directory of Post Offices tape. This tape contained a list of every valid post office in the U.S. as of March 1985, coded by state, county, and ZIP code. A set of post offices in the Pacific Northwest was extracted from the national DOPO tape, based on the county in which the post office was located. All post offices located in any county within the BPA service area were extracted from the tape. This procedure yielded all ZIP codes associated with any county in the BPA service area.
The counties that are located along the boundary of the BPA service area contained some ZIP codes which were either wholly or partly outside of the service area. ZIP codes located along the service area boundary were carefully examined to determine if any part of them were inside of the service area boundary. A conservative position was taken, and any ZIP code which was at least partially within the service area was retained. All ZIP codes lying completely outside of the service area were deleted.

Re-Allocation and Removal of Non-Area ZIP Codes and Military and Indian Reservation ZIP Codes

Although the basis of the ZIP code system is a set of non-overlapping ZIP areas, some ZIP codes are not associated with a specific geographic area. In order to build an area sampling frame, it was necessary to either allocate the non-area ZIP codes to their appropriate area ZIP codes, or, if that was not possible, to remove them from the ZIP area sampling frame.

It is important to remember that ZIP codes have been developed by the U. S. Postal Service for the purpose of facilitating the delivery of mail. Consequently, numerous modifications have been made to the basic set of non-overlapping areas in order to facilitate mail delivery. Unfortunately, many of these modifications cause distortions in the fundamental geographic structure of the ZIP code system. For example, the Postal Service has created a number of types of ZIP codes which are not associated with any unique geographic area. Examples include a set of post office boxes which has a unique ZIP code but is not associated with a unique geographic area, and a special ZIP code for a single building or business address (refer to Appendix A for a more detailed discussion of the characteristics of the ZIP code system).

It was necessary to identify all non-area ZIP codes retained in the list of regional ZIP codes, and to determine which of them could be allocated to an area ZIP code. Some ZIP codes were designated as non-area ZIP codes by the Postal Service. However, it was discovered that the Postal Service did not identify all non-area ZIP codes. Consequently, it was necessary to devote considerable effort to identifying all of the region's non-area ZIP codes. In many cases it was necessary to contact the local post office in order to make an accurate determination of a ZIP code's status. All ZIP codes which were clearly non-area ZIP codes were allocated to their proper area ZIP code wherever possible. Non-area ZIP codes which could not be allocated to an area ZIP code were removed. Included in the set of non-area ZIP codes were all FPO and APO military ZIP codes, which are military ZIP codes used for sending mail overseas.

A second set of ZIP codes which were removed from the set of regional ZIP codes were all ZIP codes located entirely within the boundaries of a Military or Indian Reservation. These ZIP codes were removed because a decision had been made to exclude from the survey all buildings located on these types of federal reservations. After all non-area and military ZIP codes had been re-allocated or removed, the number of area ZIP codes remaining was 1415.
Using the ZIP code level employment and establishment data from County Business Patterns, an analysis was conducted to determine the number of establishments and amount of employment which had been removed through the deletion of federal reservation and non-area ZIP codes. It was found that, for the state of Washington, approximately 2.5 percent of establishments and 4.9 percent of employment had been removed.

**Development of Establishment and Building Information for the Region's ZIP Areas**

During the process of identifying the ZIP areas which comprise the BPA service area, the County Business Patterns ZIP code level establishment and employment data were merged with the Postal Service listing of the region's post offices and ZIP codes.

County Business Patterns provides information on the number of establishments and employment by 4 digit SIC industry for each ZIP code. The total number of establishments in each ZIP area ultimately was used as the measure-of-size in selecting ZIP areas for the Phase I sample (see Section 2.4.2). The employment information is not a count of total employment in each 4 digit SIC industry, but rather a count of the number of establishments which fall into different employment ranges (1-4 employees, 5-9 employees, etc.). The employment range information was used to develop estimates of total employment in each ZIP area.

The information on the number of establishments by SIC code was also used to develop ZIP area level estimates of the number of non-residential buildings for ten of the study's twelve building types (estimates were not developed for the "Hospital" and "Post-Secondary Education" building types, since these were addressed with separate sampling frames). These estimates were used to gain some preliminary insight into the distribution of non-residential buildings in the region, to aid in developing the sample design.

First, the four digit SIC industries were allocated into the ten commercial building types. This allocation scheme was used to compute the number of establishments by building type for each ZIP area. The next step was to identify relationships between establishments and buildings. Information concerning these relationships was available from BPA's commercial end-use metering study (ELCAP), which was being conducted in the Seattle City Light service area. The ELCAP study involved an intensive metering and analysis of a sample of non-residential buildings in the Seattle City Light service area, an area which includes the city of Seattle and a few neighboring suburban communities. The ELCAP building sample was drawn randomly with respect to location from a list of all commercial tax parcels in the Seattle City Light service area. The relationships between number of establishments and number of buildings were computed for the ten building types using the ELCAP data. Two separate sets of relationships were identified, one for Seattle's three high density central business district (CBD) ZIP areas, and one for all other Seattle City Light ZIP areas. The relationships for the CBD ZIP areas were used to make estimates of buildings and building floor area for six high density CBD ZIP areas in the BPA service
area, and the relationships for the non-CBD ZIP areas were used to make estimates for all other ZIP areas in the BPA service area. Finally, for each ZIP area, the number of establishments in each building type was multiplied by the ratio of buildings to establishments for the appropriate building type to compute the number of buildings by building type. This procedure generated estimates, for each ZIP area, of the total number of buildings as well as the number of buildings in each of the ten building types. These estimates were not directly used in the sampling process, but they provided useful insight into the distribution of the region's non-residential buildings, as described in Section 2.3.4 below.

Classification of ZIP Areas by Type of Utility

The final step in the development of the ZIP area sampling frame was to identify the type of utility, either public or private, which served each ZIP area. This was accomplished by identifying the specific utility which provided power to each ZIP area. In cases where a ZIP area was served by more than one utility, it was necessary to determine which utility served the majority of the non-residential load in the ZIP area.

For approximately 60 percent of the ZIP areas in the region, information on the utility serving the majority of the non-residential load was available from a study done for BPA by the Evaluation Research Corporation (1985). This information was reviewed and found to be accurate. For the remaining 40 percent of the region's ZIP areas, BPA service area maps were used to identify the utility serving the majority of the non-residential load in each ZIP area. In cases in which the maps provided insufficient information with which to make a determination, the utilities involved were contacted for additional information. Once the utility serving the majority of the non-residential load in each ZIP area was identified, ZIP areas were classified as public or private on the basis of whether the utility was a public or private utility.

2.3.4 Characteristics of Commercial Activity in the BPA Service Area

The data collected and developed for the ZIP area sampling frame provided a rich source of preliminary information about commercial activity in the BPA service area. This information was used to guide the further development of the sample design. This section identifies some of the features of the region's ZIP areas, and examines some of the characteristics of its commercial economic activity and buildings, as revealed by the 1982 County Business Patterns data and corresponding building estimates (see Section 2.3.3).

General Characteristics

The region's 1415 ZIP areas contain 153,880 commercial establishments, which employ 1.77 million people. These establishments occupy an estimated 152,479 buildings, which have an estimated total floor area of 1.29 billion square feet.
The average number of establishments in a ZIP area is 109, with a minimum of zero and a maximum of 1885. Employment per ZIP area ranges from zero to 30,331, with the average ZIP area having 1251 employees. The ZIP area with the greatest number of establishments and employees is ZIP 98101 in downtown Seattle.

The average number of commercial buildings in a ZIP area is 108. The maximum is 1510, and the minimum is zero. Floor area averages 915,000 square feet per ZIP area, ranging from a low of zero to a high of 48.8 million square feet. The average floor area of the region's commercial buildings is 8491 square feet. The ZIP area with the greatest number of buildings is ZIP 97401 in Eugene, Oregon, while the ZIP area with the greatest floor area is ZIP 98101 in downtown Seattle.

Forty-three percent of the region's ZIP areas are served by public utilities, while the remaining 57 percent are served by private utilities. In terms of commercial activity, the private utility ZIP areas are somewhat larger, on average, than the public utility ZIP areas. For example, the average private utility ZIP area contains 117 commercial buildings, while the average public utility ZIP area contains 96.

The Geographic Distribution of Commercial Activity

Commercial activity is distributed among states in approximately the same manner as population. For example, Washington, with approximately 52 percent of the region's population, has 50.3 percent of its commercial establishments and 54.0 percent of its commercial building floor area. Oregon has 32.0 percent of the region's commercial building floor area, Idaho has 9.6 percent, and Montana has 3.6 percent. These shares mirror the states' shares of regional population.

Population and economic activity are highly concentrated in certain areas of the BPA service area. A small number of urban areas contains most of the region's people, jobs, and commercial buildings. Consequently, the ZIP areas and counties located in these urban centers account for most of the region's commercial employment and buildings.

A small number of the region's ZIP areas account for most of its commercial activity, while a large number of ZIP areas have very little commercial activity. There are 101 ZIP areas which contain 500 or more commercial establishments. These 101 ZIP areas, which represent only 7.1 percent of the region's total ZIP areas, contain over half of the region's commercial establishments, employment, buildings, and building floor area. It is interesting to note that employment and building floor area are more highly concentrated in large ZIP areas (i.e., ZIP area containing a relatively large number of commercial establishments) than are establishments and buildings. This indicates that, relative to small ZIP areas (i.e., ZIP areas containing relatively few commercial establishments), the large ZIP areas are characterized by large establishments and buildings.
The region's small ZIP areas are lightly populated and contain very little commercial activity. There are 820 ZIP areas, 60.0 percent of the region's total, which have less than 20 commercial establishments. These 820 ZIP areas contain 4420 commercial establishments, 2.9 percent of the region's total. The share of other measures of commercial activity accounted for by ZIP areas with less than 20 establishments ranges from 1.7 to 3.4 percent of the region's total.

The concentration of commercial activity observed at the ZIP area level is also evident at the county level. Commercial activity is highly concentrated in the region's most populous urban counties. King County, the region's most populous county, accounts for approximately 20 percent of the region's commercial activity. King and Multnomah Counties, which contain the region's two largest cities, Seattle and Portland, together account for close to one third of the commercial activity in the BPA service area. The region's ten most populous counties contain over half of its commercial activity, including 51.3 percent of its commercial buildings, and 61.6 percent of its building floor area. Less than half of the commercial activity in the region is located in the region's remaining 136 counties, most of which are lightly populated rural counties.

2.3.5 Special Sampling Frame for Post-Secondary Education Institutions

Post-secondary education institutions are one of the two building types for which a ZIP area sampling frame does not provide a satisfactory sample of buildings. This is because post-secondary education (PSE) institutions are an infrequently occurring and spatially concentrated building type, and a small number of PSE institutions account for a large share of total PSE buildings and floor area. To obtain a sample of the region's PSE institution buildings, it was necessary to develop a separate sampling frame for PSE institutions. This sampling frame consists of an inventory of all post-secondary educational institution campuses in the BPA service area, along with specific information about the campuses, including number of buildings.

Assembly of PSE Institutions Inventory and Data

A list of all post-secondary education institutions in the BPA service area was developed from the following sources: the *Higher Education Directory* (HEP Directory) (Torregrosa, 1985), university and college catalogs, state community college and post-secondary education organizations, and an institutional buildings census prepared for BPA by the Evaluation Research Corporation (1985). The HEP Directory was used as the primary data source because of its comprehensiveness. The other data sources were used to locate institutions not listed in the HEP Directory, and to confirm the accuracy of some of the HEP Directory information.

As defined in this study, the term post-secondary educational institution includes all accredited public and private community colleges, four-year colleges, and universities. Most vocational schools, such as beauty schools, are excluded from this definition. The specific criteria that were used to determine which institutions to include in the inventory follow general guidelines established by
the U.S. Department of Education. They include requirements that the institution must be properly accredited and offer a college level program leading toward a degree.

In developing a PSE institutions sampling frame, it was necessary to select an appropriate sampling unit. The PSE institution is not an appropriate sampling unit because many institutions are comprised of more than one campus or have off-campus buildings. Often these secondary campuses and off-campus buildings are located at a significant distance from the main campus. Based on an analysis of the geographic characteristics of PSE institutions, it was determined that the campus was an appropriate sampling unit. Each campus of multi-location institutions was listed separately in the PSE institutions sampling frame. Campuses were defined using the basic geographic unit of the survey, the ZIP area. A campus of a specific institution was defined as all the buildings of that institution that were located in the same ZIP area.

Information was gathered at the campus level on number of buildings, enrollment and building square footage, and campuses were designated as public or private based on whether they were part of a public or private PSE institution. Building counts were obtained for all PSE campuses, but information on enrollment and building square footage was not available for some of the smaller campuses. Because building square footage was not available for all campuses, the number of buildings was used as the measure of campus size. Number of buildings is highly correlated with building floor area.

Characteristics of the Region's PSE Campuses

The inventory of the region's PSE institutions identified 215 PSE campuses. Building counts were obtained for all 215 campuses, while enrollment figures were available for only 136 campuses and floor area data for 122. The count of buildings indicates there are 3,919 PSE institution buildings in the region, an average of 18 per campus. The largest campus has 357 buildings and the smallest has none, which indicates that the campus occupies less than 50 percent of the building in which it is located.

The geographic distribution of campuses, enrollment and floor areas generally mirrors the distribution of population at the state level. However, at the county level, the distribution of PSE activity deviates substantially from the distribution of population, because some of the region's largest PSE campuses are located in relatively small communities. Examples include Oregon State University in Corvallis, Washington State University in Pullman, and the University of Idaho in Moscow.

The inventory of PSE campuses is composed primarily of small campuses. Of the 136 campuses for which enrollment figures were available, 73 (53.7%) have less than 2,000 students. This figure actually understates the proportion of small campuses, since virtually all of the campuses for which enrollment figures were not available have less than 2,000 students. The 73 campuses with less than 2,000 students have only 11.3 percent of total enrollment and 17.6 percent of
total buildings. Although they are fewer in number, the larger campuses account for the majority of students and buildings. For example, sixty-seven percent of total enrollment and 47.1 percent of total buildings are accounted for by the 32 campuses with enrollments of 5,000 or more.

2.3.6 Special Sampling Frame for Hospitals

Like PSE institutions, hospitals are an infrequently occurring and spatially concentrated building type, and a small number of hospitals account for a large share of total hospital floor area. Because of these characteristics, an area based sampling frame does not provide a representative sample of the region's hospitals. Consequently, it was necessary to develop a separate sampling frame for hospitals. This sampling frame contains an inventory of all hospitals in the BPA service area, as well as information about the characteristics of those hospitals.

Assembly of Hospital Inventory and Data

A list of all hospitals in the region was developed from the following sources: the American Hospital Association Guide to the Health Care Field (AHA Guide) (1985), lists of licensed hospitals prepared by state government health agencies in each state, and the census of institutional buildings prepared for BPA by the Evaluation Research Corporation (1985). The AHA Guide was adopted as the primary data source. The other two sources were used to supplement and verify the information in the AHA Guide.

The AHA Guide's definition of a hospital was used to determine which facilities should be included in the hospital inventory. According to the AHA Guide, a hospital must be licensed by the appropriate state licensing agency, accredited by the Joint Commission on Accreditation of Hospitals, or certified as a provider of acute services under Title 18 of the Social Security Act. In lieu of these accreditation requirements, an institution may be registered by the AHA if it satisfies a series of AHA requirements. Included in the AHA's definition of a hospital are osteopathic and psychiatric hospitals, hospitals specializing in the treatment of alcohol and other chemical dependency, and military, Veterans Administration and Indian Service hospitals. College infirmaries and ambulatory care facilities are excluded. Nursing homes are included only if they exist as a part of a hospital and are physically located in the same building as the hospital itself.

Since hospitals frequently occupy more than one building, a "facility" concept was used to define hospitals for the purpose of sample selection. All buildings of a hospital facility which are either attached or located in close proximity to one another were treated as being part of a single hospital facility. If a hospital building which contained licensed hospital beds was located at a significant distance from other buildings of the hospital which also contained licensed beds, it was listed as a separate hospital.

After the hospital inventory had been completed, information was collected for each hospital in the inventory. The type of information collected included...
number of licensed beds, type of ownership, hospital specialization, employment and other hospital characteristics. Considerable effort was devoted to making sure that licensed beds figures were accurate and current, and that all ZIP codes were correct. Number of licensed beds was used as the measure of hospital size.

**Characteristics of the Region's Hospitals**

The inventory of hospitals in the BPA service area identified 305 hospitals, which contain 38,061 licensed beds, an average of 125 beds per hospital. The largest hospital has 940 beds, while the smallest has only ten beds. Employment, which is measured as full-time equivalent employment, was obtained for 226 hospitals. Average employment for those hospitals is 343. Maximum employment is 2668, and the minimum is 17.

Hospital characteristics vary markedly across the states of the region. Hospitals in Washington and, to a lesser extent, Oregon are substantially larger and have a significantly higher average employment than those in Idaho and Montana. Additionally, employment per licensed bed is considerably higher in Washington than in the other states. To a considerable extent, these differences are attributable to the fact that there are a number of very large hospitals in the Seattle and Portland metropolitan areas, and to the existence of highly specialized treatment and care facilities and programs in Seattle area hospitals.

A few large counties account for a large share of the region's hospital beds, but for a significantly smaller share of the region's hospitals. This discrepancy between the distribution of hospitals and beds is largely due to the fact that most of the region's large hospitals are located in a small number of its large urban counties. For example, four counties, King (Seattle), Multnomah (Portland), Pierce (Tacoma) and Spokane, account for 22.0 percent of the region's hospitals, 41.6 percent of its hospital beds, and one-third of its population.

The majority of the hospitals in the region are small. Of the region's 305 hospitals, 109, or 35.7 percent, have less than 50 beds, and 182 (59.7%) have less than 100 beds. However, hospitals in these size groups account for only 9.2 and 22.6 percent, respectively, of the region's total hospital beds. Most of the licensed beds in the region are accounted for by a relatively small number of large hospitals. Over half (52.1%) of the region's hospital beds are found in less than one-fifth (17.7%) of its hospitals, those with 200 or more beds.

### 2.4 THE PHASE I SAMPLE

The primary purpose of the Phase I sample is to develop a list of non-residential buildings in the BPA service area. The Phase I sample also provides basic information about those buildings, including type of economic activity, floor area, year built and number of tenants. Information on type of economic activity and building age is used to subdivide the population of buildings into the study's 15 domains. The floor area information makes it possible to achieve
gains in sampling efficiency through the stratification of buildings into size categories in the Phase II sample.

The Phase I sample utilizes an area based sampling approach, in which ZIP code areas are the primary sampling units. The Phase I sample design incorporates a variety of features, including certainty selection of large ZIP areas, selection of non-certainty ZIP areas using probability proportional to size (PPS) selection methods, segmentation of large ZIP areas, and the creation of special sampling frames for hospitals and post-secondary education (PSE) institutions. A list of commercial buildings is developed by enumerating all non-residential buildings located in a sample of the region's ZIP areas, as well as all buildings located in a sample of hospital facilities and PSE institution campuses selected from the special sampling frames.

This section describes in detail the design and basic characteristics of the Phase I sample. It addresses the following topics:

- Development of Phase I sample design
- Principal features of the sample design
- Selection of the Phase I sample

2.4.1 Development of the Phase I Sample Design

The development of the Phase I sample design was guided primarily by the precision requirements of the study, budget considerations, and the characteristics of the ZIP area sampling frame. The study's precision requirements concern the need to obtain, in the Phase II, estimates of a number of building measures for the study's 15 building type domains with specified levels of precision (see Section 2.2.3 for a detailed listing of the precision requirements). These precision requirements affect the Phase I sample design, because the Phase I sample of ZIP areas must supply a list of buildings for use as the Phase II sampling frame which is sufficient to satisfy the study's precision requirements.

Budget considerations affecting the development of the study design include not only the desire to satisfy the objectives of the study at the lowest possible cost, but also the fact that there was only $1.5 million available for the study.

The characteristics of the ZIP area sampling frame which had the most significant impact upon the sample design are the highly skewed distribution of buildings across ZIP areas, and the degree of homogeneity within ZIP areas. With respect to skewness, a small number of ZIP areas contain the majority of the non-residential buildings in the region, while the majority of ZIP areas account for relatively few buildings. For example, 101 (7.1%) of the region's 1415 ZIP areas contain 53.3 percent of its non-residential buildings. On the other hand, the region's 990 smallest ZIP areas (i.e. those containing the fewest commercial establishments), which represent 70.0 percent of all ZIP areas, contain only 7.4 percent of all non-residential buildings.

Homogeneity refers to the extent to which the distribution of non-residential buildings within ZIP areas differs significantly from the distribution of all
residential buildings in the region. It was determined that, with the exception of the central business district (CBD) ZIP areas of large cities, homogeneity was not a significant factor affecting the sample design.

A number of other factors also influenced the development of the Phase I sample design. These included the average number of buildings per ZIP area, BPA's desire to obtain information for public and private utility groupings, and the desire to include in the sample those ZIP areas containing exceptional buildings or high concentrations of particular building types. Taking these factors into consideration, a sample design was developed which incorporates the following features:

- A sample size of 73 ZIP areas
- Use of probability proportional to size (PPS) selection methods to draw a sample of ZIP areas
- Selection of seven large city CBD ZIP areas with certainty
- Implicit stratification of the ZIP area sampling frame according to public/private utility service provision
- Segmentation and subsampling of large ZIP areas
- Development of special sampling frames for PSE institutions and hospitals

The following section describes in detail the principal features of the Phase I sample design, and explains the rationale for incorporating the features into the design.

### 2.4.2 Features of the Phase I Sample Design

#### Sample Size

The size of the Phase I sample was determined primarily by two factors:

1. The precision requirements of the Phase II sample
2. The level of homogeneity in the Phase I sampling frame

The role of these factors in determining the size of the Phase I sample is discussed in the following sections.

#### Precision Requirements of the Phase II Sample

The primary purpose of the Phase I sample is to provide a building list to serve as a sampling frame for the selection of the Phase II sample. The Phase II sample has precision requirements which are associated with the need to obtain measures of specific variables, such as number of buildings and electricity use
per square foot, for each of the study's 15 domains (see Section 2.2.3 for a presentation of the study's precision requirements). For the precision requirements to be satisfied, there must be a sufficient number of buildings in the Phase II sampling frame. Since the buildings in the Phase II sampling frame come from the Phase I sample, the acceptable minimum size of the Phase I sample is determined by the Phase II precision requirements.

The factor which determines the minimum number of buildings which must be selected in the Phase I sample is the number of buildings required to satisfy the Phase II precision requirements for the least frequently occurring building type domain, which is grocery stores. Given the frequency of occurrence of grocery stores in the population of the region's commercial buildings and the precision requirements for grocery stores, it was determined that the minimum acceptable Phase I sample size was approximately 15,000 buildings.

Homogeneity

A sample size of 15,000 buildings is what would be required if the Phase I sample were being selected using simple random selection methods. However, the sample of elements (buildings) is derived from a sample of clusters (ZIP areas), not from a simple random selection of elements. When cluster sampling is used, the distribution of the elements within the clusters is generally not random. Instead, it is characterized by some degree of homogeneity, which tends to increase the variance of the sample. Homogeneity exists when the distribution of elements within clusters is not random, and homogeneity increases as this distribution gets further from random. As homogeneity increases, the sample size required to attain a specific level of precision grows increasingly larger than the sample size that would be required if simple random selection techniques were used.

As explained in Section 2.3.2, data from the Seattle City Light ELCAP study were used to estimate the level of homogeneity in the ZIP area sampling frame. The level of homogeneity was found to be relatively small, if the CBD ZIP areas of large cities were excluded from the set of ZIP areas.

The effect which homogeneity has upon the required sample size is influenced by the relationship between the number of elements to be selected in the Phase II sample and the number of clusters selected in the Phase I sample. This relationship is important at the level of the individual domain, since in the Phase II the samples for the different domains are drawn independently. The requirements for increasing the size of the Phase I sample because of a given level of homogeneity increase as the ratio of Phase II elements to Phase I clusters increases. One way to visualize how this relationship affects sample size is to focus on the average number of Phase II elements which come from each Phase I cluster. If the number of elements per cluster is one, then the sample approximates a simple random sample, and, consequently, homogeneity in the set of clusters has little impact. However, as the number of elements per cluster increases, the sample gets increasingly further from a simple random sample, and the homogeneity in the cluster sampling frame has an increasing effect upon the
sample which is drawn. Consequently, the greater the ratio of elements to clusters, the greater the impact of a given level of homogeneity upon sample size.

In order to insure that there would be no need to increase the Phase II sample size beyond 15,000 buildings because of homogeneity considerations, a sufficient number of ZIP areas were included in the sample so that the ratio of Phase II elements (buildings) to Phase I clusters (ZIP areas) would be very small. The number of ZIP areas included in the Phase I sample was 73. With 73 ZIP areas, the ratio of Phase II buildings to ZIP areas was approximately one for each of the 15 study domains. This ratio represents an average, and it is should be noted that the number of buildings selected from a given ZIP area could, in some cases, be substantially greater than one, due to the distribution of buildings among ZIP areas and the unpredictability inherent in sample selection. Nevertheless, for a specific domain the number of buildings selected from one ZIP area would very rarely exceed four or five.

To summarize, the level of homogeneity in the ZIP area sampling frame is relatively low, if the CBD ZIP areas of the region's large cities are excluded. Nevertheless, a precaution was taken to insure that homogeneity would not require increasing the size of the Phase II sampling frame beyond the 15,000 buildings required to satisfy the study's precision requirements. This precaution involved selecting a sufficient number of ZIP areas (73) so that the ratio of Phase II buildings to Phase I ZIP areas was very low for each of the study domains. Thus, the 15,000 buildings are to be selected from 73 ZIP areas. Since all buildings in the seven certainty CBD ZIP areas will be included in the building list, an average of 150 buildings per ZIP area must be obtained from the remaining 66 non-certainty ZIP areas.

Probability Proportional to Size Selection Method

In determining which type of selection method to use in drawing a sample of ZIP areas, it was necessary to consider the distribution of buildings across the sampling units, the ZIP areas. The distribution of buildings across the 1415 ZIP areas is lognormally distributed; most ZIP areas have very few commercial buildings, while a small number of ZIP areas contain the majority of the region's commercial buildings. When there is large variation in the size of the sampling units, as there is in this case, simple random sampling is generally not the preferred method to use in selecting a sample. Size stratified and probability proportional to size sampling methods are better suited for selecting a sample from a sampling frame characterized by large variation in sampling unit size.

Although drawing a simple random sample of ZIP areas could produce a representative sample of the region's commercial buildings, there are significant liabilities associated with the use of this approach. Since most ZIP areas selected in a simple random sample would have very few buildings, it would be necessary to select a very large number of ZIP areas to obtain the 15,000 buildings that are required. A Phase I sample containing a very large number of ZIP areas would present difficulties, from the perspectives of both cost and statistical efficiency. The difficulty and cost of enumerating buildings located in a very large number
of ZIP areas scattered throughout the region would be prohibitive, while statistical efficiency suffers whenever there are large inequalities in the size of the sampling units.

For drawing a sample from a sampling frame that is characterized by high levels of variation in the size of the sampling units, probability proportional to size (PPS) selection methods are superior to simple random techniques. Consequently, the PPS selection method was used in this study. With the PPS method, the probability of selecting a sampling unit is proportional to the unit’s size. For example, using PPS selection methods, the probability of selecting a ZIP area with 100 buildings is ten times greater than the probability of selecting a ZIP area containing ten buildings. Compared to simple random selection, use of PPS produces a more efficient sample, results in the selection of substantially fewer sampling units, and yields a sample of areas that can be enumerated at a much lower cost.

Certainty Selection of Large City CBD ZIP Areas

Seven central business district (CBD) ZIP areas located in the region’s largest cities were included with certainty in the sample of ZIP areas. Two factors motivated the certainty selection. The first factor reflects the desire to include in the sample ZIP areas which contain unique or unusual buildings, distinctive distributions of building types, or very large numbers of buildings. It was felt that if the selection of such ZIP areas was left to chance, many of the unique buildings in the region would be excluded from the Phase I sample. The second factor concerns the significant effects on sampling efficiency that result from the exclusion of the seven CBD ZIP areas from the sampling frame.

An initial identification of the types of ZIP areas which had significantly different characteristics than the majority of ZIP areas was made before the ZIP area sampling frame was developed. This identification made use of the ELCAP commercial building information which was available for the ZIP areas in the Seattle City Light service area. The ELCAP data set contains information for over 1000 commercial buildings located in the 34 ZIP areas of the Seattle City Light service area. Cluster analysis was used to identify distinctive ZIP areas through the grouping of the Seattle City Light ZIP areas on the basis of two key building characteristics, building type and floor area.

The clustering procedure began with all ZIP areas as separate units. Then, in a step by step process, ZIP areas were grouped together according to their similarity on a specific measure (in this case building type or floor area) until a single group was formed. For both the building type and floor area cluster analyses, during the clustering process the non-CBD ZIP areas grouped together to form a single cluster, while the CBD ZIP areas did not join or form any groups until after all of the non-CBD ZIP areas had grouped into a single cluster. Then, the CBD ZIP areas joined together to form a second cluster. Some experimental cluster runs made with the ZIP areas in the ZIP area sampling frame developed in this project produced similar results. On the basis of the cluster analyses, it was concluded that the CBD ZIP areas of large cities were the...
most distinctive ZIP areas, and that they contained buildings with significantly different characteristics than the buildings located in other ZIP areas.

The second motivation for selecting some ZIP areas with certainty was to enhance sampling efficiency. As discussed above in the section on sample size, the impact of homogeneity upon the sample design can be greatly reduced by removing the CBD ZIP areas of the region's large cities from the set of ZIP areas before selecting a sample. These large ZIP areas can be removed by sampling them with certainty. The inclusion in a sample of all very large sampling units is a procedure which is commonly used to reduce sampling variance.

Fortunately, the objectives of including distinctive ZIP areas in the sample and enhancing sampling efficiency are both achieved through the certain inclusion of large city CBD ZIP areas in the sample. Density, measured by the number of commercial buildings per square mile, was used to identify the CBD ZIP areas that should be included in the sample with certainty. In the analysis of the Seattle City Light ZIP area data, density was found to be highly correlated with the building type and floor area characteristics which distinguished the CBD ZIP areas from all other ZIP areas.

Based on the characteristics of the Seattle City Light ZIP areas, a decision was made to select with certainty all ZIP areas with a density of more than 800 buildings per square mile. This resulted in the selection of six CBD ZIP areas, three in Seattle, two in Portland, and one in Tacoma. In addition, the largest CBD ZIP area in Spokane was included with certainty, although it had fewer than 800 buildings per square mile. The Spokane ZIP area was included because it was considered important to include a CBD ZIP area from the region's third largest city. Additionally, it is likely that the use of a density criterion for selection reduced the likelihood of selecting a ZIP area from a low density city like Spokane.

Stratification by Public/Private Utility Grouping

One of BPA's objectives in undertaking a survey of the region's non-residential buildings was to obtain information about its public and private utility customers. As explained in Section 2.2, the size of the study budget made it impossible to treat public and private utility types as separate domains. However, a procedure known as implicit stratification was employed to insure that the sampled ZIP areas would contain the same proportions of buildings served by public and private utilities as does the entire region.

To implement the implicit stratification procedure, before the ZIP area sample was selected the region's ZIP areas were arranged in sequence, with all ZIP areas served by public utilities listed first followed by all ZIP areas served by private utilities. The use of implicit stratification in conjunction with the probability proportional to size selection method insured that the desired proportions of buildings served by the two utility types would be obtained. Table 2.1 shows the number of ZIP areas and establishments served by public and private utilities in both the entire BPA service area and the sample of ZIP areas which was selected in the Phase I.
TABLE 2.1

Distribution of ZIP Areas and Establishments by Type of Utility Providing Electricity Service

<table>
<thead>
<tr>
<th></th>
<th>All ZIP Areas in the Region</th>
<th>Sampled ZIP Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Percent</td>
</tr>
<tr>
<td>ZIP Areas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public Utility</td>
<td>1415</td>
<td>100.0</td>
</tr>
<tr>
<td>Private Utility</td>
<td>608</td>
<td>43.0</td>
</tr>
<tr>
<td></td>
<td>807</td>
<td>57.0</td>
</tr>
<tr>
<td>Establishments</td>
<td>153,880</td>
<td>100.0</td>
</tr>
<tr>
<td>Public Utility</td>
<td>59,718</td>
<td>38.8</td>
</tr>
<tr>
<td>Private Utility</td>
<td>94,162</td>
<td>61.2</td>
</tr>
</tbody>
</table>

Segmentation of Large ZIP Areas

As explained in the discussion of sample size, the required size of the Phase I sample is approximately 15,000 buildings. These 15,000 buildings must be drawn from 73 ZIP areas. Seven of the 73 ZIP areas are the large city CBD ZIP areas which are included in the sample with certainty. All commercial buildings located in these certainty ZIP areas are included in the Phase I sample. In order to obtain a Phase I sample containing 15,000 buildings, it was necessary to select an average of 150 buildings from each of the remaining 66 ZIP areas. However, the average number of buildings in the 66 non-certainty ZIP areas was 659. A procedure known as segmentation was used to obtain the desired number of buildings from the non-certainty ZIP areas.

The segmentation procedure involved subdividing the large ZIP areas into smaller areas called segments, and then selecting one of the segments for enumeration. Only the buildings in the selected segment were enumerated. All non-certainty ZIP areas containing more than 300 buildings were subdivided into segments containing approximately 150 buildings. 58 of the 66 non-certainty ZIP areas were segmented.

The first step in segmenting a large ZIP area was to make a quick count to develop a rough estimate of the number of non-residential buildings in each block of the ZIP area. The quick count was generally made in a car, by two persons. Then, the number of buildings in each block was listed on a block level map of the ZIP area. Adjacent blocks were then grouped to form rectangular shaped segments containing approximately 150 buildings. In practice, it might be necessary to make more than one attempt at forming segments in order to obtain...
segments of the proper shape which contain an appropriate number of buildings. After a ZIP area was subdivided into segments, each segment was numbered, and then one of the segments was selected randomly. Only the buildings located in the sampled segment were enumerated.

**Construction of Special Sampling Frames for Post-Secondary Education Institutions and Hospitals**

Developing a list of commercial buildings from a sample of ZIP areas provides a representative sample of buildings for most commercial building types. However, there are two building types, post-secondary education (PSE) institutions and hospitals, which are not satisfactorily represented by a ZIP area sampling approach. This is because these building types occur infrequently and are spatially concentrated. To insure that an acceptable sample of PSE institution and hospital buildings would be selected, two special sampling frames were constructed. These sampling frames consisted of lists of all hospital facilities and PSE campuses in the region. The Phase I samples of hospitals and PSE institution campuses were drawn from these lists.

Information concerning the construction of the two special sampling frames and the characteristics of the region's PSE institutions and hospitals is presented in Sections 2.3.6 -2.3.7. The identification of the region's PSE institutions and hospitals and the collection of information about them was accomplished using published sources, and through direct contact with state government agencies and the institutions themselves. A variety of information was collected, including number of buildings for PSE institutions and number of licensed beds for hospitals. Buildings and licensed beds were used as the measures of size for PSE institution campuses and hospital facilities, respectively.

**Features of the PSE Institutions Sample Design**

The sample design for the PSE institutions sample is very similar to the ZIP area sample design. It includes certainty selection of very large PSE campuses, use of PPS selection methods, and implicit stratification by type of utility. As was the case for the ZIP area sample, the primary determinant of the size of the PSE sample was the precision requirements of the Phase II sample. The PSE sample size was 23 campuses, including three certainty selections.

The three largest PSE campuses were included in the sample with certainty in order to improve the efficiency of the sample, and to insure that very large and unique campuses would be included in the sample. Like ZIP areas, PSE campuses have a highly skewed distribution of buildings. A few of the large campuses account for most of the region's PSE buildings, while the majority of campuses contain relatively few buildings. The manner in which buildings are distributed across campuses led to the use of PPS techniques for the selection of the PSE sample. The number of buildings was used as the measure of campus size. Implicit stratification by public and private utility type was employed to insure that a representative sample of the PSE institution buildings served by public and private utilities would be selected.
Features of the Hospital Sample Design

The sample design for the hospital facilities sample is very similar to the one developed for PSE institutions. The primary differences are that hospitals were not segmented and the measure of size used for hospitals was the number of licensed beds. Since the distribution of licensed beds among hospitals is highly skewed, PPS selection methods were used to select the hospital sample. The size of the hospital sample was determined primarily by the precision requirements of the Phase II sample. The hospital sample size was 40; none were selected with certainty. Before the hospital sample was selected, it was stratified by type of utility.

2.4.3 Selection of the Phase I Sample

Using the sample design described in the preceding sections, the Phase I sample was selected. This involved selecting three separate samples: a sample of ZIP areas, a sample of PSE institution campuses, and a sample of hospital facilities. It should be noted that, unless they were also selected in the PSE and hospital samples, all PSE institution and hospital buildings located in sampled ZIP areas were excluded from the Phase I building list. Only PSE and hospital buildings selected in the special frame samples were included in the list of Phase I buildings.

The selection of the ZIP area, PSE institution and hospital samples are described below.

Selection of the ZIP Area Sample

The first step in the selection of the ZIP area sample was to remove from the sampling frame the seven ZIP areas that had been selected with certainty. Next, a listing of the remaining 1408 ZIP areas was created, with the ZIP areas sorted into public and private utility groupings. All public utility ZIP areas were listed first, followed by all private utility ZIP areas. Within each utility grouping, ZIP areas were ordered randomly. Each ZIP area was then assigned a weight equivalent to the number of commercial establishments (as obtained from the 1982 County Business Patterns data, see Section 2.3.3) it contained. A cumulative measure of size was developed for each ZIP area in the list by computing a cumulative sum of the weights of the ZIP areas, starting at the top of the list and moving to the bottom (i.e. the measure of size was equal to the number of establishments in the ZIP, according to the 1982 County Business Patterns data).

The sampling interval used was 2218, which is the number of buildings in the 1408 non-certainty ZIP areas (146,396) divided by the number of non-certainty ZIP areas which were to be selected (66). The magnitude of the sampling interval was greater than the number of buildings in the largest ZIP area, which insured that none of the non-certainty ZIP areas were implicitly selected with certainty. A starting value less than or equal to the sampling interval was
selected randomly. Beginning at that starting value, the sampling interval was used to develop a series of figures to use in selecting the sample. The first figure was the starting value, the second was the starting value plus the sampling interval, the third was the starting value plus two sampling intervals, and so forth. The 66 figures that were developed in this manner were used to identify the ZIP areas that were to be selected. Each ZIP area which had a cumulative sum of weights that corresponded to one of the 66 figures was included in the sample. This procedure produced a sample of 66 ZIP non-certainty ZIP areas. With the seven certainty ZIP areas, the total sample size was 73. The locations of the sampled ZIP areas are shown on a map of the Pacific Northwest on page 1-4 of the *Handbook for First Stage Data Collection*.

**Selection of the Post Secondary Education Institutions Sample**

The procedure used to select a sample of PSE institution campuses was similar to the procedure used to select ZIP areas. The three largest campuses were included with certainty, just as the seven CBD ZIP areas were included with certainty in the ZIP area sample. The remaining campuses were sorted into public and private utility groupings, according to which type of utility supplied the campus with electricity. The sample was then drawn using PPS procedures, with the number of buildings located on each campus used as the measure of size governing the selection probabilities. Including the three certainty selections, 23 of the 215 campuses were selected in the sample.

**Selection of the Hospital Sample**

The procedure used to select a Phase I sample of hospitals was similar to the procedure used to select post-secondary education campuses, except there were no certainty selections. The hospitals were sorted into public and private utility groupings, according to the type of utility supplying the hospital with electricity. The sample was drawn using PPS procedures, with the probability of selection proportional to the number of licensed beds in each facility. 40 of region's 305 hospitals were selected in the Phase I sample.
3

Survey Implementation

3.1 INTRODUCTION

The sample design for Phase I of PNNonRES, up to and including selection of the Phase I sample, was described in Section 2.4. This chapter describes how that sample design was implemented, i.e. how the sample was handled once it had been selected. It is organized as follows:

- Section 3.2 describes adjustments to the original sample design that were necessary to address constraints and situations encountered in the field.
- Section 3.3 describes the methods used to enumerate the buildings in the Phase I sample, i.e. to collect data about these buildings.
- Section 3.4 provides a summary of the implementation of the Phase I survey, through a series of summary tables.

3.2 ADJUSTMENTS TO THE PHASE I SAMPLE DESIGN

For the most part, the Phase I sample design described in Section 2.4 was implemented in the field as designed. However, certain adjustments were necessary to account for conditions encountered in the field. These adjustments affected the size of ZIP segments and the selection of segments within a ZIP, and are discussed below.
3.2.1 ZIP Area Segmentation

Because it was not feasible to enumerate all commercial buildings in each of the selected ZIP code areas, the sample design called for ZIP areas to be segmented, with one segment chosen at random from each ZIP area to be enumerated. The segmentation was based on a drive by "quick-count" of non-residential buildings in each ZIP area; auditors systematically drove around every block in a ZIP area, and counted all non-residential buildings (including commercial, manufacturing, mining and farming buildings) larger than about 100 square feet in the ZIP area. The seven certainty ZIP areas and eight small non-certainty ZIP areas were not segmented.

According to the original sample design, each ZIP area was to be divided into segments containing 150 buildings. One segment in each ZIP area would then be chosen at random to be enumerated. However, cost constraints associated with data collection necessitated that the segment size be reduced to 75 buildings for many of the ZIP areas in the sample. As a result, actual ZIP segment size varied from 75 to 150 buildings.

3.2.2 Enumeration of Additional Segments

As mentioned above and in Section 2.4, the sample design called for one segment from each segmented ZIP area to be chosen for enumeration. The certainty ZIP areas and the smallest ZIP areas were not segmented; in these cases, the ZIP area consisted of a single segment, and the entire ZIP area was enumerated.

However, examination of the ZIP area quick-counts and segmentation revealed a problem, particularly in rural areas. In roughly one third of the ZIP areas, the building quick-count (an actual measure of ZIP area size) was 200 to 800% higher than the estimated number of establishments, the measure of size originally used in selecting the Phase I sample (see Section 2.4.3). This discrepancy seemed particularly acute in rural areas, where the original quick-count had included agricultural buildings (in comparison, the estimated number of establishments did not). As a result, the case weights for these areas appeared to be unduly high (see Chapter 2 of PNNonRES Weights: Methodology and Issues for a discussion of Phase I weight calculations).

Two steps were taken to address this problem:

1. Recount buildings in 22 ZIP areas, counting commercial and agricultural buildings separately. The new commercial building count was substituted for the original quick-count in the calculation of weights, removing the impact of agricultural buildings.

2. In six ZIP areas encompassing large geographical areas, an additional segment was chosen and enumerated in order to better characterize the ZIP area. Thus, in these ZIP areas, a total of two segments were enumerated.
The manner in which these adjustments were incorporated into the calculation of case weights is described in Section 2.1.4 of *PNNonRES Weights: Methodology and Issues*.

### 3.3 ENUMERATION AND DATA COLLECTION

In order to meet the principal objective of Phase I, the creation of a list of commercial buildings, it was necessary to enumerate the buildings located in the sampled ZIP areas, campuses and hospital facilities. All non-residential buildings in the selected ZIP segments, hospitals and PSE campuses were enumerated. The method of obtaining building information varied with the frame. The following sections briefly describe the enumeration and data collection activities undertaken for each of the three components of the Phase I sample. For more information on the enumeration of the sampled ZIP areas, refer to the *Handbook for First Stage Data Collection*.

#### 3.3.1 ZIP Area Sample

With the exception of buildings used for agricultural or mining purposes, all non-residential buildings located in the selected segments of sampled ZIP areas were enumerated. In addition, all buildings (except for agricultural or mining buildings) were enumerated in certainty ZIP areas and in the ZIP areas that were too small to segment.

Trained enumerators were sent into the sampled areas to collect information through the direct inspection of all non-residential buildings located in those areas. Since the enumerators were instructed not to enter the non-public areas of any building, these inspections were dubbed "walk-by surveys". The methodology used in this process, and the data collected, are discussed in detail in the *Handbook for First Stage Data Collection*.

The information collected included:

- building address
- building size (exterior dimensions and number of stories)
- building age (constructed before or after 1980)
- type of use (storage, office, etc.)
- type of development (free standing, part of mall, etc.)
- number of tenants
- type of business (office, grocery, etc.) of each tenant
- occupancy status of each tenant (occupied, vacant)

Subsequent data-processing algorithms used this data to calculate building floor area and primary building type (based on the business activities of the tenants). These algorithms are described in Section 4.4.
3.3.2 Post-Secondary Education (PSE) and Hospital Samples

The sampled PSE campuses and hospitals were enumerated through a survey mailed to each selected campus and hospital. The information collected included floor area and functional use for each building associated with the PSE campus or hospital being surveyed.

3.4 SUMMARY OF PHASE I IMPLEMENTATION

This section provides a brief summary of the implementation of the Phase I sample design.

Table 3.1 provides an overview of the three samples comprising the full Phase I sample. For each sampling frame, the table shows the total regional population, the number of units sampled, the method of Phase I data collection, and the number of buildings enumerated. It is important to note that not all of the buildings enumerated in the ZIP frame were actually commercial buildings -- some were subsequently classified as primarily manufacturing, residential or other non-commercial building type.

<table>
<thead>
<tr>
<th>Sampling Frame</th>
<th>ZIP Area</th>
<th>PSE</th>
<th>Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total in Region</td>
<td>1415 ZIPs</td>
<td>215 Campuses</td>
<td>305 Hospitals</td>
</tr>
<tr>
<td>Selected in Sample</td>
<td>73 ZIPs</td>
<td>23 Campuses</td>
<td>40 Hospitals</td>
</tr>
<tr>
<td>Type of Enumeration</td>
<td>In Field</td>
<td>Mail Survey</td>
<td>Mail Survey</td>
</tr>
<tr>
<td>Total Buildings</td>
<td>13,174</td>
<td>1,783</td>
<td>293</td>
</tr>
</tbody>
</table>

The samples selected from each of the three sampling frames are discussed below.

3.4.1 ZIP Area Sample

A total of 73 ZIP codes were selected in Phase I. Seven of these ZIP areas were selected with certainty. The 58 largest non-certainty ZIP area were divided into segments, with each segment containing 75 to 150 buildings. One or two segments were selected from each of these ZIP area for enumeration. All non-
residential buildings (except agricultural and mining) were enumerated in the selected segments. Non-segmented ZIP areas were enumerated in their entirety. Buildings were enumerated through direct inspection. A total of 13174 buildings were enumerated.

Table 3.2 lists the sampled ZIP areas. It then shows each ZIP area’s location, whether or not the ZIP area was a certainty selection, the number of segments selected for enumeration, and the total number of enumerated buildings in the ZIP area.

TABLE 3.2
Summary of ZIP Sample

<table>
<thead>
<tr>
<th>ZIP</th>
<th>COUNTY</th>
<th>STATE</th>
<th>CERTAINTY?</th>
<th>ENUMERATED SEGMENTS</th>
<th>ENUMERATED BUILDINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>59601</td>
<td>LEWIS AND CLARK</td>
<td>MT</td>
<td>NO</td>
<td>1</td>
<td>69</td>
</tr>
<tr>
<td>59801</td>
<td>MISSOULA</td>
<td>MT</td>
<td>NO</td>
<td>1</td>
<td>107</td>
</tr>
<tr>
<td>59917</td>
<td>LINCOLN</td>
<td>MT</td>
<td>NO</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>59937</td>
<td>FLATHEAD</td>
<td>MT</td>
<td>NO</td>
<td>1</td>
<td>58</td>
</tr>
<tr>
<td>83110</td>
<td>LINCOLN</td>
<td>MT</td>
<td>NO</td>
<td>1</td>
<td>159</td>
</tr>
<tr>
<td>83301</td>
<td>TWIN FALLS</td>
<td>ID</td>
<td>NO</td>
<td>1</td>
<td>68</td>
</tr>
<tr>
<td>83467</td>
<td>LEMHI</td>
<td>ID</td>
<td>NO</td>
<td>1</td>
<td>575</td>
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</table>

PNonRES-I Documentation
NOTES:
ZIP Areas with N/A in the Enumerated Segments column were enumerated in their entirety.
No commercial buildings were found in the selected segment of ZIP 99344.

3.4.2 Hospital Sample

A total of 40 hospitals were selected in Phase I. None were selected with certainty. All buildings at each selected hospital were enumerated through a survey mailed to the hospital. In all, a total of 293 buildings were enumerated.

Table 3.3 lists the sampled hospitals. It then shows each hospital's location, whether or not the hospital was a certainty selection, and the total number of enumerated buildings at the hospital.
### TABLE 3.3
Summary of Hospital Sample

<table>
<thead>
<tr>
<th>HOSPITAL</th>
<th>ZIP</th>
<th>STATE</th>
<th>CERTAINTY?</th>
<th># OF BLDGS</th>
</tr>
</thead>
<tbody>
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<td>CARE UNIT PHYS. SURGEONS HOSP.</td>
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#### 3.4.3 Post-Secondary Education (PSE) Sample

A total of 23 PSE campuses were selected in Phase I. Three of these were selected with certainty. All buildings at each selected campus were enumerated through a survey mailed to the campus. In all, a total of 1783 buildings were enumerated.
Table 3.4 lists the sampled campuses. It then shows each campus's location, whether or not the campus was a certainty selection, and the total number of enumerated buildings on the campus.

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<td>LEWIS &amp; CLARK</td>
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</table>
4

Data Processing and Preparation

4.1 INTRODUCTION

The Phase I analytic dataset was developed from the raw data through a number of data processing steps, the bulk of which were to bring the several datasets that resulted from the Phase I data collection together into a single dataset ready for analysis. Major building-level variables *building type* and *building size* were calculated from the raw data, and *case weights* were derived. Some data cleaning was also performed, as well as some logical consistency checks. This chapter summarizes the data processing steps that bring the raw data from its several sources to the final analytic version (Version 4.0) of the Phase I (PNNonRES-I) dataset.

The complete data dictionary for the Phase I dataset is presented in detail in Appendix A of the *Analyst's Guide to PNNonRES*; only the variables used to develop the final dataset are discussed in this chapter.

4.2 DESCRIPTION OF THE RAW DATA

The raw Phase I data included data from six separate sources:

- ZIP area sample
- Hospital sample
- Post-secondary education (PSE) sample
Data Processing and Preparation

- ZIP code level data file (ZIP area sampling frame)
- Population of hospitals (hospital sampling frame)
- Population of PSE's (PSE sampling frame)

(For an explanation of the three sampling frames, see Sections 2.3.3-2.3.6.) Each of these data sources is described below.

4.2.1 ZIP Area Sample

Information for enumerated buildings in the ZIP area sample was collected at the building level and the tenant level. (For more information on the nature of the raw data collected for buildings in the ZIP area sample, see the Handbook for First Stage Data Collection.) All tenants on the first floor were enumerated, with tenant name the primary identifier, and business type, occupancy code, and a measure of share of floor area the analytic variables. Only the business type and the occupancy code of the two largest tenants of floors above the first were collected. In addition, each building was composed of one or more physical segments, from which the site's floor area was to be calculated.

Both the segment information and the tenant data were of different levels and were stored in different datasets prior to aggregation and merging into the final product. The segment data was used to construct an estimate of each building's floor area (which became sqft, in the final dataset); the tenant data was principally used to determine the primary business type (building type) of each building (abt, in the final dataset).

4.2.2 Hospital and Post-Secondary Education (PSE) Samples

Data were collected for 1,783 PSE buildings and 293 hospital buildings, for a total of 2,076 buildings in these two special samples. The data for hospital and PSE buildings were collected through a mail survey (see Section 3.3.2). Relative to the data collected for the ZIP sample buildings, only a limited group of variables were collected (see Section 3.3.2). This is the source of the 2,076 "not applicable" values for several of the key variables in the dataset.

4.2.3 ZIP Code Data File

A ZIP code file, containing one record for each area ZIP code in the BPA service area, was created to facilitate the Phase I sampling process. This file included data such as number of commercial establishments and primary electric utility; it served as the sampling frame for the ZIP area sample. During the enumeration process, sampled ZIP codes were "quick-counted" (see Section 2.4.2), and the resulting building quick counts and ZIP segmentation results were entered into the ZIP code data file.

The ZIP code level file was the source of the data necessary to calculate the Phase I case weights (see Chapter 2 of PNNonRES Weights: Methodology and Issues).
4.2.4 Hospital and PSE Population Files

Corresponding to the ZIP code data file, which contained an enumeration of the population from which the case weights for the buildings in the ZIP area sample were calculated, were two files, one for each of the hospital and PSE samples, which contained respectively all the hospitals and PSE's in the BPA service area. These are the populations (sampling frames) from which the samples were drawn, and through which the cases weights for the auxiliary samples were derived.

4.3 DATA PREPARATION AND CLEANING

All data processing tasks were performed in SAS (the Statistical Analysis System).

An initial version (1.0) of the Phase I analytic dataset was created by BR Associates. Hard copies of all the SAS jobs used to create this initial version can be found in Appendix A of Technical Documentation of PNNonRES First and Second Stage Sample Selection. Subsequent versions (2.0, 3.2) of the analytic dataset were created by ADM Associates, and by BPA staff. With two notable exception (calculation of the building type and calculation of case weights), the algorithms used to create the final version of the Phase I analytic dataset (Version 4.0) are the same as those listed in the above-mentioned document.

Each of the datasets was checked for logical consistency and corrected where necessary as part of the reading of the raw data. Two variables, bldgage and bldgren, were extensively revised by phone survey after the initial data collection phase, and thus for these two variables there are two versions each, one containing the values of these variables as initially surveyed, and another containing the revised and corrected versions. The old versions were renamed for Version 4.0 of the dataset, to v20age and v20ren respectively.

All versions of the dataset prior to Version 4.0 used an early version of Phase I case weights. This early version has been retained in the Version 4.0 dataset in the variable v20wgt. The weight in Version 4.0 that should be used for analysis is stglwght.

Two variables, bldgage and bldgren, were extensively revised by phone survey after the initial data collection phase and thus were not in their current form at the time the Phase II sample was drawn; bldgage was used along with building type to define the domains within which the Phase II samples were drawn. The original values of these variables have been retained in Version 4.0 of the dataset as v20age and v20ren.

Besides the construction of new analytic variables (described in detail in Section 4.4 below), the bulk of the data processing involved bringing together the several datasets of the study into a single final building-level file. The ZIP code file was merged with all three of the sample files to transfer any ZIP code level data to the buildings contained in each ZIP code area. Each of the three population
Data processing and preparation

Files were merged with its corresponding sample file to obtain the probability of selection of each of the three sampling units. Finally all three sample files were merged together to produce a single file containing all of the Phase I sampled buildings in the region.

4.3.1 Treatment of Missing Values

A variety of codes were used in the raw data to indicate missing values in the Phase I dataset. Values of "-7" (for numeric data) and "N/A" (for string data) indicated data that was missing because the cases came from the hospital and PSE samples; accordingly no data was collected for these variables. The values "-99" and "UNK" generally were used for more truly missing data: for example, the variable abt ("assigned business type"), contains both "-99", for sites not classifiable by the assignment algorithm (see below), and "UNK", for sites vacant at the time of the enumeration. Generally for Version 4.0 all missing values were converted to the SAS internal missing value so that they would not be erroneously aggregated in statistical procedures, and to, more simply, store the missing value designation in the dataset in addition to just in the documentation. This means that variant missing values of a variable cannot be directly distinguished in the data from one another. But by and large the bulk of these are due to the alternate samples, and the original missing values can be recovered by using the abt variable, for example:

```
if(bldgage = .)then do;
  if(abt eq "HOS" or abt eq "UNI") then
    bldgage = -99;
  if(abt ne "HOS" and abt ne "UNI") then
    bldgage = 'UNK';
end;
```

For some cases in which a value is truly missing but which also affords some analytic promise, the value has not been recoded to missing. An example of this is the "UNK" value found in variable abt. The dangers of accidentally aggregating missing values into some descriptive or analytic statistic is much less for string variables, so missing values of numeric variables have all been recoded, and string variables are handled a little more flexibly.

4.4 DATA PROCESSING ALGORITHMS

This section describes the algorithms used to create the building size and building type variables from the raw data.

Building size: The calculation of building size (the sqft variable in the Phase I dataset) was accomplished using the following procedure.

The "footprint" of each building in the enumeration had been divided up, as necessary, into as many as six "segments", each segment classifiable as either a rectangle, a triangle, or a circle. There are three sites for which no segments at
all were collected, and these sites therefore have no estimate or calculation for the sqft variable.

The surveyors were asked to estimate the size of each segment of a building by using one of two methods. The first, and preferred, method was to pace off the dimensions of the segment and record these as the segments' widths and lengths in paces. The average length of the surveyor's stride was calibrated at least once by the surveyors' supervisor, and this value was stored with the building-level data to be used later.

When the surveyor could not get close enough to the building to accurately pace it off, he/she was asked to estimate the dimensions of the segments in feet.

The variable sqft was calculated from this raw data in the following manner:

1. For each segment, if the segment was circular and the width and the length were both present and differed by more than twenty percent, then the length and width were regarded as being "wildly" different and the segment was reclassified as a rectangle.

2. Next the area was calculated for each segment by multiplying the length by the width and multiplying the result by the height of the building (in stories). The areas of circular segments were calculated using the segment length as the diameter of the circle, and multiplying the resulting area by the number of stories. Likewise, triangular segments were calculated as half the product of the length and width variables. If the segment had been paced, then the area was calculated in square paces; if it had been estimated, then the area was calculated in square feet. A single variable was created which contained either the paced area or the estimated area, whichever was present. A logical variable was also kept to indicate the data source (paced or estimated) for the next step of the processing.

3. All of the segments of a building were measured in the same way, that is, if the first segment was paced, then all of them were paced, otherwise all of them were estimated. Thus the next step in the processing was simply to add up the values of the segments within a building to create a single total area variable for the building. Finally, this total area figure was converted, if necessary, from paces to square feet, using the paces-to-feet conversion factor associated with the surveyor.

The program SEGSUM.sas, listed in the Appendix A of the Technical Documentation of PNNonRES First and Second Stage Sample Selection (TD: pp. A16-18), performed the bulk of this task, that is, the calculation of the variable totarea, containing either square feet or square paces, according to whether or not the dimensions were estimated or paced. Program PIECEBS.sas (TD: pp. A19-22) performs the paces-to-square-feet conversion as one of its functions.
Primary Business Type on the First Floor: This important intermediate variable in the business type algorithm, prilbt, was created from the tenant-level information. In most cases -- in over 90 percent of sites -- one tenant occupied more than half of the first floor; in this case, the primary business type on the first floor was set to the business code of that predominant tenant. In the remaining cases, a probability of selection is calculated for each of the business types present, with the probability proportional to the total floor share of that business type. Business types occupying more than half of the first floor were assigned outright to the prilbt variable; when no predominant business type appeared, one was selected at random from the business types on the floor, with a probability proportional to floor share. Program PIECETEN.sas (TD: pp. A22-26) creates the prilbt variable.

Assigned Business Type: The business type variable abt was constructed using the following logic:

1. If the site had no tenants (i.e., was vacant) then abt was set to the "UNK" value. This is also the case for three sites for which the number of tenants was zero but the occupancy code indicated that the building was occupied. This was a logical inconsistency that prevented any sensible estimate of the business type of the site.

2. If the site had one tenant then abt was set to the value of the business type of the primary tenant. If the site had more than one tenant, and the business type for all tenants agreed, then abt was set to this value.

3. If there were more than one tenant and the business types did not agree, then the following algorithm was used:
   a. If there was one story and one tenant occupied more than half of the floor area of that story, then abt was set to the business type of that tenant, i.e., it was set equal to the variable prilbt.
   b. If there were two stories and the business type of the largest tenant on the second floor was the same as the business type of largest tenant on the first floor then abt was set to that business type.
   c. If there were more than two stories, abt was set to the business type of the largest tenant of the upper floors.

4. If the above algorithm failed to assign the business type, then the tenant records were compared with the building file, and if the name of the largest tenant in the building matched one of the tenant records, then the building business was set to the business code of the largest tenant.

5. Two hundred fifty-eight buildings could not be typed at all with this algorithm and were categorized "by hand". Thirteen additional cases
(making a total of 271) were added to this "problem list" and manually assigned because the data used to determine business type were identified as anomalous by the logical consistency checks performed on the data. The bulk of this manual technique used the method of step five, matching the name of the largest tenant with a tenant record and using the business code of that tenant, except that a different "matching rule" was used, that is, a visual inspection that allowed variations in spelling and spacing.

6. Buildings for which there was insufficient data for business typing were classified as "-99" (there were, coincidentally, 271 cases of these also).

4.5 CASE WEIGHTING

The methodology and algorithms used to develop the Phase I case weights are described in detail in Chapter 2 of *PNNonRES Weights: Methodologies and Issues*.

The weights in the PNNonRES Phase I analytic dataset, contained in variable `stg1wght`, are used to estimate the regional population totals from the enumerated sample. SAS routines to generate weighted regional estimates of characteristics from the Phase I data involve simply indicating the name of the weighting variable in the appropriate SAS statistical procedure. For example, the sample SAS job of Figure 4.1 will reproduce an analogous display (in a somewhat different layout) to Table 2 of the *Phase One Descriptive Data Analysis Report* (DDAR: p. 9 -- Note that this table was prepared using the early version of the case weights, now contained in variable `v20wght`). Most other statistical packages also contain some sort of "built-in" weighting facility.

**FIGURE 4.1**

Sample SAS Code to Produce Weighted Tables

```sas
proc freq data=data.phase1;
  title 'Weighted Frequencies of Phase I Data (Version 4.0)';
  weight stg1wght;
  tables
    abt
    sqft  sqft*abt
    utilcd1 utilcd1*abt
    stories stories*abt
    numoften numoften*abt
    bldguse bldguse*abt
    bldgtype bldgtype*abt
    bldgage bldgage*abt
  /norow nocol nopercent missing;
  format abt $buscode.;
  format sqft sqft.;
  format utilcd1 utilcd.;
  format stories stories.;
```

*PNNonRes-1 Documentation*
If no "built-in" weighting facility is available, or if the use of some lower-level language is required, the effect of weighting can be reproduced as follows:

- for "frequency tables", simply accumulate the weight of each case instead of just incrementing by one for each (this is the weighted n);

- for means and related statistics of analytic variables, multiply the value of each case by that case's weight, sum the weighted values, then divide the total by the sum of the weights (the weighted n).

For example, the weighted mean of a variable $X$ would be:

$$X_{\text{mean}} = \frac{\sum (X_i \cdot W_i)}{\sum W_i}$$

where $X_i$ is the value of the variable $X$ for building $i$ and $W_i$ is the value of the variable $X$ for building $i$. 
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Introduction

This Handbook provides guidelines and instructions for all of the staff which will be carrying out the first stage of the Bonneville Power Administration's (BPA) Non-Residential Buildings Survey. The Handbook describes in detail the methods you and the other members of the survey staff are expected to use to "enumerate" or "list" non-residential buildings found in areas sampled for this survey. You should read this Handbook thoroughly and refer to it often.

The first stage of this survey will require a methodical approach and concern for detail. A sound foundation can be established for the later stages of this survey if you and the other members of the staff carefully apply the procedures described in this Handbook. The validity of the survey results rests largely on the survey staff's ability to maintain accuracy and consistency when applying all of the required procedures.

In the course of conducting this survey you and the other members of the field staff will be examining and photographing 14,000 non-residential buildings. You can expect to encounter a great diversity of circumstances and challenging measurement problems. You will be working in a variety of areas ranging from the highest density Central Business Districts of large cities to sparsely populated rural regions. The buildings you enumerate may be "Mom & Pop" grocery stores or high rise office buildings.

The purpose of this Handbook is to provide you with the tools you will need to successfully complete the first stage data collection. Included for each phase of the work are step-by-step instructions along with a discussion of how to deal with the many special circumstances which may cause problems in the field.

Before learning how to carry out the required field work you may find it useful to learn about the overall design of the survey and why it is being conducted.
1.1 DESIGN OF THE BPA NON-RESIDENTIAL BUILDINGS SURVEY

In the latter part of 1984, BPA undertook the design of a non-residential buildings survey. Although there had been previous efforts to study non-residential buildings, none had ever attempted to cover the entire BPA service area, which includes all or part of eight states in the Pacific Northwest.

The design work lead to a plan for a two-stage survey effort. According to this plan the first stage of the survey would involve the collection of some simple, but highly valuable, information for a large number of non-residential buildings. The buildings included in the first stage of the research would be located in representative areas scattered throughout the BPA service territory.

In the second stage of the effort a much smaller number of buildings will be examined in greater detail. These buildings will be carefully selected from the list of buildings developed in the first stage. One of the most important features of the design is that information collected in the first stage will make it possible to draw a very efficient sample, and thus a relatively small sample, for the second stage of the survey.

One unique difficulty overcome by the design of the survey was the lack of any comprehensive list of non-residential buildings located in the BPA service area. Usually when an electric utility wishes to study commercial or other non-residential customers, the utility's customer list provides the "sampling frame". However, BPA is a wholesaler of electric power and as such does not have access to any customer lists.

In the early part of the design effort it became clear that creating a list of non-residential buildings would be a major undertaking. BPA serves a large and diverse region of the country. The land area involved exceeds 250,000 square miles, and includes areas ranging from large tracts of wilderness to dense urban development. Included in this service area are the entire states of Washington, Oregon and Idaho along with portions of Montana, Wyoming, Utah, Nevada and California. More than 150,000 businesses are operating in non-residential buildings scattered throughout this area.

It was considered impossible to list every non-residential building in the service area. Instead a method was devised for sampling areas where businesses were known to be located. Relying on information provided by the U.S. Bureau of the Census, 73 U.S. Postal Service ZIP code areas (ZIP areas) were selected to represent the entire region. ZIP areas were selected in a fashion which favored those containing large numbers of businesses.

While working with the Census data, the design team discovered that Colleges and Universities were poorly represented in the 73 sampled ZIP areas. These institutions maintain a large number of buildings and are important consumers of energy. In order to insure that they are adequately represented by the study, a special list of campuses was prepared, and a sample of campuses was selected from this list. This sample of campuses has been included in the survey.

Figure 1.1 shows the location of the ZIP areas sampled for this survey. Note that most of these ZIP areas are found in the most densely populated areas in
the region, in and around the cities of Seattle and Tacoma, Washington and Portland, Oregon.

You or another member of the survey field staff will visit each of these ZIP areas and prepare a list of its non-residential buildings. The ZIP area building lists will be used to represent all non-residential buildings in the BPA service area. These building lists will provide the sampling frame for the second stage of the survey.
1.2 SURVEY OBJECTIVES

BPA's basic goal in conducting this research is to improve its understanding of how businesses consume energy. BPA wishes to use the data collected in this survey to develop better ways to predict how much electricity will be consumed by various types of non-residential buildings. It is also interested in using the survey to identify ways that businesses can become more efficient in their use of electricity. In order to accomplish these goals, accurate and consistent information must be collected from a representative sample of non-residential buildings.

The first stage data collection procedures described in this Handbook lay the groundwork for accomplishing BPA's goals. The first stage of the survey will provide a list of buildings and sufficient information on the listed buildings so that an efficient sample can be selected in the second stage.

To be a success the first stage effort must achieve the following four objectives:

1. Complete listing of all non-residential buildings in the sampled areas.
2. Accurate classification of the types of businesses present in each of the listed buildings.
3. Accurate classification of the use type for each listed building.
4. Reliable estimation of floor area for each of the listed buildings.

The first objective must be accomplished through careful application of the procedures for identifying the boundaries of each ZIP area, and defining the smaller areas (segments) which will be the focus of the attention for certain "big" ZIP areas. It will also require systematic and methodical efforts by the field staff to locate every non-residential building within the defined areas.

Each of the sampled ZIP areas plays a vital role in representing the BPA service area. The areas have been carefully selected so that only a relatively small number of them are required. Only 73 ZIP areas were selected from the 1415 which make up the entire service area.

To accomplish the second objective you will have to properly identify the types of businesses present in each listed building. Information on the types of businesses present in any particular building provides a major clue as to the likely uses of energy within the building. For example, one group of businesses of concern to BPA are those involved in retail sale of dry goods (dry goods retail). Included in the dry goods retail group are shoe repair shops, pharmacies and department stores, along with a variety of other businesses. Although each business provides very different services or goods
they all use energy in approximately the same manner. (These collections of similar businesses will be referred to throughout this Handbook as business types.)

There is another equally important way to classify the buildings listed in the first stage of the survey. The third objective deals with this alternative method, which is to classify an entire building (not just a single tenant or group of tenants) according to its principal type of use. There are four categories of use which will be used to classify buildings in the first stage: storage, office, manufacturing and other. Determining the type of use can be difficult, particularly for buildings which contain auxiliary business functions. A good example would be a storage building used by a major restaurant. The business type of this building is restaurant, but the type of use is storage.

One of the major challenges of this first stage of data collection is to avoid any confusion between these two methods of classification. Care must be exercised to not confuse use types of the building with business types of the tenants. Detailed guidelines for using both of these classifications methods are presented in Chapter 5.

When preparing the list of buildings for each sampled ZIP area, careful inspection (without venturing onto the premises of any business establishment) will be required in order to properly classify each building. BPA will be able to select a reliable sample for the second stage of the survey only if each of the listed buildings is correctly classified.

The fourth objective is to record reliable estimates of floor area for each of the enumerated buildings. BPA does not expect that these floor area estimates will be exact. Nevertheless, you will have to make the best observations which are possible without going into the building to take measurements. Although these estimates will be approximate they must be carried out in a consistent fashion.

Information on building size that is developed during the first stage can be used to greatly reduce the size of the sample required for the second stage of this survey. In fact, the survey will only be economically feasible if you and the other members of the field staff can produce reliable information on building floor area in the first stage of data collection.
1.3 OVERVIEW OF THIS HANDBOOK

This Handbook can be viewed as a road map. It describes how the various members of the survey staff are to proceed from the very earliest steps in preparing for field work, through completing the transfer of data to the survey data base.

Chapter 2 provides a quick summary for all of these steps. Without getting stuck in the details, it will give you an overview of all of the things which must be accomplished. In reading this chapter and the later chapters be aware that certain steps may be accomplished by people other than members of the field staff. For example, the selection of segments in large ZIP areas, which is described in Chapter 4, will be carried out by staff members responsible for survey management and quality control. All steps in the process have been included so that this Handbook is complete and can serve as a basis for training all staff associated with this research.

Chapters 3 through 6 cover the first stage survey tasks in the order in which they are to be performed. These chapters provide detailed instructions and graphic illustrations of the procedures which you will follow.

Considerable field testing of these procedures has been carried out. The field test experience indicates that the procedures work in most, if not all, cases. However, in this type of research it is always possible to encounter extraordinary circumstances. If you encounter a situation not covered by the Handbook, you must be prepared to contact your supervisor and ask questions. Guessing at the appropriate response is never a good idea. Such guesses ultimately make the data hard to interpret. Further, if you do not share your experience, none of the other field staff will know how to respond if they encounter a similar situation.
Overview of Stage One Procedures

This Handbook is organized according to the sequence of tasks which you and the other members of the survey staff will be expected to carry out in completing the first stage data collection. All of the necessary tasks can be placed in four major groups:

1. Preparing maps.
2. Dividing "big" ZIP areas into segments.
3. Collecting information for individual buildings.
4. Entering and transmitting data.

The survey staff will carry out all four of these tasks for all sampled ZIP areas which are expected to contain more than 300 buildings (Except for a special group of seven ZIP areas that are located in the Central Business Districts of Seattle, Tacoma, Portland and Spokane, which will not be divided into smaller segments). ZIP areas containing more than 300 buildings are considered "big" ZIP areas (big in terms of number of buildings - not land area). Forty-nine of the 73 ZIP areas which were selected for this survey are big ZIP areas.

Only the first, third and fourth major tasks apply to the remaining 24 sampled ZIP areas (the areas which are not "big" ZIP areas).

Chapters 3 through 6 provide a detailed explanation of how you are to complete each step of the work in the stage one of this survey. The topics covered by each of these chapters are summarized below.
Chapter 3 Preparing for Field Work

Certain tasks must be completed in the office before the field staff can be sent out to the areas which are to be inspected in this survey. If this preparation in the office is performed well, it can set the stage for efficient and smooth work in the field. Most of this effort will be spent working with detailed maps of each ZIP. Some of the time will be spent working with other sources of information, such as college and university catalogues.

Maps are the key to success in the first stage of the survey. They will be used to provide a detailed picture of the geographic boundaries and contents of the sampled areas. Chapter 3 describes how members of the survey staff can acquire the best available maps for each ZIP area and prepare the maps for use in the field. Instructions are given for each step in the map preparation process, which includes how to: work with the U.S. Postal Service to determine the exact boundaries of a ZIP area; define and number blocks and block-groups; and mark the outline of certain special areas in each ZIP that either will be excluded from the first stage of the survey or be given special treatment.

Chapter 4 Sampling a Segment in "Big" ZIP Areas

ZIP areas vary considerably in their geographical size and in the number of non-residential buildings which they contain. A large portion of the ZIP areas which have been sampled for this study contain more buildings than can be economically listed. The objective of the work described in Chapter 4 is to divide these "big" ZIP areas into a number of smaller areas, which are referred to as segments. Each segment will contain approximately 150 buildings.

Chapter 4 describes each of the steps of the segmentation procedure. The first step is to make a "quick count" of the non-residential buildings located in each block of the "big" ZIP areas. Other steps include counting buildings present in each block, adding together blocks to form segments, and the random sampling of a segment in each "big" ZIP area. Included in this chapter are the definition of a building and a description of the types of buildings which fall under the category of non-residential buildings.

Chapter 5 Listing Buildings in Sampled Areas

Once the "big" ZIP areas have been segmented and a sample segment has been selected from each "big" ZIP, the survey team can proceed with the task of listing all non-residential buildings found in the sampled areas. The sampled areas include the sampled segments of the "big" ZIP areas, and the entire area of the remaining sampled ZIP areas. Approximately 13,000 buildings will be listed. In addition, information will be collected on the size of each building and the types of businesses which occupy each building. When all of the listings are complete, they will be assembled into a sampling frame which will be used in the selection of the second stage sample of buildings.
Chapter 5 provides a description of the methods to be used in examining each block in the sampled areas and preparing the listing data. Included in this chapter are rules for defining sites and buildings. Also included is an item by item description of the Enumeration Form (Appendix A) and how to complete this form under a variety of circumstances.

Chapter 6 Data Entry and Transmission

The data recorded on the Enumeration Forms during the listing process has to be converted to electronic form and transferred to the survey administration offices. If this can be accomplished on a daily basis, then the data can be reviewed quickly by the survey administrative staff. Quick turn-around on the conversion of the data to electronic form will allow for better quality control.

Chapter 6 describes how to use a transportable micro-computer and data entry software to accomplish this task. Instructions are provided for how to operate each of the computer programs which make up this system: SIP (Survey Input Program), DATESTMP (Electronic Date Stamping) and MINITEL (communications program). Each of the screen displays which you will use are illustrated, and you are asked to practice on the machine as you review each of the steps involved in operating the program.

Appendices A and B

This Handbook contains two appendices to which you will frequently need to refer. Appendix A contains a copy of the Building Enumeration Form. This is the form you will be filling out for each building present in the sampled ZIP areas or sampled segments in "big" ZIP areas. Appendix B contains an extensive listing of all of the kinds of businesses you can expect to encounter in your field work. This list is organized by business type. By studying this listing you can learn which kinds of businesses should be assigned to each of the business type categories used in the building enumeration form.
3

Preparing for Field Work

This chapter describes how to obtain the best available maps, establish the boundaries of a ZIP area, and define both blocks and block-groups within a ZIP area. Before venturing into the field it will be necessary to establish these boundaries precisely on the best available road maps for the sampled areas. Precision is required because any ambiguity, such as whether or not both sides of a particular street belong in a specific ZIP, must be eliminated in order for the field work to proceed smoothly.

The tasks described in this chapter are to be carried out by members of the survey management and quality control staff. However, it is important that all members of the survey staff be familiar with how these tasks are accomplished. Everyone associated with the survey will have to work with the maps which are prepared according to the guidelines described in this chapter. In addition, the field staff must be able to identify problems with maps encountered in the field and to take corrective actions.

One general note of caution before proceeding. The quality of the information that is required for densely populated areas is very different than that which is necessary in rural regions. In part this is true because the U.S. Postal Service definition of a ZIP area becomes exceedingly vague in rural regions. It is also true because mistakes are more likely to cause major problems in dense areas, where many non-residential buildings are found, than on stretches of rural roads where such buildings may be miles apart.

3.1 GETTING THE BEST MAPS

It is very important to obtain the best available map of each ZIP area. The map shown in Figure 3.1 is a portion of a U.S. Postal Service map for a sampled ZIP area (98118). It is a good example of a map which provides adequate detail. It has two important features. The scale is sufficient to provide room to code information on each block, and the map is up-to-date.
If the Postal Service had prepared similar maps for all ZIP areas in the Pacific Northwest, finding the best maps would be fairly simple. Unfortunately, such maps are available for only about half of the sampled ZIP areas.

**FIGURE 3.1**

Full Scale ZIP Area Map, Section of
ZIP 98118, Seattle, WA

U.S. Postal Service maps are generally available for ZIP areas in large urban places, for example, Portland, Oregon. In these urban settings ZIP areas tend to be small in terms of land area but contain a large number of business establishments. As you move away from the center of the urban area, the land area of each ZIP increases. ZIP areas on the fringe of large cities will often encompass a mix of urban, suburban and rural regions. Moving out further, ZIP areas are found which cover large areas (often with ill defined boundaries) containing mostly rural lands with some small towns and villages.

For the ZIP areas which are not mapped by the Postal Service, other types of maps can be used if they provide sufficient detail. For rural areas, state Highway Department county maps have been found to be the most effective. However, these maps must be used in conjunction with street maps for major
towns and villages. Usually the chamber of commerce, visitors bureau or city
manager's office can supply the required detailed street maps for towns and
villages.

Although some of these maps provide adequate detail, they will need to be
enlarged in order to provide sufficient room for listing the block codes and
other information.

3.2 ESTABLISHING THE BOUNDARIES OF A ZIP AREA

Once the most detailed maps available have been obtained, work can begin on
the task of defining the exact boundaries of the sampled ZIP areas. The first
step is to call the post office serving each of these areas. The office manager
or another employee who is willing to provide assistance should be located.
The person you find to work with must be familiar with the mail delivery
routes which originate at that post office. Describe to the contact at the post
office the nature of this study and why it is necessary to develop precise
boundaries for the ZIP area.

For some ZIP areas, particularly those for which U.S. Postal Service maps are
available, it may be possible to determine precise boundaries based on the
information gained from a phone conversation with the post office staff. If
this appears to be the case, you should pursue this information in the initial
phone contact with the post office staff. Unfortunately many of the ZIP area
boundaries are too complex to accurately identify via a phone conversation,
and will require further efforts.

For the more complex ZIP areas, the next step is to send a copy of your ZIP
area maps to your post office contact. The maps should be accompanied by a
letter which again explains the nature of this study and provides details on
how to mark the boundaries for each map. The contact at each post office
should be asked to mark on the maps the outer extent of the ZIP area's mail
delivery routes. These boundaries need to be precise. For example, in urban
areas the mail routes will sometimes include both sides of a border street and
other times just one side. You should plan to make a follow-up call to your
contact to answer any questions concerning the map and to urge them to
complete the process and return the map.

You can expect some errors to occur in this process. The postal employees
have little incentive to take much time in marking the map and may not be
familiar with all mail delivery routes. The outer boundaries of each ZIP
should be checked against the most recent ZIP Code Directory (and the ZIP +
4 directory) published by the U.S. Postal Service. You can look up addresses
which are on or near the border of a ZIP area to determine if the ZIP area
boundaries marked on the map are correct. If you find errors, you should
recontact the post office and discuss the problems. Keep in mind that the ZIP
Code Directory can be out of date or contain incorrect ZIP codes for
particular addresses.

Once the boundaries for a ZIP area have been accurately identified, you
should mark these boundaries with an orange colored pencil on the ZIP area
map or maps.
3.3 DEFINING BLOCKS

After the ZIP area boundaries have been accurately mapped, each ZIP area needs to be sub-divided into many small regions before the field work can begin. The smallest region which you will define on the maps is a block. A block is a well defined concept in urban areas. It generally is a small piece of land surrounded on all sides by roadways. The small section of ZIP 98118 shown in Figure 3.2 contains very well defined blocks.

FIGURE 3.2
Well Defined Blocks in ZIP 98118

There are, however, many circumstance where blocks become difficult to define. In urban areas, open space, large industrial facilities, and natural features such as hills and lakes can all disturb the simple pattern of rectangular blocks with streets on four sides. An example of this type of area is shown in Figure 3.3, again for ZIP 98118. The dotted lines in the figure illustrate the block boundary marks which must be recorded on the map when roadways do not provide clear boundaries for each block. You can see that in some cases roads that do not physically connect have been connected to form a block (hollow arrows), and in other places dead-end spurs have been left inside a block (solid arrows).

The objective in defining blocks is to minimize block size, but to avoid splitting lots which may contain a building. It will be very difficult to count buildings in a block if the block boundary passes through a building. It will also be difficult to keep track of a block boundary if it contains many
internal road spurs. You have to trade-off these two concerns in defining block boundaries. One rule you can apply in general is that no block can be DIVIDED by any internal roadways.

When marking the map to clarify block boundaries you should use a blue colored pencil.

FIGURE 3.3
Defining Blocks in Poorly Defined Areas in ZIP 98118

In rural areas blocks become more difficult to define. This is especially true in areas which have a single roadway with no side streets. Figure 3.4 shows a blow-up of this type of region. You will have to impose arbitrary block
definition in this type of area. The best method is to define the section of roadway, including both sides of the roadway, between two intersections as a block. (Buildings located on the corners of these intersections can be assigned to blocks based on the "main door" rule which will be discussed in the next chapter.) If there are few intersections, a block may sometimes extend from one small settlement to the next small settlement.

FIGURE 3.4
Defining Blocks in a Rural Area

One other difficulty can arise at the outer boundaries of a ZIP area. As illustrated in Figure 3.5, the ZIP area boundary can split a block. It is even possible for the boundary to split buildings. When buildings are split, tenants with addresses on one side of the building belong in one ZIP, and those with addresses on the other side of the building should be assigned to the other ZIP. (The "main door" rule should be used in these areas when counting buildings.) Fragments of blocks at the boundary of a ZIP which contain addresses assigned to that ZIP should be marked and treated as separate blocks.
Another problem can arise when roadways cross bodies of water. When bridges are evident on a map, block boundaries should meet at the center of the span.

This may seem like a lot of work just to define blocks, but you will find that the concept of a block is indispensable for keeping track of your work in the field.

3.4 DEFINING BLOCK-GROUPS

Two additional units of area are required in order to establish block numbers and to select segments in "big" ZIP areas. Blocks have to be grouped to form block-groups, and then block-groups combined to form segments. (Block-groups will also be used in ZIP areas which are not segmented.) The first task, grouping blocks into block-groups, can be done before anyone goes out into the field. The latter step, defining segments, can only be accomplished after the field staff has completed the "quick count" of the "big" ZIP areas. This section explains how to define block-groups. The formation of segments is described in Chapter 4.

Block-groups are collections of 3 to 6 blocks. (However, in some cases it may be necessary to have less than 3 or more than 6 blocks in a block group.) Grouping blocks is necessary because blocks are often too small and
irregularly shaped to use directly in defining segments. The objective in defining a block-group is to create regions which are close to rectangular in shape. A typical ZIP area will contain 200 to 400 blocks which should be organized into about 40 to 80 block-groups.

Figure 3.6 illustrates the definition of block-groups using a portion of ZIP area 98118. Shown is a portion of the ZIP area where 6 block-groups were defined from 27 blocks. You should use a red colored pencil to define the borders of each block-group.

**FIGURE 3.6**

Example of Block-Groups Defined for the Sampled ZIP 98118

3.5 CODING BLOCKS

Once the blocks and block-groups are defined they need to be numbered. Great care must be exercised in this numbering process because the block and block-group numbers will become the basic code used to indicate the location of a building. This code will be used throughout the first and second stages.
of the survey. The basic approach is to give each block-group a three digit number and each block a two digit number.

In Figure 3.7, an area in ZIP 98118 has been coded.

FIGURE 3.7
Block Numbering

Both the block-group and block numbers should be recorded on the first block in each block-group. For example, in Figure 3.7 the number 10101 identifies the first block in block-group 101. The block-group number, 101, is recorded first, and the block number, 01, follows. Only block numbers are required in the remaining blocks in the block-group.

When coding a ZIP area, you should always start with block-group number 101. Subsequent block-group numbers should be 102, 103, and so forth. This allows for up to 899 block-groups, which is more than you should ever need. The block numbering within a block-group should always begin with 01. Subsequent block numbers should be 02, 03 and so forth. In most cases, a block-group should have between 3 and 6 blocks. However, you may occasionally need to define a greater number of blocks in a block-group. For
very large block-groups that contain only a single block, the block number should be coded 00.

Blocks should be coded in all areas of each "big" ZIP area except for regions which contain Military or Indian Reservations, or main campuses of colleges or universities. These reservations and main campuses are not to be included in this survey. They should be marked on the map so that they can be excluded from the "quick counts" and the subsequent task of listing buildings. The boundaries of the Military and Indian Reservations can be found on detailed state road maps. Main campuses of colleges and universities are delimited by the extent of the contiguous area of the central campus. Any buildings separated from the main campus by land that does not belong to the university are not part of the main campus. These are off-campus buildings, which should be surveyed. The Military and Indian Reservations and the university and college main campuses should be outlined on the maps using a purple colored pencil.

With the boundaries clearly marked, blocks and block-groups numbered and special areas outlined, the maps are ready for use in the field. The maps for "big" ZIP areas will be used in the segmentation procedures described in the next chapter. The other ZIP maps are complete and can be used immediately in preparing a detailed listing of buildings contained in these ZIP areas. Procedures for the detailed listing are described in Chapter 5.
Sampling a Segment in "Big" ZIP Areas

Some of the sampled ZIP areas contain so many buildings that it is necessary to break them up into smaller segments before the listing of buildings can begin. The segmentation procedure subdivides "big" ZIP areas into smaller segments, which contain approximately 150 buildings. This chapter describes the "quick count" and sampling procedures which you will use in defining these segments.

There is one important point to remember as you begin to learn about segmentation. You will be carrying out procedures that will lead to the selection of a random portion of "big" ZIP areas. You are not trying to find a segment which is representative of the whole ZIP. Some ZIP areas may contain a region dominated by industrial firms and other regions which are mostly residential. Your tendency may be to define a segment which includes a little of both regions. This needs to be avoided because it could potentially bias the results of the survey in ways that would be difficult if not impossible to correct.

4.1 "QUICK COUNT" OF BUILDINGS

The "quick count" procedure is designed to supply a rough estimate of how many non-residential buildings are located in each block of a ZIP area. In order to complete this task you will need to know how to count in the field, what types of buildings to include in the count and the definition of a building.

This quick count requires two people working together in the same car. One drives while the other counts and records block counts on the detailed ZIP map. You begin the process by driving to the ZIP and to block number 10101. You drive around that block and each of the other blocks in the first block-group. The counter uses a clicker to record the number of non-residential buildings contained inside each block. The driver stops after navigating each block so that the counter can record the count on the map.
You should complete the block-groups in the order that they are numbered, making sure that you complete a block-group before moving on to the blocks in the next block-group. Within a block-group, blocks can be counted in any convenient order.

Remember to always travel in a direction which minimizes the time required to circle blocks. In areas containing only two-way streets you will be most efficient if you always make right-hand turns. This may not be true in areas which contain many one-way streets. Be prepared to adapt your travel patterns to the prevailing street conditions.

Getting out of Your Car in Congested Areas

Completing the count by driving around blocks in a car makes sense in most areas. There are, however, circumstances where this procedure is too time consuming and should be modified. When you are given a ZIP that contains a very dense region, such as the Central Business District in Seattle or an area containing a public market, you may find it more efficient to do the count on foot rather than fighting the traffic. Use your best judgement in deciding whether to continue on foot. Do so whenever you feel that this will reduce the time required to count an area. All other quick count procedures should be followed in these congested areas.

Potential Problems with the ZIP Maps

There are a number of potential problems that you may encounter in working with the ZIP maps in the field. The maps assembled for this task will be the best available, but they still may contain errors and omissions. Further, you may find that some errors have been made in defining and numbering block-groups and blocks. Some of the possible problems include:

- areas under construction containing roads that will soon be paved,
- roads that have been added within a block or which form a new block,
- the removal of roads that were used to define a block,
- block-groups or blocks which have not been numbered or are incorrectly numbered.

If you discover new paved roads which are not included on your ZIP map, then you need to draw them on the map. Also, roads which are in areas under construction, such as a new suburban shopping strip or major housing development, and which will soon be paved should be drawn on the map. You should mark with an X (make sure its in pencil) any roads which have been removed. Alleys can be ignored as long as you are able to make a complete count of the buildings contained between the roadways which outline the block.
If you encounter problems, record notes in one place on the map (if there is not enough space, staple an additional sheet to the map). Indicate where roads have been added or deleted, or where block numbering has been missed. You should include references to adjacent roads and blocks to make it easier for others to find the area on the map where you discovered the problem.

When the counts for these "big" ZIP areas have been completed and the maps returned to the survey management staff, the block numbering should be modified to account for any problems discovered in the field. New block-groups should be created as necessary starting with block-group 900.

"Main Door" and "Main Gate" Rule

There are two situations where you may be uncertain whether a building should be included in the count for a block. The first arises when a building is split by the outer boundary of a ZIP. This can occur if one side of the building lies on a roadway which is included in the ZIP while another side of the building lies in an adjacent ZIP area. The other problem circumstance occurs in rural areas when a building is located on a corner which divides two blocks. In both of these cases you should apply the "main door" rule in deciding whether and how to count the building.

When you find a building either on a ZIP boundary or at a rural corner, you should look for the principal entrance, or "main door", used for foot traffic (ignoring openings like freight doors at a loading dock). At the boundary of a ZIP a building should be included in the ZIP if the side of the roadway which the "main door" faces is assigned to the ZIP. If the building has no doors on the side assigned to the ZIP, then you should exclude it from the block count (and it should be excluded from the listing for the ZIP). You should also exclude the building if it has entrances on more than one side and you can not determine whether the entrance facing the ZIP is the "main door."

You should use a similar approach when dealing with buildings located at the corners of rural blocks. A building should be included in the block which faces the "main door." When there is more than one door and you can not determine which is the "main door," you can assign the building to either of the blocks which connect on that side of the intersection.

You should also apply the "main door" rule to situations in which buildings are located under a block or ZIP boundary. This can happen in areas where there are overpasses and elevated highways. Buildings lying under such raised roadways should be assigned to the block that their "main door" faces. They should not be counted at all if their "main door" faces out of the sampled ZIP area.

You may also encounter sites where there is no public access, such as a large manufacturing plant. It may be impossible to determine where the "main door" is located for buildings inside such a site. When you encounter this type of site you should use the "main gate" rule. Assign all of the buildings
contained in a site which has no public access to the sampled ZIP area if the address of the main gate falls within the ZIP area.

What's a Building?

You may be wondering at this point how you will be able to tell when one building ends and another begins. You may even be wondering which structures are considered to be buildings. These are some of the most difficult questions dealt with by this Handbook. For the purposes of the "quick count" a building is a structure which has a roof which covers at least 100 square feet of floor area.

When a non-residential structure which has a roof is free standing and you can see all sides clearly from the roadway you know to click the clicker. Sometimes two structures will be connected with a walkway at the ground floor or some higher story. Ignore such connections and count them as two structures.

When you get into regions of strip developments where buildings adjoin, or areas containing shopping centers it gets more difficult. Often the architectural style or type of construction materials will vary between two adjoining structures. You can use that as an indication that they should be counted as two buildings. You may also be able to see a joint line where the two external walls come together -- this is another indication that you are looking at two buildings.

Remember that these are supposed to be quick counts. In the absence of clear visual signs that structures are separate you should count them as one building and move on. You should not pause for a thorough examination of the structure.

You may encounter areas, such as industrial plants, that are fenced off or for other reasons are inaccessible. Drive as close as you can and estimate the number of buildings contained in the restricted area.

Rules for Counting Buildings

What buildings should be included in the category of "non-residential buildings?" This category includes all buildings which are used either in-part or entirely by any type of business or government agency. This includes buildings which are predominately residential structures, but which contain some business space. You should also include buildings which are vacant but appear to have been occupied in the past by a business, and non-residential buildings which are under construction.

Non-residential buildings should be counted in all regions of the sampled ZIP areas that have numbered blocks. This will exclude buildings located on reservations (Indian and Military).

Figure 4.1 provides a summarization of all the rules you should apply in "quick counting" buildings located in "big" ZIP areas. Every structure which
qualifies as a building and is not expressly excluded by one of these rules should be included in the "quick count." This includes all types of buildings associated with food growing and harvesting and processing businesses.
COUNT BUILDINGS IN:

- Sampled ZIP areas which are to be segmented

EXCLUDE REGIONS OF THESE ZIP AREAS WHICH ARE:

- Occupied by Military or Indian Reservations
- Only accessible via unpaved roads in rural areas

INCLUDE IN YOUR COUNT:

- Any structure which qualifies as a building,
  \( AND \),
- Is partly or entirely used by a business or government agency
  \( OR \),
- Is a non-residential building under construction, e.g., foundation hole dug or some of the structure is built.

A STRUCTURE QUALIFIES AS A BUILDING IF:

- It has roof,
  \( AND \),
- The roof covers at least 100 square feet of floor area.
Summary of Rules for "Quick Counting" Non-Residential Buildings

DO NOT INCLUDE IN YOUR COUNT:

- Structures which are entirely residential, e.g., apartment buildings or condominiums.
- Any structure which is part of a mining operation.
- Any type of tank, e.g., oil storage, water towers or silos.
- Any large piece of equipment which does not contain roofed space e.g., incinerators, smokestacks, cranes, conveyance systems.
- Any structure supported by wheels.

COUNT ANOTHER BUILDING WHEN:

- Structures are separated by an air gap, even if the roofs are attached or the walls are connected by an enclosed walkway.
  
  OR,
  
- When, a joint line between two abutting walls runs from the ground to the lowest roof-line.
  
  OR,
  
- When, the architectural style or construction materials of the entire visible wall changes.
4.2 RANDOM SELECTION OF A SEGMENT

Once the field staff has completed the quick counts and recorded the figures on the ZIP maps, the maps should be returned to the survey administration offices. These block level counts will provide the survey management staff with the information necessary to define and sample segments in each of the "big" ZIP areas.

[Note for field staff: You are only responsible for completing the "quick count" in the field and getting accurate and complete maps back to the survey management staff. You will not have to deal with the ZIP maps again until segments have been defined and one segment has been selected for each ZIP].

The first step in defining segments is to add up the building counts for blocks found in each block-group. Next, adjacent block-groups are added together until the total counts becomes approximately 150 buildings. No segment should have less than 120 buildings or more than 180. When adding together block-groups try to keep the boundaries of the segment rectangular in shape. Very long or oddly shaped segment areas will make the subsequent field work more difficult. Give each of these segments a number starting with 1 (subsequent segments would be number 2, 3, 4 ...).

You may find that you have to try a couple of different combinations before you have regularly shaped segments each with approximately the same number of buildings. Figure 4.2 shows the results of this process for ZIP 98118.
FIGURE 4.2
Segment Boundaries Defined for ZIP 98118

ZIP Area 98118
Seattle, Washington

Segment Boundary
(orange)
ZIP Area Boundary
(green)
Once block-groups have been successfully combined into segments you can proceed to select a random segment. A hand held calculator that is capable of random number generation should be suitable for this process.

You should use a green colored pencil to define the outlines of the sampled segment. Once the segment is marked on the original and a copy, the map is ready again for use in the field.
5
Listing Buildings in Sampled Areas

After the segmentation of the big ZIP areas is completed and the sampled segments have been selected, the next step is to develop a listing of all non-residential buildings in the sampled areas. For the "big" ZIP areas, the listing is limited to the sampled segment of each ZIP. The completed and verified building lists for all of the sampled ZIP areas will form the sampling frame for the second stage of this survey. The information you collect will be used to classify buildings in the sampling frame according to their types of tenants and building size.

This chapter presents all the rules you must follow in preparing a listing of non-residential buildings for each of the sampled ZIP areas. Be careful that you are not misled by the use of the word listing. Unlike listings found in a phone book, the listings you will prepare are to contain a number of critical pieces of information on each of the non-residential buildings present in the sampled ZIP areas. Among the items included in this listing will be information on the tenants occupying the building, approximate floor area, the building's principal type of use and the building's age.

You will encounter many difficult situations in preparing these listings. Most of these difficulties can be resolved if you carefully apply the rules and measurement procedures which are described in this chapter. However, you will probably encounter circumstances which have not been anticipated. If you have carefully applied all the rules and procedures and you still do not know how to handle a particular building or site, then you should contact your supervisor for guidance.

5.1 WHAT IS A NON-RESIDENTIAL BUILDING?

You will be expected to list all non-residential buildings found in the sampled areas. Before you can begin that process you have to make sure that you understand all the rules which are to be used in determining which structures
qualify as non-residential buildings. Figure 5.1 provides a summary of these rules.

Before you list any structure in a sampled ZIP area make sure that it meets the requirements described in Figure 5.1. You will notice that the rules described in this figure are very similar to those presented in Chapter 4 for use in the "quick counts". There are however, a number of important differences.

In particular, more stringent conditions have to be met before a structure can qualify as a building. In order to list a structure as a building you have to find some indication that the structure is supplied with electricity, and that it has at least one exterior entrance. Determining if there is an exterior entrance should be easy in most instances, although at times you may have to walk along all sides of the building in order to locate the entrance. Determining whether the building is supplied with electricity can be somewhat more difficult.

There are number of things you can look for which will provide evidence of electrical service. You can look for wires running to a mast on the building, an electric meter or some piece of equipment which would require the use of electricity. The most difficult cases will be buildings which have underground electric service and which have few windows or windows which are covered. In these cases you may want to step back from the building and try to see fans or other electrical equipment which may be on the roof. You also should look for exterior lighting.
Figure 5.1
Summary of Rules for Listing Non-Residential Buildings

LIST STRUCTURES WHICH:
- Qualify as buildings.
- Are located in numbered blocks.
- Are visible from paved roads.
- Are at least partly occupied by a business or government agency.

IN ADDITION LIST NON-RESIDENTIAL STRUCTURES WHICH:
- Are vacant, if it is likely that they once were occupied, at least in part, by a business or government agency.
- Are under construction, if there are indications of construction activity.

DO NOT LIST:
- Structures which are entirely residential, e.g., apartment buildings or condominiums.
- Any structure which is part of a mining operation.
- Any type of tank, e.g., oil storage, water towers or silos.
- Any large piece of equipment which does not contain roofed space, e.g., incinerators, smokestacks, cranes or conveyance systems.
- Any structure supported by wheels.
- Any buildings located on a Military or Indian Reservation, or on the main campus of a university or college. These areas are outlined in purple on the maps.
Summary of Rules for Listing Non-Residential Buildings

**ONLY LIST A BUILDING:**

- If it has a roof
  - AND,
  - The roof covers at least 100 square feet of floor area.
  - AND,
  - There is some indication that the structure has electric service, e.g., wires running to the building, an electric service mast, electric meters or equipment that requires electricity.
  - AND,
  - There is at least one exterior entrance

**LIST ANOTHER BUILDING IF:**

- Structures are separated by an air gap, even if the roofs are attached or the walls are connected by an enclosed walkway.
  - OR,
  - If a joint line between two abutting walls runs from the ground to the lowest roof-line.
  - OR,
  - If the architectural style or construction materials of the entire visible wall changes.

**UNLESS:**

An upper story spans the air gap, joint line or change in architectural style or construction materials.
Dealing with Abutting or Connected Structures

The last item in figure 5.1 "LIST ANOTHER BUILDING IF:" provides some guidance in how to deal with abutting or connected structures. These types of structures often occur in neighborhood business districts and the central business districts of major cities. They can also occur anywhere that you find multiple building sites. For example, a motel complex by an airport may have many connecting walkways which are covered or even enclosed. You have to make a decision concerning where one building ends and another begins based on clues you can obtain from outside the building.

One of the most common clues to use in dealing with abutting structures is evidence of a joint (sometimes filled with joint compound) between two abutting firewalls. If there is a joint line running the entire height of abutting walls, then you can assume that the buildings end at the joint line. However, joint lines may be covered or otherwise impossible to observe. When joint lines are obscured you have to use a more complex decision-making rule. Examine the type of construction used in the two structures that you suspect are separate buildings. If, the architectural style or construction materials of the entire visible wall changes at a point along the face of the abutting structures, then you should assume that a new structure has started at that point.

Connections between structures can also cause confusion. If the connection is just ornamental or solely for the purpose of sheltering foot traffic (including enclosed areas found in malls), then the connected structures should be considered separate buildings. This is true even if there is no change in architectural style or wall construction between the two connected structures. If the connection is occupied for any purpose, other than sheltering foot traffic, then the connection plus the two connected structures should be considered to be a single building.

5.2 WHAT IS A SITE?

In the field, you will often encounter a group of buildings which are physically separate but which are used in some coordinated manner. These groups of buildings will be referred to as Sites. For the purposes of this study, a site is defined as an area containing one or more buildings, all of which are adjacent, and which display signs of common operation. Adjacent means that there are no intervening buildings, although there can be roadways which partition a site.

Some examples of sites which often contain more than one building are:

- school
- motel
- hospital
- gas station
- auto dealership
- lumber yard
In many cases the bounds of a multiple building site can be easily identified. A good example is a motel which might have a building containing an office and a restaurant, and then separate buildings for guest rooms and an indoor pool. Other situations may not be as clear. Again consider a motel, but one which has a restaurant operated by a separate business located in a common parking lot. In this case, if there is no indication that the two buildings are jointly operated, they should not be assigned to the same site.

5.3 PROCEDURES TO FOLLOW IN THE FIELD

Once you have the necessary maps and clearly understand the definition of a building and a site, you can drive to a sampled ZIP area and begin the process of listing buildings. When you arrive at the ZIP area, you should spend some time becoming familiar with the area by thoroughly reviewing the maps.

At the start of each day's work in a ZIP area, you should quickly inspect the areas that you intend to list. Getting into the habit of making an initial inspection of the ZIP area can help you avoid two critical mistakes: missing a building and listing a building twice.

It's particularly easy to miss buildings in areas where there are many alleys or where the buildings do not extend to the edge of the roadway. If you are listing a sampled segment in a "big" ZIP area, you can use the quick counts recorded on the ZIP map as a guide. When you start a new block-group you can review the counts. If you find more or fewer buildings you may want to double check your work. You can increase your chances of finding all buildings in one pass through the area by establishing a consistent pattern for moving around blocks and completing all blocks in a block-group. You should always complete the listing of one block-group before moving on to the next block-group.

Dealing with Map Problems

You have to be prepared to deal with mistakes and omissions on the maps. In particular, if you are working in a ZIP area which was not segmented, then you will be the first one to use the maps in the field. Roads may have been added or removed since the map was created. It is also possible that block-group or block numbers may be missing or incorrectly recorded on the map.

Unlike the "quick count," it is not sufficient to just leave a note on the map concerning corrections which should be made. In order to record the data for any building you have to have valid block-group and block numbers. This means that when you encounter a problem with a map you have to make the necessary corrections before proceeding.

If you encounter an area where new roads have been constructed, you should draw these roads on the map and create any new block-groups and blocks which are necessary to code all of the additional roadways. All new block-groups should have a number greater than 900. When dealing with a ZIP area
which has not been segmented, you can assign the first new block-group the number 900 and count up from there as necessary. If you are dealing with a sampled segment of a "big" ZIP area, you should first check to see if any block-group numbers above 900 have already been used. Make sure that any new block-group numbers are higher than any numbers already used on the map.

Note on the map (or on a sheet stapled to the map) any changes which you make.

A Systematic Pattern for Listing

Assuming that all problems with the map have been resolved, the listing effort for a typical block-group might proceed as follows. Drive to block 01. Quickly scout the block to see if there are any sites which extend into an adjacent block. Sites which extend into other blocks should be dealt with first. You should list all buildings associated with such sites, and then go back to complete the listing of block 01 (In Figure 5.2, Bill Pierre Ford is an example of a site which is located in more than one block).

Once block 01 has been completed, you can move on to the second block, 02. Proceed until all the blocks in a block-group are finished. However, if you find a site that is split by a block-group boundary, you should complete the listing for all buildings associated with the site, even if the listing for the second block-group has not been completed.

Figure 5.2 illustrates the order in which buildings should be listed for a block group. The numbers next to each building indicate their listing order. Note that the buildings located in sites which extend into two or more blocks are listed first.
It is necessary that the listing of all multiple building sites be complete at the end of each day's work. The data entry system, which is described in Chapter 6, requires that you complete entries for all buildings belonging to a site before entering data for the next site. If at all possible, you should not end a day in the middle of listing a block. Try to complete the listing of the last block before stopping for the day. If you must stop in the middle of a block, be careful to note where you have stopped, so that you don't double count or skip any buildings on the following day.

Remember to use the "main door" and "main gate" rules described in Chapter 4 for deciding whether or not a building should be included in a specific block.

5.4 HOW TO USE THE ENUMERATION FORM

Collecting the listing data is a two step process. First you have to fill out an Enumeration Form for each building that you find in the sampled areas. Next you have to convert the data to electronic form using data entry software and a transportable computer. In order to accomplish these tasks you have to become thoroughly familiar with both the Enumeration Form and the data entry software. A copy of the Enumeration Form is included in Appendix A. You should have a copy of the form out and available for quick reference as you read the rest of this chapter. The operation of the data entry software will be described in Chapter 6.
Before Going into the Field Each Day

There are a number of things you can do, before leaving your home or office each day, that will streamline the fieldwork. Start off by reviewing the maps for the sampled area and noting the number of buildings which were counted in the block-groups you intend to cover that day. [Note: If you are dealing with a ZIP which was not included in the "quick count" you should assume that on average every block will contain 3 buildings.] Make sure that you have enough copies of the enumeration form. Generally you should take 50 percent more forms into the field than you expect to use. This will cover instances where the "quick counts" are low or where the time required to complete the forms is shorter than expected.

You can fill out a number of items (Make sure you use a pencil for all entries.) on each form before you leave for the field. One of these items is the Surveyor ID, which is found on page one and at the top of all remaining pages of the form. The ID is a string of characters which consists of a number for your home office, your supervisors number, your two initials, and a two digit number. (Your supervisor will give you all the information required to fill-in your Surveyor ID.) The ID is repeated on each page so that if a form loses its staple, each of the pages can still be identified. (Notice that there is additional identifying information that must be repeated at the top of each page, which ties each page to a particular building.)

There are a few other entries that you can make to speed-up your use of the form in the field. In the top box on page one you can fill in the State abbreviation and the ZIP and Segment numbers. The valid state abbreviations for this study are:

<table>
<thead>
<tr>
<th>State</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washinton</td>
<td>(WA)</td>
</tr>
<tr>
<td>Oregon</td>
<td>(OR)</td>
</tr>
<tr>
<td>Idaho</td>
<td>(ID)</td>
</tr>
<tr>
<td>Montana</td>
<td>(MT)</td>
</tr>
<tr>
<td>Wyoming</td>
<td>(WY)</td>
</tr>
</tbody>
</table>

There are 73 valid ZIP codes that can be recorded; make sure that you have the correct ZIP code. If you are dealing with a "big" ZIP area, check the map to find the correct segment number. If you are not dealing with a "big" ZIP, then the ZIP area contains only one segment and the segment number is 01.

Figure 5.3 illustrates a particularly tricky circumstance that you need to keep in mind. When you are examining a site located near the border of a sampled ZIP area or a sampled segment, you need to determine whether the ZIP or segment boundary divides the site.

A site might straddle the boundary of a sampled segment, but still be entirely contained within the sampled ZIP area. All buildings in such a site, both those within the segment and those located outside of the segment, should be listed. In this case, you will have to change the segment number to the special code NS, which stands for Non-sampled Segment, for all buildings in the site which are located outside of the sampled segment. Buildings within the sampled segment are given the segment number of the sampled segment.
It is also possible to find a multiple building site which straddles a ZIP boundary. In this case, all buildings in the site are listed. However, you will need to change the ZIP code to the special code NSADJ, which stands for Non-Sampled ADJacent ZIP, for all buildings in the site which are located outside of the segment, and, in this case, outside of the ZIP area as well. For all buildings with a ZIP code of NSADJ, you should use the special code NS for the segment number.

**FIGURE 5.3**

A Multiple Building Site Which Crosses a ZIP or Segment Boundary

In addition to the ZIP and Segment numbers you can also fill-in the first two parts of each Site ID: Month and Day. Month numbers start with 01 for January and end with 12 for December. Similarly, days are numbered starting with 01 for the first day of each month. The month and day that you record on each form is the day that you use the form in listing buildings. This part of the Site ID can be filled-out at the top of each page in the form.

**In the Field: Page One**

Assume that you have now finished preparing forms for the day and have driven to a block in a sampled segment or ZIP area. You scout the block to locate any multiple building sites that extend into adjacent blocks. If any exist you start with them, otherwise you start with any building nearest a
corner of the first block. You get out of the car and begin to fill out the
form for the first building. Remember that you fill out a separate form for
each building, even in multi-building sites.

Since you have already filled in the Surveyor ID, the first entry you make on
the form is to complete the Site ID and building number. If the building is
located on a multi-building site, you need to determine how many buildings
are in the site. For example, the Site ID and building number for the first
building in a two building site which you observe on the 5th day of July
would be as follows:

  Site ID /0 7 /0 5 /0 0 1 /
  Month /Day /Number
  Building 0 0 1 of 0 0 2

Next, complete the large box on page one, which requires the State, ZIP,
segment, and block-group and block numbers. [Note: You do not fill out the
date data transmitted field until you finish transmitting the data, over the
phone line, to the survey administration offices. See section 6.2 in Chapter 6.]
The only other entry to be made on page one is the type of site. Your
response to this question determines whether you will continue recording
observations at this site, or move on to another site. You have to determine
whether or not the site is primarily used for food growing, food harvesting,
forestry or mining. If it is, enter either FRH or MIN, as appropriate. If
either of these is entered, then the form is complete and you can move on to
the next site. If the site is used for any other type of business, enter CMA,
and then complete the rest of the form.

Page Two

As was discussed in Chapters 1 and 2, one of the primary objectives of the
first stage survey effort is to estimate the floor area for each of the listed
buildings. Answers to the questions on the second page of the form will
provide the information necessary to derive these estimates for each of the
listed buildings.

[Note: Before you can enter any data on the size of a building you have to
determine the average length of your stride (feet per pace). You should
complete a standard pace test administered by your supervisor before listing
any buildings.]

Questions 2.A and 2.B provide you with two methods for estimating the floor
area of a building. The method described in 2.A, which involves pacing off
the dimensions of the building, is the preferred method. It should be used
unless it is impossible to get close enough to a building to pace off its
dimensions. The method described in 2.B can be used for a site which has
restricted access, such as a manufacturing plant.
The correct method for pacing is illustrated in Figure 5.4. Note that you should begin with your toes even with the wall of the building. Pace to the end of the building face, keeping count of the number of paces. If you reach the far end of the building in the middle of a pace, round off your count to the nearest full pace.

FIGURE 5.4
Pacing Techniques and Pacing Calibration

In some instances, you will be unable to walk right next to the building wall you are pacing. This may occur because of such things as a fence, or construction activity that obstructs your path. In such situations, you may have difficulty locating the proper point from which to begin and end pacing. For a rectangular building you need to begin and end your pacing at what can be described as imaginary lines which represent extensions of the walls perpendicular to the walls which you are measuring. The easiest way to locate
the proper starting point is to begin at a point located before the actual starting point, and walk forward toward the starting point while keeping parallel to the wall you intend to pace. While walking, keep your eye on the wall that is perpendicular to the wall you intend to pace (i.e. the wall that defines your starting point). The point at which this perpendicular wall disappears from sight is your starting point.

There are two ways you can identify the end point. For small buildings, it is best to locate the ending point before you begin pacing, using the procedure described for locating the starting point. Mark the end point somehow, and then pace from the starting point until you reach it. For large buildings, it may be more efficient to begin looking for the end wall (the wall which is perpendicular to the wall which you are pacing and which defines the end of the paced wall) as you approach the ending point. When that end wall first becomes visible you have reached the ending point.

The first step in completing 2.A is to divide the building into a series of cubes or other standard volumetric shapes which are referred to as segments. Figure 5.5 provides illustrations of proper segmenting techniques. If you must segment a building with a complex shape, you should sketch a plan of the building before segmenting it (see Figure 5.6). Keep in mind that you are trying to achieve a reliable, but approximate estimate. Minor irregularities, such as small sections of walls that protrude or portions of walls which are circular, can be ignored. Your goal should be to arrive at an estimate which is within 10 percent of the actual floor area of the building. Note that Questions 2.A and 2.B allow for the use of only six segments to describe a building.

FIGURE 5.5

Segmenting Techniques
Portions of the building which have a different number of stories should be assigned to separate segments. Be careful, changes in roof height are not sufficient evidence that another floor has been added. You should look for another row of windows or other indications that the number of stories has increased for a portion of the building. When counting stories, you should remember that sometimes one or more stories will be taller than the others. For difficult buildings, count stories in two or three different ways to be sure that you have counted correctly. A mezzanine floor should not be counted as a separate story. A mezzanine is an intermediate story that projects in the form of a balcony inside of the building.

Once you decide on the segments required, pace the length and width of each segment and record on the form the number of paces and the number of stories associated with each segment. When dealing with simple rectangular segments leave the last column (Circle or Triangle ?) blank.

Sometimes you will encounter triangular or circular segments. Figure 5.7 illustrates how to identify the length and width of these segments. For right triangles, pace off the two shortest sides; for other triangles, the longest side is the length, and the width is the shortest distance from that side to the opposite corner. For triangles you should record a T in the last column. For circles you should pace off the diameter and enter it twice, once as the length and again as the width. For circles record a C in the last column.

You will find many shapes which are not exactly rectangles, triangles or circles. When you do encounter non-standard shapes (i.e. shapes which are not rectangles, triangles, or circles), you should determine which of the three
standard shapes can be used to best approximate the shape of the building or segment. Figure 5.8 illustrates how to use rectangles to approximate semicircles, trapezoids and parallelograms. Note that the width of the parallelogram is measured perpendicular to the length, not along the building face. For a trapezoid, the length is defined as the longest of the two parallel sides.
FIGURE 5.7
Standard Building Shapes

TRIANGLES

Right triangle

Other triangle

CIRCLES

FIGURE 5.8
Non-Standard Building Shapes

TRAPEZOID

SEMICIRCLE

PARALLELOGRAM
Although, if at all possible, you should use the procedure in 2.A to estimate the floor area of a building, in some extraordinary situations you will be forced to adopt the alternative approach. In this case, enter your measurements in 2.B. For 2.B you use the same basic approach as in 2.A, dividing the building into segments, measuring the length and width of each segment, and so forth. However, since you will be unable to pace off the dimensions of the building segments, you will have to use an alternative method of estimation. There is no single recommended procedure for doing this. You must be creative, and make use of any available resources. For example, if there is a car parked in front of the building, you can use that car to estimate a building's length in terms of car lengths. Multiplying the number of car lengths by the length of a car provides an estimate of the building's length. Other features, such as parking spaces, parked airplanes, doors, and telephone poles can be used to help estimate building dimensions (see Figure 5.9 for a listing of the dimensions of some common features that you can use for estimating building dimensions).

You can use a scaling stick to help you measure buildings which you are unable to pace. Any stick can be used as a scaling stick. It will probably be easiest to use your pencil. Find an object with a known length that is located at the same distance from you as the building. For example, assume a car is parked next to the building. Hold your scaling stick at arm's length and place one end of the stick at one end of the car (see figure 5.9 for an illustration of the process). Move your thumb along the stick until it reaches the other end of the car. The length of the car is now defined by a distance on the scaling stick between the end of the stick and your thumb. You can use the stick length to scale any object located the same distance from you as the car. In this case use the car length to measure the building length. Do this by holding your scaling stick at arm's length, and moving your defined car length along the building face, one car length at a time, until you have covered the entire building length in terms of car lengths. Multiply the number of car lengths counted by the length of the car to obtain an estimate of the building length.
COMMON MEASURES

- Cars (13'-15')
- Tractor/trailer
  (55' long x 8' wide)
- Parking space
  (10' wide x 20' long)
- Concrete block (3 blocks=4')

A final technique which may prove helpful in estimating building dimensions makes use of building modules. This technique is to be used only where you
can not pace off the building dimensions, or can only pace off a part of a building. The building module technique can only be used on a building face which is subdivided into different lengths by certain building components, such as structural bays, windows, entries or balconies. For the purpose of illustration, assume that a long building face is composed of a series of regularly spaced balconies, and that each balcony is the same width. In this case, you can think of the building as being composed of a series of components of equal width, where a component is a balcony plus the space between it and the next balcony (on one side only). If you determine the length of the component you can estimate the length of the building face by multiplying the width of the component by the number of components which make up the building face. This technique is particularly useful for situations in which you are able to pace off only a portion of the building face.

Page Three

There are four questions to be answered on the third page of the form. The first one, Questions 3 and 3.A, asks you to record the street addresses for all sides of the building which have public entrances. This requires that you record addresses in a standard format. The address is divided into the following components (You must provide as much of the following information which is available for each side of the building for which there is a public entrance.):

Start #
The lowest street number. If there is only one street number, list it here.

Ending #
The highest street number. If there is only one street number, leave this blank.

Direc. Prefix
A directional qualifier which precedes the street name such as NE for NorthEast (only use when posted as part of the street name).

Street Name
Just the street name alone, such as ELM ST or 1ST AVE.

Direc. Suffix
A directional qualifier which follows the street name such as S for South (only use when posted as part of the street name).

Standard abbreviations to be used in recording directional (Direc.) prefixes or suffixes are shown in Figure 5.10. In addition, you should always use the full street name as it appears on local street signs or, if no street signs are available, on your map. You can abbreviate some common street name suffixes such as ST for STREET. The common suffixes which you can abbreviate are listed in Figure 5.10. Do not abbreviate any street name suffixes except those listed in Figure 5.10. There is no way to assure that all
members of the field staff would use the same abbreviations. The use of different abbreviations would cause considerable problems when the listing data is used.

**FIGURE 5.10**

Standard Abbreviations for Directional Prefixes and Suffixes and Street Name Suffixes

<table>
<thead>
<tr>
<th>DIRECTIONAL (DIREC.) PREFIX OR SUFFIX</th>
<th>STREET NAME SUFFIXES</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = North</td>
<td>AVE = AVEnue</td>
</tr>
<tr>
<td>NE = NorthEast</td>
<td>BLVD = BouLeVarD</td>
</tr>
<tr>
<td>NW = NorthWest</td>
<td>CIR = CIRcle</td>
</tr>
<tr>
<td>S = South</td>
<td>CT = CourT</td>
</tr>
<tr>
<td></td>
<td>DR = DRIve</td>
</tr>
<tr>
<td>SE = SouthEast</td>
<td>HTS = HeighTS</td>
</tr>
<tr>
<td>SW = SouthWest</td>
<td>JCT = JunCTion</td>
</tr>
<tr>
<td>E = East</td>
<td>LN = LaNe</td>
</tr>
<tr>
<td>W = West</td>
<td>RD = RoaD</td>
</tr>
<tr>
<td></td>
<td>ST = STreet</td>
</tr>
</tbody>
</table>

Not all buildings have posted addresses. In a significant number of cases, the only part of the address that you will be able to list is the street name. Use the space provided in 3.A to record additional comments which help to identify the location of the building. A common description might include the name of the closest cross street, which side of the street the building is on, and in which direction from the cross street the building is located (eg.: N side of Elm ST, E of Maple AVE). Depending on the circumstances other types of clues may be necessary. In rural areas it may make sense to give the direction and miles to the nearest cross street or to some notable natural feature, for example: 3 miles N of Wilard Creek.

Questions 4 and 5 deal with other information which can be used to identify the building. In Question 4 you are asked to record the name of the largest tenant. In many cases there will be a sign on the outside of the building or a directory posted in a public lobby. Do not enter the building to answer this or any other question unless there is an area open to the general public. If you can not determine which tenant is the largest, record the name of any major tenant. If there are no tenants leave the question blank. To answer Question 5 record the name of the building if any is posted.

For Questions 6 and 6.A, you are asked to estimate the number of businesses which occupy space in the building. Each business having a unique name should be considered a tenant. If you can count the number of tenants either by the signs posted on the outside or from a building directory, record that count in response to Question 6. If the building is vacant record a 0. If you
cannot count the number of tenants then pick one of the ranges in 6.A that you think comes closest to the actual number of tenants. Use the abbreviation for the appropriate range shown on the form, such as: 16T for 2 to 16 Tenants.

Pages Four and Five

The fourth and fifth pages of the form are designed to be used together. The codes to be used in filling out Questions 7.A and 7.B are shown at the bottom of page 4. These are codes for types of businesses and occupancy. In addition, you will have to refer often to Appendix B in order to learn how to assign the correct business type codes. Appendix B contains a reference list of business type codes.

Question 7.A deals with only the first floor of the building. The first floor is the lowest level of the building which has entrances intended for use by the general public. To answer Question 7.A you need to record the street name and the tenant name for each of the businesses which occupy the first floor of the building. In addition, you need to estimate the portion of the first floor which is occupied by each tenant and assign each tenant a business code (Bus. Code) and an occupancy code (Occ. Code).

Any one tenant can occupy a Small, Medium or Large share of the first floor. A Small share means that the tenant occupies less than one quarter of the first floor of the building. A Medium share indicates that the tenant occupies more than one quarter but not more than one half of the first floor of the building. A Large share means that the tenant occupies more than one half of the first floor of the building. There can only be one Large tenant in any building.

Figure 5.11 illustrates how the floor area shares, business type coding and occupancy coding would work for two relatively simple buildings. The first building is one story tall and contains only a supermarket. The second is a one story building which contains both a travel agency and a small grocery store. (There is enough space on the form, including the supplemental section on page 5, to list 16 tenants on the first floor of a building).
If a building is vacant and there are no signs indicating what type of business will be occupying the space in the future, then you would have to assign a business type code of UNK for UNKnown and an occupancy code of VAC for VACant. Signs indicating the type of future tenants can be used to assign the business type codes to a building even though the occupancy code is VAC. Similarly you can assign business type codes to a building under-construction if there are clear indications as to the type of tenant which will be occupying the building, such as a sign which reads "Home of a new Burger King". Buildings under construction should be given an occupancy code of UCO.

For the most difficult sites, where there is no clear indication of the type of tenant and you are not sure whether or not the building is occupied, you should assign UNK for both the business type and the occupancy codes.

Question 7.B requests both business type and occupancy codes for floors above the first, if the building has more than one story. In order to answer this question you have to combine the portions of these upper floors which are occupied by businesses of the same type. For example, if you were listing a building which had a restaurant, an insurance agency and a travel firm on the second and third floors you would combine the floor areas used by the insurance and travel agency under the business type office. This is illustrated in Figure 5.12.
In answering Question 7.B, you should record information for the two largest business types occupying the floors above the first floor. In most cases this should allow you to give a business code and occupancy code to a very large fraction, if not all, of the floor area of the building. In field tests, few buildings have been found in which there is a third or fourth type of business located above the first floor which accounts for a large share of the floor area.

The most critical thing to remember in dealing with Question 7.A and 7.B is that you are trying to describe the businesses that are operating in the building and not how the space in the building is being used. For example, if you are listing a building which is occupied by a clothing wholesaler then the business type is WAR (See Appendix B for the listing of Wholesalers which are assigned to the business type Warehousing). This is true even if most of the building is used by the administrative staff of the firm and functions as office space. Later on in answering Question 8 you will have an opportunity to clarify, for a building of this sort, how the building’s space is used.

The label office can be very confusing. It is both a type of business and type of use. If you examine Appendix B you will see that the office business type is mostly composed of various types of service industries such as banking and insurance. The label office is also used in Question 8 to refer to a type of use. Virtually every type of business reserves some of the space it occupies
for office uses such as planning, administration and stenography. Be careful that when you are answering Questions 7.A and 7.B you use the BUSINESS TYPE definition for the label office.

Question 7.C provides an opportunity to describe problems which you may encounter in attempting to answer 7.A and 7.B for some buildings. For example, if you encounter a building which has no windows and no external business signs, you should briefly describe these circumstances so that the survey management staff can understand why it was not possible to determine the appropriate business type code for the building.

Page Six

Question 8 asks you to assign a type of use code to the entire building. The four type of use codes are:

- STR SToRage
- OFF OFFice
- MAN MANufacturing
- OTH OTHer

In order to answer this question you have to consider all of the floor area in the building, regardless of how many tenants there are. This question focuses on the use of space in the building and not the types of businesses. For example, you might be listing buildings in an area containing mostly industrial firms. In Seattle this might be where the buildings that belong to the Boeing company are located. In examining the site containing Boeing's buildings you might encounter a building that from the outside looks just like a conventional office building. Some of the indication of this type of activity might be shades on the windows, the number and type of windows and the kind of entrances to the building, i.e., mostly intended for foot traffic. Although you would give this building a business code of MAN for MANufacturing in Question 7.A and 7.B, you should give it a type of use code of OFF for OFFice in Question 8.

Question 9 asks you to characterize the type of development for each building. The simplest and most common type is FRE which is assigned to all buildings that are FREe standing. There are also codes for buildings which are part of strip developments (SDV), plazas (PLZ) and malls (MAL). You are asked to select the type of development code which best describes each building.

Question 10 requires that you make an estimate of each building's age. This is important because it will provide the basis for separately sampling new and old buildings in the second stage of this survey. You are asked only to determine whether the building was built before or after the beginning of 1980. Sometimes this will be a simple question, especially if there is a visible cornerstone with a year inscribed. It will also be easy if the building's architectural style is clearly indicative of construction practices of another
period. However, this question can be difficult for buildings which were built since 1970. If there are no obvious indications of age, then use the UNK code for UNKnown.

Question 11 is closely related to Question 10. It is included for the purpose of identifying old structures which have been renovated since the beginning of 1980. Often if a renovation is comprehensive, the energy consumption of a renovated old buildings may be very similar to the energy consumption of a new building of the same type. In some cases the renovation may be underway and it will be clear that you should record a YES in response to this question. In other cases you should look for clues that might indicate that renovations have occurred recently. If there is no evidence of recent renovation then you should record a NO in response to Question 11.

Page Seven

Page seven contains the final item in the form. You are asked to take a picture of the principal face of the structure. This should be the side of the building which has the most active entrance. You should take this picture using an instant development camera supplied by your supervisor. Check the picture after it has developed to insure that it is useable. If the picture is clear and sharp then mark on the photo the outlines of the building that you measured and staple the photo to page seven. Use a red felt pen to indicate the outlines of the building.
The final step in the first stage data collection process is to convert the data you collect in the field into electronic form, and transmit the data to the survey administration office. This chapter describes how you will accomplish this task using a transportable micro-computer and special software which has been developed for this survey. Keep in mind as you read through this chapter, that one of the key objectives of this final step is to verify that the data are correct. One of the major advantages of using micro-computers to enter the data is that you will have an opportunity to review the results of your data collection, and to uncover and correct any errors while you are still in the field and close to the sites where the data was recorded.

Before you can use the information provided in this chapter, you have to learn some basics about the operation of transportable micro-computers. Your supervisor will provide you with any necessary instruction; this type of instruction is not included in this Handbook. You should be generally familiar with the purpose of the keys on the computer's keyboard. You should also learn, through hands-on instruction, how to accomplish the following tasks:

- Turning the computer on and off
- How to safely transport the computer
- How to format a diskette
- How to list a directory of files
- How to copy the contents of one diskette onto another diskette
- What to do if you encounter a bad diskette
- How to connect a MODEM to the computer and to a telephone
- How to reboot the computer
- Understand the basics of DOS
If you are uncertain how to accomplish any of these tasks, you should ask your supervisor before attempting to carry out the procedures described in this chapter.

This chapter will teach you how to use the computer software which has been developed for use in the first stage of this survey. In the first section you will learn how to enter and edit data for each of the enumerated buildings using a computer program called SIP (Survey Input Program). The second section describes how to electronically date your entries and then transmit them to the survey administration offices, either over the phone lines or using delivery services. The final section of this chapter explains how to correct errors in data collection which are uncovered by you or the survey administration staff.

As you read through this chapter, you should have available copies of completed sample Enumeration Forms and a transportable computer. Practice with the computer by reproducing the sample forms as you read through this chapter. The only way to learn how to use computers is by using them. Just reading the instructions will not prepare you for the work in the field.

In order to make the examples and illustrations in this chapter easier to follow, we have used some conventions in the text for referring to the microcomputer screen, the keyboard, and commands which you must type.

1. Condensed (small type) has been used for anything which is displayed on the micro-computer screen.

2. Bold has been used to show what needs to be typed by the user.

3. Square Brackets around text denote that a special key should be pressed. For example [PgUp] means to press the Page Up key (look at the number 9 on the numeric keypad to find this key).

Note: The key marked [Enter] on the keyboard is commonly referred to as the "RETURN" key. We have tried to consistently use [Enter] but if [Return] is shown, do no let it confuse you--it always means the [Enter] key.

6.1 ENTERING AND EDITING DATA USING SIP

You will be using a computer program, developed for this survey, which is called SIP (Survey Input Program). Two of the basic requirements for its use are that you keep each day's data collection separate, and that each day you complete all forms for each site included in that day's work. The most fundamental organizing concept in this system is that each member of the survey staff will transmit data for each day's work at the end of that day.

At the end of each day, find a comfortable setting for entering your data, such as your motel room, your home, or a regional site office. Turn the transportable computer on and confirm that it is working properly. Format a
data diskette. Record your initials, the current date and the appropriate ZIP on a diskette label, and attach the label to the data diskette. (Note that you must use a separate diskette for each day's entries.) Put the disk which is labelled Survey Software into the A drive and your formatted data diskette into the B drive. Sort your Enumeration Forms so that they will be in the correct order for input. This means that all of the sites are sorted in ascending order by Site ID, and that the buildings for multiple building sites are sorted in ascending order by building number. For example, site 4 must follow site 3 and building 2 of 2 must follow building 1 of 2.

Once your forms are sorted, and you have out a piece of paper and a pencil, you are ready to begin data entry. You start the input program by typing SIP. You will enter data into a series of screens, which are similar to pages of paper forms. You should complete one screen before moving onto the next screen. The following discussion takes you through SIP's ten screens, one at a time.

The First Screen Displayed by SIP: The Date

The first screen that you will see displayed is shown below in Figure 6.1. The program greets you by name. If the name on the screen is not your correct name, then something is wrong and you should contact your supervisor immediately. The program then asks you to enter the date. For example on June 6th, you would enter 0605. As soon as you type these numbers and press the [Enter] key, SIP will immediately request that you enter the date again. You have to enter the same date twice in a row before the program will believe that you have entered the correct date.
FIGURE 6.1

Entering the Date

Good day, Joe Surveyor (JS00), welcome to SIP

please specify the file name for this session.
the file name should have the following form:
month - month - day - day

the month and the day must match those on the forms
to be entered for this session.

please remember to enter all four characters.
for example: 0703 for July 3rd.
0423 April 23
If the above date is correct, re-enter file name
If the above date is not correct, enter correct file name
0423

SIP's Second Screen: Add, Edit or Leave

Once you have entered the date correctly, SIP takes you to the next screen
which is shown in Figure 6.2. Here you have to tell the program whether you
intend to add new data or edit data that you have previously entered. You
type an A to add or an E to edit. If for some reason you decide that you
need to stop your work at this point, you can type an L to leave the SIP
program and return to DOS. After you type the appropriate letter, you have
to press the [Enter] key. If you make a mistake and type the wrong letter,
you can use the [Back Space] key (the one with an arrow pointing to the left)
to erase the entry and then replace it with the correct letter.
For now just focus on the task of adding entries. The procedure for editing will be discussed later. Press A and then [Enter] and SIP will advance to the next screen.

SIP's Third Screen: Site ID and building number

In the next screen, shown in Figure 6.3, SIP asks for the Site ID and building number for the building you wish to enter. You have to enter buildings in the same order in which you filled out the forms during the day. Each day, the Site ID starts with 001. For single building sites the building number is always 001 of 001. For a site which has more than one building, building numbers depend on the number of buildings at the site and which of the buildings you are currently entering.
FIGURE 6.3

Entering Site ID and building number

Try typing in a few examples. Type 0 0 2 for the Site ID. Notice that as soon as you type the first 0 the cursor moves to the second 0 and that when you type the 2 the cursor jumps to the building number field. You will find that SIP always advances you to the next field or action when you reach the last space in any data entry field on the screen. If you realize that you have made a mistake on this screen or any other screen you can move back to previous data entry fields by pressing the [UpArrow] key on the numeric keypad. Try it so that you can go back and change the Site ID to 0 0 1. In later screens you may need to move backward or forward through a number of fields. You can move backwards by pressing the [UpArrow] key repeatedly and you can move forward by pressing the [DownArrow] key.

SIP is designed to catch a number of possible mistakes that you might make in entering the Site ID and building number. If you make any of these mistakes, error messages will appear at the bottom of the screen. The possible messages are:
First site number must be 0 0 1
First structure number must be 0 0 1
Total number of structures on site must be > 0
Total number of structures can't change until all structures are complete
Current structure number must be one greater than last structure number
Current site number can't change until all structures for site are complete
First building number in site must be 0 0 1
Current site number must be one greater than last site number
Current surveyor ID does not match last surveyor ID

If you see any of these messages, you have to make the appropriate corrections before you can move to the next screen.

For these entries and all of the entries on the remaining screens which ask for data for a particular site and building, you should double check your inputs. You will save a lot of time by taking the time to stop and examine what you have typed, to make sure that it corresponds to the correct entries. Not only will it save time, but it is the only way to insure that the survey data is of high quality. Although certain errors will be caught by SIP, many can only be caught by your careful inspection of your own entries.

Complete the entry on this screen by typing 0 0 1 for the first part of the building number and 0 0 2 for the last part of the building number. You will notice that when you type the last number in the last data entry field a message appears at the bottom of the screen.

[PgDn], [PgUp] - next, previous screen, Any Other to Stay.

If you press the [PgDn] key you will move to next screen, which deals with site location data. If you press the [PgUp] key you will move back to the previous screen, in which you were asked to choose whether you wished to add or edit entries. [PgUp] can be helpful if you have made a wrong entry in the previous screen. This ability to [PgUp] and [PgDn] is available in all of the remaining screens. You can even [PgUp] or [PgDn] through a number of screens. Press [PgDn] and move forward to the fourth screen.
SIP's Fourth Screen: Site Location

As shown in Figure 6.4 the fourth SIP screen asks for information on the location of the site. You have to enter the State, ZIP, Segment #, Block-group # and Block #. The first three entries are checked by SIP before you can leave this screen. Only valid entries are allowed (See the instructions for page one of the Enumeration Form in Chapter 5 for a listing of the valid entries.). Type in OR for State, 97201 for ZIP, 1 for Segment #, 101 for Block-Group #, and 01 for Block #. Remember that if you make a mistake you can use the [Arrow] keys on the numeric keypad to move back and correct the entry. When you type the last number in Block # you will again see the message that you can move to the next screen using the [PgDn]. Press this key and move to the fifth screen.

Note that the fields in which you must enter the data are initially filled with either a -9 or a -99. You must type over these values to enter your data. Be sure that none of the original characters (either - or 9) remain when you are finished. They should all be replaced by the characters which you enter, or be changed to a blank by pressing the [Space Bar]. The initial values are necessary for SIP's error checking procedures to work.

FIGURE 6.4
Entering the Site Location

==============================================================================
| Segment tl                  | 9 |
| Block·group tl               | 99 |
| Block tl                     | 1 |
| State -9                     |    |
| ZIP -99                      |    |
| Segment # -9                 |    |
| Block-group # -99            |    |
| Block # -9                   |    |
==============================================================================
SIP's Fifth Screen: Type of Site

The fifth screen is shown in Figure 6.5. The entry required here is quite simple. This is where you tell the program what type of site is being entered. Only three entries are possible: FRH, MIN, or CMA.

FIGURE 6.5
Entering the Type of Site

If you enter anything other than the three acceptable entries, you will get an error message at the bottom the screen which says:

You Entered ===>ABC<=== This is an invalid value -- try again please

Try it. Type CMS and see what happens. Don't be afraid of making a mistake, just make sure that you always correct your mistakes. All you have to do to correct the mistake is to type CMA.

In general, you must make entries for all buildings associated with a site. The only exception to this rule is when you are entering data for a food growing or harvesting establishment, or a mining establishment. For these two types of sites you enter the Site ID and building number. Then you [PgDn] to the
fifth screen and enter the appropriate three letter abbreviation. Once you have made the correct entry you can press the [Esc] key. This will complete the entry for the site and, if no internal consistency errors are found, take you back to the second screen where you can chose to add or edit another site or leave SIP. [Note: Do not press [Esc] after you have entered CMA for a building's site type. This will put you back in screen two and you will have to use SIP's edit features in order to complete data entry for that building.]

Press [PgDn] so that you can move on to the next screen.

**SIP's Sixth Screen: Building Size**

Figure 6.6 shows the screen onto which you enter the data that you record on page two of the Enumeration Form. You have to enter all of the data required to compute the area of the building. You can move freely among the data fields on this screen using the [UpArrow] and [DownArrow] keys.

**FIGURE 6.6**

**Entering Building Size Data**

<table>
<thead>
<tr>
<th>Segment Number</th>
<th>Length (paces)</th>
<th>Width (paces)</th>
<th>Stories</th>
<th>Circle or Triangle</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-99</td>
<td>-99</td>
<td>-99</td>
<td>-99</td>
</tr>
<tr>
<td>2</td>
<td>-99</td>
<td>-99</td>
<td>-99</td>
<td>-99</td>
</tr>
<tr>
<td>3</td>
<td>-99</td>
<td>-99</td>
<td>-99</td>
<td>-99</td>
</tr>
<tr>
<td>4</td>
<td>-99</td>
<td>-99</td>
<td>-99</td>
<td>-99</td>
</tr>
<tr>
<td>5</td>
<td>-99</td>
<td>-99</td>
<td>-99</td>
<td>-99</td>
</tr>
<tr>
<td>6</td>
<td>-99</td>
<td>-99</td>
<td>-99</td>
<td>-99</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Segment Number</th>
<th>Length (feet)</th>
<th>Width (feet)</th>
<th>Stories</th>
<th>Circle or Triangle</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-99</td>
<td>-99</td>
<td>-99</td>
<td>-99</td>
</tr>
<tr>
<td>2</td>
<td>-99</td>
<td>-99</td>
<td>-99</td>
<td>-99</td>
</tr>
<tr>
<td>3</td>
<td>-99</td>
<td>-99</td>
<td>-99</td>
<td>-99</td>
</tr>
<tr>
<td>4</td>
<td>-99</td>
<td>-99</td>
<td>-99</td>
<td>-99</td>
</tr>
<tr>
<td>5</td>
<td>-99</td>
<td>-99</td>
<td>-99</td>
<td>-99</td>
</tr>
<tr>
<td>6</td>
<td>-99</td>
<td>-99</td>
<td>-99</td>
<td>-99</td>
</tr>
</tbody>
</table>

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When you make an entry in the Length, Width or Stories fields for either Question 2.A or Question 2.B, it must be a number. Notice that each of the fields is pre-filled with the special values -9 or -99. These values are used to indicate that the building segment has not been used in measuring the area of the building. Any number that you type in a field replaces the initial fill value. You have to be careful that you reinstate the special values -99 or -9, if you mistakenly overwrite one of the segment fields. Additionally, whenever you enter a value you must be sure to delete all of the pre-filled characters. For example, if you enter a width of 7 paces, you must be sure that the 7 is the only character in the field.

The only entries which the program will accept for the last column in these two tables are C (Circle) or T (Triangle).

Pick one of the sample Enumeration Forms, and enter the data for the building's segments. Stop after you complete the entries, look at the paper form, and confirm that the entries are correct. If any are wrong, then use the [UpArrow] key to move back to that field and make corrections. When you are sure the entries are correct press [PgDn]. You will then see displayed at the bottom of the page the message asking you whether you wish to [PgUp] or [PgDn]. You have to press [PgDn] again to move to the next screen.

SIP's Seventh Screen: Building Addresses

Address ranges for all sides of a building which have public entrances are entered using the next screen. Figure 6.7 shows how the screen will be displayed on your computer. Notice that all of the data fields are again pre-filled with the special code -99. For this question all of these values appear in the left-most portion of each field because they are all treated as text instead of numbers (including the columns which are to contain the Start # and Ending # for each address range).

You have to be careful that you completely overwrite the special pre-filled codes, especially when you encounter small street numbers such as "12 S ELM ST". If you just enter the characters 12 in the Start # column, you will see that you are left the last 9 from the pre-fill value and that the Start # is 129. To avoid this you have to press the [Space bar] after the characters 12 to erase the 9. Give this a try and the concept should become clear.
You have to be particularly careful when entering building address information because there are no checks which can be imposed by SIP. The number of possible entries is very large and the only way to insure that the correct entries are made is to frequently double check your typing.

Continue to practice moving around in the screen by using the [UpArrow] and [DownArrow] keys. Type in some practice address ranges, check them against the entries recorded on your trial forms, and then go back and correct any mistakes. When you are satisfied that you understand how to enter this data then press [PgDn] twice and move to the next screen.

### SIP’s Eighth Screen: Comments, Names and Number of Tenants

The next screen, shown in Figure 6.8, deals with the data you will record for Questions 3.A, 4, 5, 6 and 6.A on the Enumeration Form. The first three require the entry of text data similar to that required for the building address ranges on the previous screen. Because these are text fields, SIP cannot be used to check your typing. You must accomplish the necessary quality control through frequent comparison of the characters entered on the screen and those recorded on the Enumeration Form. Continue to extract examples from your trial forms. Type these in, check them, and go back to make any necessary corrections.
FIGURE 6.8

Entering Comments, Names and Number of Tenants

Record comments for buildings which have no addresses.

Name of largest tenant.

Building name.

Number of tenants.

If you cannot determine the exact number of tenants, record the code for the appropriate range.

Questions 6 and 6.A return the data entry process to a more restricted mode in which entries you make have to pass checks imposed by SIP, in addition to your visual comparison with the form. The entry for Question 6 must be a number and the entry for Question 6.A, which is only used if you cannot answer Question 6, is limited to one of the five abbreviations shown on the Enumeration Form.

When you are finished experimenting with Questions 6 and 6.A, press [PgDn] twice and move to the next screen.

SIP's Ninth Screen: Types of Businesses and Occupancy

Show in Figure 6.9 is the next screen, which is used to enter data for tenants that occupy the first floor of a building. This entry involves a mixture of text data entry and more restricted entries of abbreviations. Notice that the column headed Share of 1st floor allows for the entry of only one character: S for Small, M for Medium or L for Large. Whenever you move to this field and type a letter you are immediately moved to the beginning of the next field, Bus. Code, which can be filled with one of 17 three letter abbreviations.
When you complete that field you are moved to the beginning of the next field, Occ. Code., which can be filled with one of four three character abbreviations. The abbreviations which SIP allows in these last two fields are shown on page 5 of the Enumeration Form.

**FIGURE 6.9**

Entry of Types of Businesses and Occupancy

<table>
<thead>
<tr>
<th>Types of businesses and occupancy.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Street Name</td>
</tr>
<tr>
<td>-99</td>
</tr>
<tr>
<td>-99</td>
</tr>
<tr>
<td>-99</td>
</tr>
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<td>-99</td>
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<tr>
<td>-99</td>
</tr>
<tr>
<td>-99</td>
</tr>
</tbody>
</table>

When you are finished experimenting with this screen, press [PgDn] twice and move to the last data entry screen.

**SIP's Tenth Screen: Remaining Items on the Form**
The tenth data entry screen is illustrated in Figure 6.10. You are asked to enter data for Questions 7, 8, 9, 10 and 11. Enter some trial data and continue with you cursor movement and error correction practice. All of the entries made for the final items are checked by SIP to determine whether or not they correspond to valid abbreviations.

FIGURE 6.10
Entering Data for the Remaining Items on the Form

SIP's Error Checking After the Last Screen

Once you have completed all the data input screens for a building, SIP will go back and check through all of your entries to determine whether there is any indication that you have made mistakes. If you had made some mistake in the entry of data for your trial case the screen might look something like Figure 6.11 below. In this example, six different mistakes were made.
The program looks for two types of problems and displays two types of messages. The first are errors that must be corrected before the program will accept the entries you have made for the building. The possible error messages, all of which begin with the letter E, are:

E-1: Cannot find zip 98103 in x-ref table
E-2: Zip code cannot be -99
E-3: Segment # cannot be < 1
E-4: Block group # cannot be < 1
E-5: Block # cannot be < 1

Press [Return] key to continue
Data Entry and Transmission

E-6: Segment 1 shape not equal to C, or T
E-7: Tenant 1 share type not equal to S, M, or L
E-8: Sitetype cannot be missing
E-9: State code not = OR, WA, MT, ID

Notice that all of these error messages begin with a message number, for example E-1 or E-3. When you are using the program, you should record on paper the message numbers for all error messages you receive after the last entry screen. Then press [Enter] to continue, and the program will take you back to the fourth screen so that you can find your mistakes and correct them. Since the messages are numbered, you can use this page of the Handbook as an easy reference if you forget what a particular error number means.

SIP also looks for potential problems in your data. Items which are unusual but which may be correct. If it encounters such entries it will display warning messages. The possible warning messages, which all begin with W, are:

W-1: Segment 2 W-L Ratio vs BusType
W-2: Square footage vs BusType
W-3: Segment 2 Stories vs BusType
W-4: BldgSeg #2 Area (Length x Width) less than 100 sq.ft.
W-5: Segment does not match zip code.
W-6: Invalid block group number detected.
W-9: Explanation missing in Ques. 7C

If there are warning messages, then you need to use the [Enter] key to move back to the screens where you might have made a mistake. Recheck the Enumeration Form and the entries you made on the screen. If you made a typing mistake, correct it and move on to inspect the source of the other warnings. If you find that there is a mistake on the Enumeration Form, correct it if you can and make the appropriate change on the screen.

When you again complete the last screen the program will recheck your entries and display any appropriate warnings. If your entries pass all of the tests, then you can move on to the next building. If warnings are again displayed, you will have to go back and recheck your entries. The process will repeat again after your second retry. If warnings still appear after the third try, the program will ask whether you want to proceed and have the remaining
warnings included in the data for this building. If you answer by pressing a Y for yes, then the program will allow you to proceed to the next building. If you press N for no, then you will get an additional opportunity to correct the warnings.

Editing Entries

SIP also provides you with the ability to go back and make changes in previous building entries. After successfully completing an entry for a building, you are returned to the second screen, which is shown in Figure 6.2. If you wish to edit a previous entry, all you have to do is type an E and then press [Enter]. You will then be asked for the Site ID and building number. After entering this information, SIP will find the data associated with that building and show your previous entries on each of the screens. Try this feature by typing 0 0 1 for the Site ID and 0 0 1 of 0 0 1 for the Building number. After SIP works for a few seconds you should be able to press [PgDn] a few times and review familiar entries.

You can edit fields in exactly the same manner that you made the initial entries. Once you have completed the last screen, SIP will carry out the same two types of post-entry checks that are performed after building data is added for the first time.

You can also leave SIP, and then come back to it later to edit previous entries. You might wish to do this if you noticed problems with a set of forms and wanted to check with your supervisor before finalizing the entries. When you are ready to restart SIP, you have to check to make sure the survey software disk is in the A drive and the the data diskette for the appropriate day is in the B drive. You type SIP and then press [Enter]. Once the program starts and the first screen is displayed you will have to enter a date. This should be the same date that you recorded on the data diskette label. On the next screen you should indicate that you wish to edit entries. On the third screen you will enter the specific Site ID and building number.

6.2 PROCEDURES FOR COMMUNICATIONS

Once all of the forms for the day have been entered and satisfactorily error checked, the data files (These files are located on your diskette in the B: drive and all have a suffix of .dat. You can see these files by typing the DOS command DIR B:. ) are ready to be transferred to the survey administration offices.

Before the files are actually transferred they need to be date stamped with the DATESTMP program. To use the DATESTMP program start by typing DATESTMP at the A> prompt.
The DATE_TMP program responds with:

Date stamp

Good day, Joe Surveyor

Please enter file date as a four character string -- 0704

Enter the four characters which correspond to the month and day which you recorded on the label of the data diskette in drive B:. This should correspond to the date the data was recorded on the Enumeration Forms.

The program will respond with:

Now, enter the transfer date as six character string -- 010986

Enter the current date. In most cases this should be the same date you recorded the data in the field.

The program will respond with:

Date stamp process completed ...

Please transmit the following FOUR transmission files to the ADM home office using MINITEL.

Phone number is: (916) 363-1785

Files: A0421JS.TRN
      B0421JS.TRN
      S0421JS.TRN
      T0421JS.TRN

Make sure that you record these four file names exactly as they are displayed before continuing. Now you are ready to call the host computer at the survey administration offices and transfer the files.

Before dialing the host computer it is necessary to know what to dial to get an outside line. If instructions for the phone system are not available, you will usually be able to obtain this information from the hotel operator. Once you figure out the code write it down for later use.

The next step is to plug one end of the modular jack into the wall and the other end into the jack labeled line on the back of the computer.
With the modem connected, the next step is to execute MINITEL by typing MINITEL at the A> prompt. MINITEL will respond with:

```
Minitel - Tom Jennings 5 November 1985 v3.4 - Type ESCape for Menu
```

Press [Enter] and the screen will go blank and the cursor will be located at the bottom.

Make sure that you are typing in capital letters. Then type:

```
AT
```

and press [Enter]

If the computer responds with:

```
OK
```

then type:

```
ATDT 8, 0 916 363 1785,,503 276 6836 6058
```

where 8 is the number to get an outside line and,

```
503 276 6836 6058 is the credit card number you are to use.
```

Listen to the modem for a series of sounds. First the sound of the phone being taken off-hook, then the sound of the numbers being dialed, next you should hear the phone ring (or busy, which means you must try again later), then you should hear the host answer the call (this is a short click), and lastly the host computer will send a high pitched sound called the carrier. If the sequence of sounds does not follow this pattern, note which sounds were different, this will help in diagnosing the problem.

Note: in the example there are three commas between the phone number and the credit card number. Start by following the example and use three. However, if three does not allow a long enough pause, increase to four and retry, then to five and retry. You should not need more than five.

If you have problems establishing a connection, call ADM directly at (916) 363-8383.

If the computer does not respond with OK, check that all of the cables are connected properly, that all necessary power switches are turned on, and that you have accurately followed the procedure described thus far. If everything seems in order but the modem will not respond with OK, turn the computer and other equipment off and start again.

If you dial successfully, the host should respond with a high pitched tone and the screen will display:

```
CONNECT
```

---

*Volume VI Handbook For First Stage Data Collection*
A few seconds later the bulletin board will begin the login sequence, and the screen will look like the one illustrated in Figure 6.12:

**FIGURE 6.12**

Login Screen for the Bulletin Board Operating at the Survey Administration Offices

BPA/ADM Non-residential Energy Survey BBS System
PCBoard Software - Ver. 10.0 - 01/08/86

System up at 12:08 on 12-31-2099 at 300 baud.

Want color graphics [C/R]=no?

You should answer with an N for no

You will then be asked to enter your first and last names followed by your password, which will be your first name again. The host machine will display the following messages on your screen:

What is your first name? JOE
What is your last name? SURVEYOR
Checking user file. Please wait ...
Password (Dots Will Echo)? ...
Note: you will not see the letters you type when you enter your password, rather you will see dots.

You will then be asked if you would like to check your mail. The host will display:

Good afternoon Joe. Check your mail today [C/R]=yes?

You should respond with Y for yes. Figure 6.13 shows the response from the bulletin board's mail system:

**FIGURE 6.13**

Bulletin Board Mail System

<table>
<thead>
<tr>
<th>ZIP</th>
<th>SEG</th>
<th>GRP/BLK#</th>
<th>SURVEYOR-ID</th>
<th>SITE-ID</th>
<th>SPECIAL INSTRUCTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>97201</td>
<td>01</td>
<td>101/01</td>
<td>1/1/SA/00</td>
<td>04/11/001</td>
<td>NONE</td>
</tr>
<tr>
<td>97202</td>
<td>04</td>
<td>107/05</td>
<td>1/1/MM/00</td>
<td>05/11/004</td>
<td>NONE</td>
</tr>
</tbody>
</table>

When you are finished with your mail you will be at the main menu of the host bulletin board. The host will display the menu illustrated in Figure 6.14:
Choose the U option to upload your data files.

Type:

U

The host will respond with:

Enter the full filename to upload?

Enter one of the four data files with a .TRN suffix: (Keep track by checking them off your handwritten list, so that you do not attempt to send the same file twice).

Remember NOT to prefix the file name with B:

Press [Enter] after the file name.
The host will then respond with a display which looks like the one illustrated in Figure 6.15:

![File Transfer Display from Host](image)

Checking file transfer request. Please wait ...
Upload Drive : 10608640 bytes total/ 7987200 bytes free
Upload Plcmnt: Main Board Upload Directory
Upload Status: Posted Immediately
Transfer aborts if not started within 40 seconds.
Ready to receive using CRC Xmodem. [Ctrl-X] to Abort.

At this point the host is waiting for you to send the file.
Press [Esc] followed with T for the transmit option of MINITEL.

The following will be displayed:

```
Minitel - Tom Jennings  5 November 1985  Version 3.4
File(s) to send:
File:
Block:       Time Left:       Tries Left:
```

Enter the file name which you entered above. This time remember to preceed the filename with B:. Then press [Enter] to start the transmission process.
Monitor the file's progress by watching the number of Blocks (which should increase) and the Tries Left. If the number of Tries Left counts down to zero, you will be asked if you want the program to keep trying or abort. Choose the Abort option. Follow the procedure to exit the bulletin board, and try to establish the connection again.

If the file transfer completes successfully, you will be asked to enter a description of the file you have just uploaded. The host will display:

```
Upload successfully completed. Thanks for the file Joe!

Enter a description of (S0423JS.TRN).
Begin with [/] if for Operator only.
[-----------------------------]
?
```

You should enter your full name followed by a comma followed by the name of the file that you transmitted. The screen would look like this:

```
Upload successfully completed. Thanks for the file Joe!

Enter a description of (S0423JS.TRN).
Begin with [/] if for Operator only.
[-----------------------------]
?
```

JOE SURVEYOR, S0423JS.TRN

Press [Enter].

The host will again display its main menu, as illustrated in Figure 6.16:
Choose the U option and follow the steps above for each of the remaining three files.

When all of the files are completed, exit the bulletin board by typing the G selection from the main menu for Good-bye. The host will display:

Time Logged: 6 minutes
Time Used: 6 minutes

Thanks for calling Joe...

Then type [Esc] followed by Q to quit MINITEL.

If you were able to successfully transfer all of your data files, you need to go back through each of the paper forms for that day and enter the transmission date in the large box on page one.
6.3 PROCEDURES FOR MAILING DISKETTE

If you are not able to establish a good connection and transfer all four of your data files, you need to make an additional copy (see Section 6.4, "Procedures for Making Daily Backup") of your data diskette and send it to the ADM home office using the most expedient services available.

In areas served by an express service, the materials should be sent via one of these services (Express Mail, Federal Express, DHL, etc.). You will be given a supply of packaging materials for the express service before you are assigned to enumerate an area. In areas where express service is not available, send the diskettes via the U.S. Postal Service using special delivery. You will also be supplied with this type of packaging material.

Once you have obtained confirmation that your data diskette has been received by the site office, you may recycle your copy of the diskette by formatting it and putting on a new label.

6.4 PROCEDURES FOR MAKING DAILY BACKUP

At the end of each day you are required to make a backup copy of the data diskette using the DISKCOPY program.

Type in DISKCOPY A: B: at the A> prompt. The computer will respond with:

Insert SOURCE diskette in drive A:
Insert DESTINATION diskette in drive B:
Press any key when ready...

Now, remove the program diskette from drive A: and the data diskette from drive B:. Next, reinsert the data diskette into drive A: and place a blank backup diskette in drive B:. Finally, press a key to start the backup process.

At the end of DISKCOPY the program prompts:

ANOTHER COPY (Y/N):

Type N followed by a carriage return.

Remove both the data diskette and the backup diskette from the disk drives and place them in a safe place.

6.5 RECOVING FROM A DISK FAILURE

This procedure should only be used if you are not able to use the data diskette for data entry.
Insert the program diskette in A: and type DISKCOPY followed by a carriage return.

Remove the program diskette from A: and insert the backup diskette in its place. Insert a new diskette in B: and press a key to start the data recovery process.

At the end of the data recovery process, the DISKCOPY program prompts for:

```
Another copy (Y/N):
```

Type N followed by a carriage return.

At this point, remove the new data diskette and the backup diskette from the disk drives. Reinsert the program diskette in drive A: and the new data diskette in drive B:. Resume your data entry process as usual.

6.6 MAKING WEEKLY DELIVERY

At the end of each week, you are required to get a copy of the data diskette and the enumeration forms to the site office.

If you are close to the site office, you should hand deliver these materials. Once you have hand delivered your data diskettes you can reuse the backup copies.

If you are not close to the site office, you should mail the original data diskette and the enumeration forms to the site office. Keep the backup diskette in a safe place and do not use it for other purposes. Not until a confirmation of delivery is received from the site office will you be allowed to recycle and reuse the backup diskette.

6.7 CORRECTING MISTAKES IN A PREVIOUS DAY'S WORK

No matter how careful you are, mistakes are bound to occur. You will catch some of these mistakes as you go through the Enumeration Forms and enter the data using SIP. Others will be caught by the staff who are responsible for quality control. Sometimes the mistakes can be corrected by examining the picture you take of each building or by reviewing the data for other buildings at the site. If you can, you should correct these types of errors before you transmit the data for a day's work. At other times, you will discover errors that can only be corrected by going back out to the building site.

If you discover an error which can only be corrected by revisiting a building, you should call your supervisor and describe the problem. You should also call your supervisor on a regular basis, twice a day, to see if any problems have been identified by the quality control staff. Your supervisor will tell you which sites should be enumerated again and when to go back to these sites. Never revisit a site without the approval of your supervisor.

If you have to revisit a building, then you should act as if you were starting fresh with data collection from the site where the building is located. If it is
a multiple building site, you should collect data for all buildings at the site. The site should be handled in the same way that you handle any other site during that day's data collection. Except, all revisits will be completed on their scheduled day, before any of that day's regularly scheduled sites are enumerated.

New site ID numbers will be filled in on the form for the revisited sites corresponding to the current day's date and the appropriate sequence number (e.g. 05/22/001 for May 22, the first building of the day). The day's regular enumeration site ID numbers will then continue on after the last revisited site sequence number (e.g. 05/22/002).

Described below are the three primary situations where problems could be identified, and the steps which must take place to correct them.

1. You identify a problem in one or more of the enumeration forms and can only correct the problem by revisiting the building site.
   a. You contact your field supervisor, describe the problem, and schedule a revisit date.
   b. Your field supervisor contacts ADM (using BBS if possible), before 11:00 a.m. of the revisit date and advises ADM of the problem and scheduled revisit date.
   c. ADM places the revisit approval notice on the BBS.
   d. You transfer revisit data, on the scheduled date, only after approval notice has been placed on the BBS by ADM.
   e. ADM places a notice on the BBS confirming receipt of revisit data.

2. An Equifax field supervisor identifies problem in one or more enumeration forms.
   a. Your field supervisor contacts you, describes the problem, and schedules a revisit date.
   b. Your field supervisor contacts ADM (using BBS if possible), before 11:00 a.m. of the revisit date and advises ADM of the problem and scheduled revisit date.
   c. ADM places a revisit approval notice on BBS.
   d. You transfer revisit data, on the scheduled date, only after approval notice has been placed on BBS by ADM.

3. ADM identifies problem in one or more enumeration forms.
   a. ADM contacts you and the field supervisor using the BBS and describes problem.
b. The field supervisor contacts you and schedules a revisit date.

c. Your field supervisor contacts ADM (using BBS if possible), before 11:00 a.m. of the revisit date and advises ADM of the problem and scheduled revisit date.

d. ADM places a revisit approval notice on BBS.

e. You transfer revisit data, on the scheduled date, only after approval notice has been placed on BBS by ADM.

f. ADM places notice on BBS confirming receipt of the revisit data.
APPENDIX A

Building Enumeration Form
BONNEVILLE POWER ADMINISTRATION
NON-RESIDENTIAL BUILDINGS SURVEY
Building Enumeration Form

Surveyor ID / _ / _ / _ / _ / (off-suprv-initials-two digit ID)

[NOTE: A SITE is any group of buildings showing evidence of common OPERATION that are located on one or more ADJACENT LOTS OR BLOCKS. See chapter 5 in your first stage data collection handbook for more extensive definitions of SITES and BUILDINGS.]

Record the Surveyor ID, Site ID and Building # on each page before you answer question 1. (See Handbook page 5-11.)

Site ID / _ / _ / _ / Building _ _ _ of _ _

Month /Day /Number

State _____ ZIP _________ Segment # _________

Block group # ________ Blk # ________

Date data transmitted ________________

[NOTE: Use special codes NSADJ NS for ZIP and Segment # for sites that cross into non-sampled areas]

1. Type of site. Record the code for the most appropriate description of this site. (See Handbook page 5-11.)

        ______

FRH = Farm, Ranch, Hatchery or other food growing or harvesting establishment, including forestry.

MIN = MINing establishment.

CMA = Commercial or Manufacturing Activity including buildings that are predominantly residential but contain some commercial or manufacturing space.

If this building is part of a site occupied by a FARM, RANCH, OTHER FOOD GROWING or FORESTRY establishment, or a MINING establishment, do not fill out the rest of this form. Make sure the field control data is complete and that you have assigned a site ID. Estimate the number of buildings at the site in order to complete the site ID. DO NOT FILL OUT ANY OTHER FORMS FOR THIS SITE IF IT IS A MULTIPLE BUILDING SITE.

If this building contains any other type of commercial or manufacturing activity, proceed with the remaining questions.
2. Building size. For each segment of the building record the length, width, and number of stories. Remember that minor irregularities in shape can be ignored. If the segment is primarily a circle or triangle record a C or T in the last column. (See Handbook page 5-11.)

2.A If you can pace off the dimensions of the building, record your measurements using this table. **THIS IS THE PREFERRED METHOD.**

<table>
<thead>
<tr>
<th>Segment Number</th>
<th>Length (paces)</th>
<th>Width (paces)</th>
<th>Stories</th>
<th>Circle or Triangle ?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
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<tr>
<td>4</td>
<td></td>
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<td>5</td>
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</tr>
<tr>
<td>6</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

2.B If you CAN NOT get close enough to the building to pace off its dimensions, estimate the dimensions in FEET. Record your measurements using this table.

<table>
<thead>
<tr>
<th>Segment Number</th>
<th>Length (feet)</th>
<th>Width (feet)</th>
<th>Stories</th>
<th>Circle or Triangle ?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
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<tr>
<td>2</td>
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<tr>
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<tr>
<td>6</td>
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</tr>
</tbody>
</table>
3. **Building Addresses.** If street addresses are visible, record the addresses using the following table. Record addresses for all sides of the building which have a public entrance. (See your Handbook for standard abbreviations for Directional (Direc.) Prefixes and Suffixes, page 5-18.)

<table>
<thead>
<tr>
<th>Start #</th>
<th>Ending #</th>
<th>Direc.</th>
<th>Prefix</th>
<th>Street Name</th>
<th>Direc.</th>
<th>Suffix</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

**Examples:**

<table>
<thead>
<tr>
<th>Start #</th>
<th>Ending #</th>
<th>Direc.</th>
<th>Prefix</th>
<th>Street Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1020</td>
<td>1034</td>
<td>NE</td>
<td>RIVERSIDE AVENUE</td>
<td></td>
</tr>
<tr>
<td>800</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.A Record comments for buildings which have missing or incomplete addresses. **Example:** "SE CORNER OF 2ND AND RIVERSIDE" or "2 MILES N OF SALT CREEK."

4. **Name of largest tenant.** Record the name of the largest tenant in the building. When it is not obvious which tenant is largest pick any major tenant. Leave blank if vacant. (See Handbook page 5-19.)

5. **Building name.** Record the building name if one is posted. (See Handbook page 5-19.)

6. **Number of tenants.** Record the number of tenants which occupy the building? Record a Zero if vacant. (See Handbook page 5-19.)

6.A If you cannot determine the exact number of tenants, record the code for the appropriate range. **Example:** 16T would indicate that the building contains between two and sixteen tenants.

<table>
<thead>
<tr>
<th>16T</th>
<th>2 to 16 Tenants</th>
</tr>
</thead>
<tbody>
<tr>
<td>25T</td>
<td>17 to 25 Tenants</td>
</tr>
<tr>
<td>49T</td>
<td>26 to 49 Tenants</td>
</tr>
<tr>
<td>50T</td>
<td>50 or more Tenants</td>
</tr>
<tr>
<td>UNK</td>
<td>UNKNOWN</td>
</tr>
</tbody>
</table>

A.3
7. Types of Businesses and Occupancy. Refer to codes for Types of Businesses and Occupancy on the next page.

7.A For the FIRST STORY of the building record the following information for each tenant. Determine each tenant's share of the first floor area. Record an S for Small (less than one quarter); M for Medium (more than one quarter, but, not more than one half); L for Large (more than one half). Valid Business Codes (Bus. Code) and Occupancy Codes (Occ. Code) are listed at the bottom of next page. If there are more than six tenants use the 7.A supplemental form on the next page. (See Handbook page 5-20 and Appendix A for Business Codes.)

<table>
<thead>
<tr>
<th>Street Name</th>
<th>Tenant Name</th>
<th>Share of First Floor</th>
<th>Bus. Code</th>
<th>Occ. Code</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

Detailed listing of the businesses which should be assigned to each of the following groups is presented in the Handbook Appendix A.

Codes for Types of Businesses (Bus. Code)

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WAR</td>
<td>Warehousing</td>
</tr>
<tr>
<td>DGR</td>
<td>Dry Goods Retail</td>
</tr>
<tr>
<td>GRO</td>
<td>Groceries</td>
</tr>
<tr>
<td>RES</td>
<td>Restaurants</td>
</tr>
<tr>
<td>OFF</td>
<td>Office</td>
</tr>
<tr>
<td>PRI</td>
<td>Primary schools</td>
</tr>
<tr>
<td>UNI</td>
<td>Universities</td>
</tr>
<tr>
<td>HTM</td>
<td>Hotel/Motel</td>
</tr>
<tr>
<td>HOS</td>
<td>Hospital</td>
</tr>
<tr>
<td>OHE</td>
<td>Other Health</td>
</tr>
<tr>
<td>OTH</td>
<td>Other Commercial</td>
</tr>
<tr>
<td>MAN</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>CON</td>
<td>Construction</td>
</tr>
<tr>
<td>SFM</td>
<td>Single Family</td>
</tr>
<tr>
<td>MFM</td>
<td>Multi-Family</td>
</tr>
<tr>
<td>LOB</td>
<td>Lobby/Common</td>
</tr>
<tr>
<td>UCO</td>
<td>Under Construction</td>
</tr>
<tr>
<td>VAC</td>
<td>Vacant</td>
</tr>
<tr>
<td>UNK</td>
<td>Unknown</td>
</tr>
</tbody>
</table>

Occupancy Codes (Occ. Code)

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>UCO</td>
<td>Under Construction</td>
</tr>
<tr>
<td>VAC</td>
<td>Vacant</td>
</tr>
<tr>
<td>OCC</td>
<td>Occupied</td>
</tr>
<tr>
<td>UNK</td>
<td>Unknown</td>
</tr>
</tbody>
</table>

A.4
Surveyor ID / ____________ Site ID / ____________ Building # ____________

7.A Supplemental Tenant Listings for the FIRST STORY.

<table>
<thead>
<tr>
<th>Street Name</th>
<th>Tenant Name</th>
<th>Share of First Floor</th>
<th>Bus. Code</th>
<th>Occ. Code</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

7.B If the building has more than one story, record the Business Code, and Occupancy Code for the first and second largest types of business activity occupying all floors ABOVE THE FIRST FLOOR. (See Handbook page 5-20.)

<table>
<thead>
<tr>
<th></th>
<th>First Largest</th>
<th>Second Largest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Code</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupancy Code</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7.C Record an explanation for any unknown codes or unusual circumstances. Example: "No tenant name found and building windows covered." (See Handbook page 5-23.)

________________________________________________________________________

________________________________________________________________________
8. Types of building use. Record the code which best characterizes the TYPE OF USE for the entire building or for the largest portion of the building's floor area. COMBINE THE FLOOR AREA FOR TENANTS WHICH HAVE THE SAME TYPE OF USE. (See Handbook page 5-23.)

[________]  
STR = Storage  
OFF = Office  
MAN = Manufacturing  
OTH = Other

9. Type of development. Which of the following best describes this building. Record the code for the most appropriate description. (See Handbook page 5-23.)

[________]  
FRE = Free Standing building  
SDV = Part of a Strip Development, a single row of abutting buildings, no covered or enclosed walkways between buildings.  
PLZ = Part of a Plaza, connected to other buildings by covered, but not enclosed, walkways  
MAL = Part of a Mall, connected to other buildings by enclosed walkways.

10. Estimate of building age. Record the code which best represents your estimate of the age of this building. (See Handbook page 5-23.)

[________]  
B80 = Built before 1980  
A80 = Built during or After 1980  
UCO = Under Construction  
UNK = Unknown

11. Building renovations. Is there any evidence that this structure has been renovated since the beginning of 1980? Record a YES or NO. (See Handbook page 5-24.)

[________]
12. Building Picture. Take a picture of the principal face of the building. With a red felt pen indicate on the picture the building boundaries. (See Handbook page 5-24.)

Attach Picture Here
APPENDIX B
Reference List for Business Type Codes

This appendix contains a list of all the business which should be assigned to each of the seventeen types of businesses used to classify tenants in item 7 of the Enumeration Form. [Note: The business descriptions listed in this appendix are excerpted from the Standard Industrial Classification Manual, Executive Office of the President, Office of Management and Budget, 1972.]

You will find the lists of businesses, assigned to each of the 17 possible business types, on the following pages:

<table>
<thead>
<tr>
<th>Business Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>WAR</td>
<td>B-2</td>
</tr>
<tr>
<td>DGR</td>
<td>B-3</td>
</tr>
<tr>
<td>GRO</td>
<td>B-5</td>
</tr>
<tr>
<td>RES</td>
<td>B-5</td>
</tr>
<tr>
<td>OFF</td>
<td>B-6</td>
</tr>
<tr>
<td>PRI</td>
<td>B-12</td>
</tr>
<tr>
<td>UNI</td>
<td>B-12</td>
</tr>
<tr>
<td>HTM</td>
<td>B-12</td>
</tr>
<tr>
<td>HOS</td>
<td>B-13</td>
</tr>
<tr>
<td>OHE</td>
<td>B-13</td>
</tr>
<tr>
<td>OTH</td>
<td>B-14</td>
</tr>
<tr>
<td>MAN</td>
<td>B-21</td>
</tr>
<tr>
<td>CON</td>
<td>B-22</td>
</tr>
<tr>
<td>SFM</td>
<td>B-22</td>
</tr>
<tr>
<td>MFM</td>
<td>B-22</td>
</tr>
<tr>
<td>LOB</td>
<td>B-22</td>
</tr>
<tr>
<td>UNK</td>
<td>B-23</td>
</tr>
</tbody>
</table>

Volume VI Handbook For First Stage Data Collection
MOTOR FREIGHT TRANSPORTATION AND WAREHOUSING

Trucking, Local and Long Distance
Public Warehousing
Terminal and Joint Terminal Maintenance Facilities for Motor Freight Transportation

WHOLESALE TRADE -- DURABLE GOODS

Motor Vehicles and Automotive Parts and Supplies
Furniture and Home Furnishings
Lumber and Other Construction Materials
Sporting, Recreational, Photographic, and Hobby Goods, Toys and Supplies
Metals and Minerals, Except Petroleum
Electrical Goods
Hardware, and Plumbing and Heating Equipment and Supplies
Machinery, Equipment, and Supplies
Scrap and Waste Materials
Jewelry, Watches, Diamonds and Other Precious Stones
Durable Goods, Not Elsewhere Classified

WHOLESALE TRADE -- NONDURABLE GOODS

Paper and Paper Products
Drugs, Drug Proprietaries and Druggists Sundries
Apparel, Piece Goods, and Notions
Groceries and Related Products
Farm-Product Raw Materials
Chemicals and Allied Products
Petroleum and Petroleum Products
Beer, Wine and Distilled Alcoholic Beverages
Miscellaneous Nondurable Goods
  Farm supplies
  Tobacco and tobacco products
  Paints, varnishes, and supplies
  Nondurable goods, not elsewhere classified
Appendix B

FOOD STORES
Candy, Nut, and Confectionery Stores
Retail Bakeries -- Selling Only
Retail Bakeries -- Baking and Selling

BUILDING MATERIALS, HARDWARE, GARDEN SUPPLY, AND MOBILE HOME DEALERS
Lumber and Other Building Materials Dealers
Paint, Glass, and Wallpaper Stores
Hardware stores
Nurseries, Lawn and Garden Supply Stores
Mobile Home Dealers

GENERAL MERCHANDISE STORES
Department Stores
Variety Stores
Miscellaneous General Merchandise Stores

AUTOMOTIVE AND BOAT DEALERS
Motor Vehicle Dealers (New and Used)
Motor Vehicle Dealers (Used Only)
Auto and Home Supply Stores
Boat Dealers
Recreational and Utility Trailer Dealers
Motorcycle Dealers
Automotive Dealers, Not Elsewhere Classified

APPAREL AND ACCESSORY STORES
Men's and Boys' Clothing and Furnishings Stores
Women's Ready-To-Wear Stores
Women's Accessory and Specialty Stores
Children's and Infants' Wear Stores
Family Clothing Stores
Shoe Stores
Furriers and Fur Shops
Miscellaneous Apparel and Accessory Stores

DGR = Dry Goods Retail
FURNITURE AND HOME FURNISHINGS, AND EQUIPMENT STORES

Furniture, Home Furnishings, and Equipment Stores, Except Appliances
Household Appliance Stores
Radio, Television, and Music Stores

MISCELLANEOUS RETAIL

Drug Stores and Proprietary Stores
Liquor Stores
Used Merchandise Stores
Miscellaneous Shopping Goods Stores
  Sporting goods stores and bicycle shops
  Book stores
  Stationery stores
  Jewelry stores
  Hobby, toy, and game shops
  Camera and photographic supply stores
  Gift, novelty, and souvenir shops
  Luggage and Leather goods stores
  Sewing, Needlework, and piece goods stores
  Retail Stores, Not Elsewhere Classified
  Florists
  Cigar stores and stands
  News dealers and newsstands
  Miscellaneous retail stores, not elsewhere classified

PHOTOCOPYING AND EQUIPMENT RENTAL

Blueprinting and Photocopying Services
Equipment Rental and Leasing Services

AUTOMOTIVE RENTAL AND LEASING

Passenger Car Rental and Leasing, Without Drivers
Truck Rental and Leasing, Without Drivers
Utility Trailer and Recreational Vehicle Rental
Appendix B

FOOD STORES -- WITH REFRIGERATION

Grocery Stores
Meat and Fish (Seafood) Markets, Including Freezer Provisioners
Fruit Stores and Vegetable Markets
Dairy Products Stores
Miscellaneous food stores
  Eggs and Poultry
  Health foods
  Spices
  Herbs
  Coffee
  Tea

EATING AND DRINKING PLACES

Eating and drinking places
OFFICE

FREIGHT FORWARDING AND ARRANGEMENT

Freight Forwarding
Arrangement of Passenger Transportation
Arrangement of Transportation of Freight and Cargo

BANKING

Federal Reserve Banks
Commercial and Stock Savings Banks
Mutual Savings Banks
Establishments Performing Functions Closely Related to Banking

CREDIT AGENCIES OTHER THAN BANKS

Rediscount and Financing Institutions for Credit Agencies Other than Banks
Savings and Loan Associations
Agricultural Credit Institutions
Personal Credit Institutions
Business Credit Institutions
Mortgage Bankers and Brokers

SECURITY AND COMMODITY BROKERS, DEALERS, EXCHANGES, AND SERVICES

Security Brokers, Dealers, and Flotation Companies
Commodity Contracts Brokers and Dealers
Security and Commodity Exchanges
Services Allied with the Exchange of Securities or Commodities

INSURANCE

Life Insurance
Accident and Health Insurance and Medical Service Plans
Fire, Marine, and Casualty Insurance
Surety Insurance
Title Insurance
Pension, Health, and Welfare Funds
Insurance Carriers, Not Elsewhere Classified

INSURANCE AGENTS, BROKERS, AND SERVICE

Insurance Agents, Brokers, and Service
Appendix B

REAL ESTATE

Real Estate Operators (Except Developers) and Lessors
Real Estate Agents and Managers
Title Abstract Offices
Subdividers and Developers

COMBINATIONS OF REAL ESTATE, INSURANCE, LOANS, LAW OFFICES

Combinations of Real Estate, Insurance, Loans, Law Offices

HOLDING AND OTHER INVESTMENT OFFICES

Holding Offices
Investment Offices
Trusts
Miscellaneous Investing
Oil Royalty Traders
Commodity Traders
Patent Owners and Lessors
Investors, not elsewhere classified
BUSINESS SERVICES

Advertising
Consumer Credit Reporting Agencies, Mercantile Reporting Agencies, and Adjustment and Collection Agencies
Direct Mail Advertising Services
Commercial Photography, Art, and Graphics
Stenographic Services; and Reproduction Services, Not Elsewhere Classified
Services to Dwellings and Other Buildings
News Syndicates
Personnel Supply Services
Computer and Data Processing Services
Management, Consulting, and Public Relations Services
Detective Agencies and Protective Services
Trading Stamp Services
Business Services, Not Elsewhere Classified
Bondsmen
Bottle exchanges
Drafting service
Interior designing
Lecture bureaus
Notary publics
Telephone message service
Water softening service
Auctioneering service on a commission or fee basis

MOTION PICTURE DISTRIBUTION

Motion Picture Distribution and Allied Services

AMUSEMENT AND RECREATION SERVICES, EXCEPT MOTION PICTURES

Theatrical Producers (Except Motions Pictures), Bands, Orchestras, and Entertainers

LEGAL SERVICES

Legal Services
OFF = OFFice

SOCIAL SERVICES

Individual and Family Social Services
Job Training and Vocational Rehabilitation Services
Social Services, Not Elsewhere Classified
Antipoverty boards
Community action agencies
Health and welfare councils
Parole offices
United fund councils

MEMBERSHIP ORGANIZATIONS

Business Associations
Professional Membership Organizations
Labor Unions and Similar Labor Organizations
Civic, Social, and Fraternal Associations
Political Organizations
Membership Organizations, Not Elsewhere Classified
A thlet ic associations - regul at or y only
Automobile owners' associations and clubs
Christian Science reading rooms
Farm bureaus
Farm granges
Historical clubs, other than professional
Humane societies, animal
Poetry associations

MISCELLANEOUS SERVICES

Engineering, Architectural, and Surveying Services
Noncommercial Educational, Scientific, and Research Organizations
Accounting, Auditing, and Bookkeeping Services
Services, Not Elsewhere Classified
Authors
Lecturers
Radio commentators
Song writers
Weather forecasters
Writers
Artists working on their own account
EXECUTIVE, LEGISLATIVE, AND GENERAL GOVERNMENT, EXCEPT FINANCE

Executive Offices
Legislative Bodies
Executive and Legislative Offices Combined
General Government, Not Elsewhere Classified
   Civil rights commissions
   Civil service commissions
   General accounting offices - government
   Government services departments
   Personnel agencies - government
   Purchasing and supply agencies - government

JUSTICE, PUBLIC ORDER, AND SAFETY

Courts
Police Protection
Legal Counsel and Prosecution
Fire Protection
Public Order and Safety, Not Elsewhere Classified
   Law Enforcement Assistance Administration
   Public safety bureaus

PUBLIC FINANCE, TAXATION, AND MONETARY POLICY

Public Finance, Taxation, and Monetary Policy

ADMINISTRATION OF HUMAN RESOURCES PROGRAMS

Administration of Educational Programs
Administration of Public Health Programs
Administration of Social, Manpower, and Income Maintenance Programs
Administration of Veterans' Affairs, Except Health and Insurance

ADMINISTRATION OF ENVIRONMENTAL QUALITY AND HOUSING PROGRAMS

Administration of Environmental Quality Programs
Administration of Housing and Urban Development Programs
ADMINISTRATION
OF
ECONOMIC
PROGRAMS

Administration of General Economic Programs
Regulation and Administration of Transportation Programs
Regulation and Administration of Communication, Electric, Gas, and Other Utilities
Regulation of Agricultural Marketing and Commodities
Regulation, Licensing, and Inspection of Miscellaneous Commercial Sectors

INTERNATIONAL AFFAIRS

Agency for International Development
Action
Consular Service
Diplomatic Service
Overseas Private Investment Corporation
Peace Corps
State Department
United States Information Service
Appendix B

PRI = Primary schools

ELEMENTARY AND SECONDARY EDUCATION

Elementary and Secondary Schools

UNI = Universities

POST-SECONDARY EDUCATION

Colleges, Universities, Professional Schools, and Junior Colleges
Correspondence Schools and Vocational Schools
Schools and Educational Services, Not Elsewhere Classified
Music schools
Dramatic schools
Language schools
Civil service and other short term examination preparatory schools

HTM = Hotel/Motel

HOTELS, ROOMING HOUSES, AND OTHER LODGING PLACES

Hotels, Motels, and Tourist Courts
Rooming and Boarding Houses, Including Dormitories
Organization Hotels and Lodging Houses, on Membership Basis

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Appendix B

HOSPITALS

General Medical and Surgical Hospitals
Psychiatric Hospitals
Specialty Hospitals, Except Psychiatric

HEALTH SERVICES

Offices of Physicians
Offices of Dentists
Offices of Osteopathic Physicians
Offices of Other Health Practitioners
Skilled Nursing Care Facilities
Nursing and Personal Care, Not Elsewhere Classified
  Convalescent homes with health care
  Domiciliary care with health care
  Homes for retarded with health care
  Personal care facilities with health care
  Personal care homes with health care
  Rest homes with health care
Medical and Dental Laboratories
Outpatient Care Facilities
  Family planning clinics
  Health maintenance organizations
  Outpatient treatment clinics for alcoholism
  Rehabilitation centers, outpatient (medical treatment)
  Speech defect clinics
Health and Allied Services, Not Elsewhere Classified
  Blood banks
  Blood donor stations
  Medical photography and art
  Oxygen tent service
  Visiting nurse associations

Volume VI  Handbook For First Stage Data Collection
RAILROAD TRANSPORTATION

Railroads

LOCAL AND SUBURBAN TRANSIT AND INTERURBAN HIGHWAY PASSENGER TRANSPORTATION

Local and Suburban Passenger Transportation
Taxis
Intercity and Rural Highway Passenger Transportation
Passenger Transportation Charter Service
School Buses
Terminal and Service Facilities for Motor Vehicle Passenger Transportation

U.S. POSTAL SERVICE

U.S. Postal Service

WATER TRANSPORTATION

Deep Sea Foreign Transportation
Deep Sea Domestic Transportation
Transportation on Rivers and Canals
Local Water Transportation
Services Incidental to Water Transportation
  Docks, including buildings and facilities: operation and maintenance
  Loading vessels
  Marine cargo handling
  Piers, including buildings and facilities operation and maintenance

TRANSPORTATION BY AIR

Air Transportation, Certificated Carriers
Air Transportation, Noncertificated Carriers
Fixed Facilities and Services Related to Air Transportation
  Aircraft cleaning and janitorial service
  Aircraft storage at airports
  Airports
  Hangar operations
  Air Freight Handling
  Airport Terminal Services

OTH = OTHER commercial
Appendix B

PIPE LINES, EXCEPT NATURAL GAS

Crude Petroleum Pipe Lines
Refined Petroleum Pipe Lines
Pipe Lines, Not Elsewhere Classified
  Coal pipe line operation
  Slurry pipe line operation

TRANSPORTATION SERVICES

Rental of Railroad Cars
Miscellaneous Services Incidental to Transportation
  Inspection and weighing services connected with transportation
  Packing and crating
  Highway bridges, operation of
  Toll bridge operation
  Toll roads, operation of
  Tunnel operation, vehicular
  Cabs, horse drawn: for hire
  Car loading
  Freight car loading and unloading (not truckers)
  Stockyards, not primarily for fattening or selling livestock

COMMUNICATION

Telephone Communication
Telegraph Communication
Radio and Television Brodcasting
Communication Services not Elsewhere Classified
  Cablevision service, rental to homes
  Phototransmission service
  Television antenna construction and rental
  Other telecommunication and communication services

ELECTRIC, GAS, AND SANITARY SERVICES

Electric Services
Gas Production and Distribution
Combination Electric and Gas, and Other Utility Services
Water Supply
Sanitary Services
Steam Supply
Irrigation Systems

OTH = OTHer commercial
DIRECT SELLING AND FUEL AND ICE DEALERS

Direct Selling Establishments
- Dairy products, house-to-house
- Huckster
- Ice cream wagons
- Lunch wagons
- Magazines, house-to-house selling

Fuel and Ice Dealers

CAMPS

Camps and Trailering Parks

PERSONAL SERVICES

Laundry Cleaning, and Garment Service
- Power laundries, family and commercial
- Garment pressing, and agents for laundries and dry cleaners
- Linen supply
- Diaper service
- Coin-operated laundries and dry cleaning
- Dry cleaning plants, except rug cleaning
- Carpet and Upholstery cleaning
- Industrial launderers
- Hand laundries
- Pillow cleaning and renovating
- Weaving textiles (mending service)

Photographic Studios, Portrait

Beauty Shops

Barber Shops

Shoe Repair Shops, Shoe Shine Parlors, and Hat Cleaning Shops

Funeral Service and Crematories

Miscellaneous Personal Services
- Baby-sitting bureaus
- Beauty spas
- Health clubs or spas
- Massage parlors
- Reducing salons
- Spas, health: except resort with lodging
- Turkish baths
- Valet parking
LABORATORIES

Miscellaneous Business Services
Research and development laboratories
Photofinishing laboratories
Commercial testing laboratories

GASOLINE SERVICE STATIONS

Gasoline Service Stations

AUTOMOTIVE REPAIR, SERVICES, AND GARAGES

Automobile Parking
Automotive Repair Shops
Automotive Services, Except Repair
Car washes
Diagnostic centers
Inspection service
Towing service
Undercoating cars

MISCELLANEOUS REPAIR SERVICES

Radio and Television Repair Shops
Electrical and Electronic Repair Shops, Not Elsewhere Classified
Watch, Clock and Jewelry Repair
Refrigeration and Air Conditioning Service and Repair Shops
Miscellaneous Repair Shops and Related Services
Welding repair
Armature rewinding shops
Bicycle repair shops
Blacksmith shops
Boiler repair shops
Engine repair, except automotive
Farm machinery repair
Harness repair shops
Horseshoeing
Lawn mower repair shops
Locksmith shops
Luggage repair shops
Motorcycle repair shops
MOTION PICTURE PRODUCTION AND THEATRES

Motion Picture Production, Except for Television
Motion Picture and Tape Production for Television
Services Allied to Motion Picture Production
  Casting bureaus
  Developing and printing of commercial motion picture film
  Laboratories, motion picture (service)
  Motion picture consultants
  Rental of motion picture equipment
  Wardrobe rental for motion picture film production
  Motion Picture Theatres

LIBRARIES

Libraries and Information Centers

AMUSEMENT AND RECREATION SERVICES, EXCEPT MOTION PICTURES

Dance Halls, Studios, and Schools
Bowling Alleys and Billiard and Pool Establishments
Professional Sports Clubs and Promoters
Racing, Including Track Operation
Miscellaneous Amusement and Recreation Services
  Public golf courses
  Coin-operated amusement devices
  Amusement parks
  Membership sports and recreation clubs
  Aerial tramways, amusement or scenic
  Amusement concessions
  Aquariums, commercial
  Botanical gardens, commercial
  Canoe rental
  Carnival operation
  Circus companies
  Game parlors (not coin-operated)
  Go cart raceway operation
  Karate instruction
  Picnic grounds operation
  Rental of bicycles
  Rental of golf carts
  Swimming pools
  Tennis courts, outdoor and indoor: operation of -- nonmembership
DAY CARE AND RESIDENTIAL CARE

Child Day Care Services
Residential Care (Health Care Incidental)
  Boys' towns
  Children's homes
  Homes for destitute men and women
  Homes for retarded
  Homes for the aged
  Homes for the deaf and blind
  Homes for the emotionally disturbed
  Old soldiers' homes
  Orphanages
  Rest homes
  Training schools for delinquents

MUSEUMS, ART GALLERIES, BOTANICAL AND ZOOLOGICAL GARDENS

Museums and Art Galleries
  Arboreta, Botanical, and Zoological Gardens

CHURCHES

Religious organization
  Churches
  Convents
  Monasteries
  Religious organizations

CORRECTIONAL INSTITUTIONS

Correctional Institutions

SPACE RESEARCH AND DEVELOPMENT

Space Research and Technology
  National Aeronautics and Space Administration
NATIONAL SECURITY

Air Force
Army
Civil Defense
Marine Corps
Military Training Schools
National Guard
Navy
MANUFACTURING

Food and Kindred Products
Tobacco Manufactures
Textile Mill Products
Apparel and Other Finished Products Made from Fabrics and Similar Materials
Lumber and Wood Products, Except Furniture
Furniture and Fixtures
Paper and Allied Products
Printing, Publishing, and Allied Industries
Chemicals and Allied Products
Petroleum Refining and Related Industries
Rubber and Miscellaneous Plastics Products
Leather and Leather Products
Stone, Clay, Glass, and Concrete Products
Primary Metal Industries
Fabricated Metal Products, Except Machinery and Transportation Equipment
Machinery, Except Electrical
Electrical and Electronic Machinery, Equipment, and Supplies
Transportation Equipment
Measuring, Analyzing, and Controlling Instruments; Photographic, Medical, and Optical Goods; Watches and Clocks
Miscellaneous Manufacturing Industries
Jewelry, silverware, and plated ware
Musical instruments
Toys and amusement, sporting, and athletic goods
Pens, pencils, and other office and artists' materials
Costume jewelry, costume novelties, buttons, and miscellaneous notions, except precious metal
Brooms and brushes
Signs and advertising
Burial caskets
Linoleum, asphalted-felt-base, and other hard surface floor covering, not elsewhere classified
Manufacturing industries, not elsewhere classified
CON = Construction

Building Construction -- General Contractors and Operative Builders
Construction Other than Building Construction -- General Contractors
Construction -- Special Trade Contractors

SFM = Single Family

Buildings which contain a single dwelling unit, but which also contain some type of business activity

MFM = Multi-Family

Buildings which contain more than one dwelling unit, but which also contain some type of business activity

LOB = LOBby/common

Portions of non-residential buildings which are used in common by more than one business.
\textit{UNK} = \textit{UNK}nown

Buildings or portions of buildings which can not be classified.