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PNNL-29787

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June 2020

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Joshua Butzbaugh
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U.S. DEPARTMENT OF ENERGY

Prepared for the U.S. Department of Energy
under Contract DE-AC05-76RL01830

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Richland, Washington 99354

Executive Summary

The U.S. Department of Energy (DOE) tasked Pacific Northwest National Laboratory (PNNL) with updating commercial building[1] construction weights for the purpose of estimating national and state-by-state energy savings impacts of changes made to various commercial energy codes and standards. A similar activity was last completed by PNNL in 2010 using disaggregate construction volume data acquired from the Dodge Data & Analytics database (formerly McGraw Hill) for the years 2003-2007 (Jarnagin and Bandyopadhyay, 2010). As time passes, changes in economic and social demand reshape construction volume trends. For the current update, PNNL reviewed the same data source with the latest construction data for the years 2003-2018.

For commercial building analyses, PNNL typically uses a suite of 16 prototype buildings simulated in the 19 ASHRAE climate zones with 16 of them present in the United States. The 2003-2018 commercial building weighting factors were created by refining and extending the approach used to develop the original 2003-2007 set (Jarnagin and Bandyopadhyay, 2010) with the objective of establishing a more accurate, comprehensive, repeatable, and fine-granular categorization method for mapping Dodge Data samples to the 16 prototype categories. Applying the construction volume data from the database to the prototypes and climate zones resulted in the following new construction area-based weighting factors. Table ES.1 shows the weighting factors including all building categories found in the database, and Table ES.2 shows the weighting factors normalized to include only buildings represented by the 16 prototypes. Section 3.0 also includes national- and state-level weighting factors by area and building count.

Table ES.1. Square footage percentage weighting factors aggregated by climate zone (CZ) and prototype category (including 'No Prototype[2]').

	1A	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8	Weight by Bldg Type
Large Office	0.08	0.41	0.05	0.41	0.19	0.17	0.85	0.00	0.18	0.36	0.12	0.00	0.07	0.00	0.01	0.00	2.89
Medium Office	0.11	0.58	0.15	0.54	0.33	0.12	0.71	0.02	0.13	0.66	0.23	0.00	0.13	0.02	0.02	0.00	3.76
Small Office	0.08	0.58	0.12	0.52	0.21	0.04	0.43	0.02	0.07	0.50	0.15	0.00	0.10	0.02	0.01	0.00	2.85
Stand-alone Retail	0.22	1.35	0.23	1.33	0.64	0.09	1.44	0.06	0.20	1.78	0.40	0.01	0.37	0.05	0.04	0.00	8.21
Strip Mall	0.12	0.48	0.10	0.52	0.32	0.07	0.50	0.01	0.07	0.46	0.09	0.00	0.04	0.01	0.01	0.00	2.79
Primary School	0.10	0.73	0.09	0.70	0.27	0.03	0.66	0.02	0.09	0.58	0.17	0.00	0.12	0.04	0.01	0.00	3.62
Secondary School	0.20	1.40	0.14	1.62	0.58	0.10	1.48	0.05	0.20	1.63	0.38	0.01	0.28	0.07	0.05	0.00	8.19
Hospital	0.07	0.56	0.08	0.47	0.24	0.07	0.69	0.02	0.10	0.71	0.18	0.01	0.15	0.02	0.02	0.00	3.39
Outpatient Healthcare	0.04	0.41	0.07	0.40	0.13	0.03	0.46	0.02	0.07	0.60	0.15	0.00	0.14	0.02	0.02	0.00	2.57
Full Service Restaurant	0.02	0.13	0.02	0.13	0.06	0.01	0.12	0.01	0.02	0.15	0.03	0.00	0.02	0.00	0.00	0.00	0.73
Quick Service Restaurant	0.01	0.05	0.01	0.05	0.02	0.00	0.04	0.00	0.00	0.05	0.01	0.00	0.01	0.00	0.00	0.00	0.25
Large Hotel	0.13	0.53	0.08	0.42	0.41	0.07	0.61	0.02	0.10	0.49	0.14	0.00	0.11	0.03	0.02	0.00	3.17
Small Hotel	0.02	0.23	0.02	0.20	0.08	0.01	0.23	0.01	0.02	0.20	0.07	0.00	0.06	0.02	0.01	0.00	1.19
Non-Refrigerated Warehouse	0.40	2.65	0.47	2.08	1.68	0.14	2.77	0.04	0.41	2.35	0.61	0.00	0.28	0.02	0.03	0.00	13.92
High-rise Apartment	1.08	0.89	0.06	0.43	0.47	0.22	2.45	0.00	0.37	1.02	0.14	0.00	0.08	0.01	0.00	0.00	7.23
Mid-rise Apartment	0.27	1.68	0.20	1.33	0.88	0.37	2.26	0.02	0.53	1.66	0.55	0.00	0.43	0.04	0.03	0.00	10.27
No Prototype	1.09	3.93	0.63	3.89	2.31	0.66	4.53	0.13	0.89	4.40	1.23	0.02	0.97	0.14	0.13	0.02	24.97
Weights by Zone	4.04	16.58	2.51	15.07	8.81	2.21	20.25	0.46	3.44	17.61	4.67	0.06	3.34	0.50	0.42	0.04	100.00

[1] Throughout this report, the term commercial buildings is used to include both commercial buildings and multi-family residential buildings above three stories in height, as those are the buildings covered under the scope of what are typically referred to as commercial or non-residential building codes.
[2] 'No prototype' represents any building type found in the Dodge Database that cannot be mapped to one of the 16 prototypes.

Table ES.2. Square footage percentage weighting factors aggregated by climate zone and prototype category (excluding 'No Prototype').

	1A	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8	Weights by Bldg Type
Large Office	0.11	0.54	0.07	0.54	0.26	0.23	1.13	0.00	0.24	0.48	0.15	0.00	0.09	0.00	0.01	0.00	3.86
Medium Office	0.14	0.78	0.19	0.73	0.45	0.16	0.95	0.03	0.17	0.88	0.31	0.00	0.17	0.03	0.02	0.00	5.01
Small Office	0.11	0.77	0.15	0.70	0.27	0.05	0.58	0.03	0.09	0.67	0.21	0.00	0.13	0.02	0.02	0.00	3.80
Stand-alone Retail	0.29	1.79	0.31	1.78	0.85	0.12	1.92	0.08	0.26	2.37	0.54	0.01	0.49	0.06	0.06	0.01	10.94
Strip Mall	0.16	0.63	0.14	0.70	0.42	0.09	0.66	0.02	0.09	0.61	0.12	0.00	0.06	0.01	0.01	0.00	3.71
Primary School	0.13	0.98	0.12	0.94	0.36	0.04	0.88	0.03	0.12	0.77	0.23	0.00	0.16	0.05	0.02	0.00	4.83
Secondary School	0.26	1.86	0.19	2.16	0.77	0.14	1.98	0.07	0.27	2.18	0.51	0.01	0.37	0.09	0.06	0.01	10.92
Hospital	0.09	0.75	0.11	0.63	0.32	0.10	0.92	0.03	0.13	0.95	0.23	0.01	0.20	0.03	0.03	0.00	4.52
Outpatient Healthcare	0.05	0.54	0.09	0.53	0.17	0.04	0.62	0.02	0.10	0.80	0.20	0.00	0.18	0.03	0.03	0.00	3.42
Full Service Restaurant	0.03	0.18	0.03	0.17	0.08	0.01	0.16	0.01	0.02	0.19	0.04	0.00	0.03	0.00	0.00	0.00	0.97
Quick Service Restaurant	0.01	0.07	0.01	0.06	0.02	0.00	0.06	0.00	0.00	0.07	0.02	0.00	0.01	0.00	0.00	0.00	0.33
Large Hotel	0.18	0.71	0.10	0.56	0.55	0.09	0.82	0.02	0.13	0.65	0.19	0.00	0.14	0.04	0.02	0.00	4.22
Small Hotel	0.03	0.30	0.02	0.27	0.11	0.02	0.30	0.01	0.03	0.27	0.10	0.00	0.08	0.03	0.02	0.00	1.59
Non-Refrigerated Warehouse	0.53	3.53	0.63	2.77	2.23	0.18	3.69	0.05	0.54	3.14	0.82	0.00	0.37	0.03	0.04	0.00	18.56
High-rise Apartment	1.44	1.19	0.08	0.57	0.63	0.29	3.26	0.00	0.49	1.36	0.19	0.00	0.11	0.01	0.00	0.00	9.64
Mid-rise Apartment	0.36	2.24	0.27	1.78	1.18	0.49	3.02	0.03	0.71	2.22	0.73	0.01	0.57	0.05	0.04	0.00	13.69
Weights by Zone	3.94	16.85	2.52	14.89	8.67	2.06	20.94	0.43	3.39	17.60	4.59	0.05	3.17	0.49	0.38	0.03	100.00

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Yan Chen, Task Lead
Pacific Northwest National Laboratory

Acronyms and Abbreviations

ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
CBECS	Commercial Buildings Energy Consumption Survey
DOE	U.S. Department of Energy
EIA	Energy Information Administration
EUI	energy use intensity
HVAC	heating, ventilation, and air conditioning
IECC	International Energy Conservation Code
IES	Illuminating Engineering Society
IESNA	Illuminating Engineering Society of North America
LBNL	Lawrence Berkeley National Laboratory
PBA	principal building activity
PI	Progress Indicator
PNNL	Pacific Northwest National Laboratory
SSPC	Standing Standard Project Committee
TMY	typical meteorological year

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1.0 Introduction

When evaluating the impacts of technologies applied to buildings, stakeholders are not only interested in those on individual buildings but also, the aggregated impacts at state, regional or national scale. Such evaluations are particularly helpful for market research and policy decisions for technology adoption and development. The aggregation requires the building stock to be characterized and generalized to representative building categories, to which the technologies are applicable. When the weighting factors of the representative categories are available, the impacts on individual category can be aggregated. Pacific Northwest National Laboratory (PNNL) researchers established a methodology for evaluating commercial building energy code changes (Thornton et al., 2011 and Hart and Liu 2015) and used it in various analyses for state and national codes (Chen et al., 2019, Zhang et al., 2015, and Athalye et al., 2016a). In those analyses, weighting factors developed by Jarnagin and Bandyopadhyay (2010) for commercial buildings constructed from 2003 to 2007 were used. As time passes, changes in economic and social demand reshape construction volume trends; thus, a newer and wider range dataset can improve aggregated energy impact analyses. Therefore, PNNL initiated this analysis of new construction weighting factors based on the 2003-2018 dataset.

1.1 Significance of Commercial Building Weights

In support of the U.S. Department of Energy's (DOE's) Building Energy Codes Program, PNNL provides technical analysis for ANSI/ASHRAE/IES[1] Standard 90.1 (herein referred to as Standard 90.1) with the aim of guiding its development toward increased levels of energy efficiency. As part of this process, PNNL uses the Progress Indicator (PI) methodology (Thornton et al., 2011) to track the national impact of Standard 90.1 throughout the standard's three-year development cycle, and periodically reports the results to Standing Standard Project Committee (SSPC) 90.1. The PI applies the requirements of two different editions of the standard—the new edition compared to the previous—to a suite of established prototype energy models, including 16 building types in the 16 ASHRAE climate zones found in the United States (DOE and PNNL, 2020). The savings are computed using energy simulation software, EnergyPlus™, and the results aggregated across building types and climate zones using weighting factors based on new-building permit data to provide a single national savings number in accordance with Equation B.1. The prototype buildings are listed in Table 1.

$$EUI_{weighted} = \sum_{i=1}^{n} \sum_{j=1}^{m} wt_{i,j} \times EUI_{i,j} \quad (1)$$

Where

$EUI_{weighted}$ = weighted average EUI (kBtu/sf)
$EUI_{i,j}$ = EUI for building prototype i in climate zone j (kBtu/sf)
$wt_{i,j}$ = construction weight for prototype i in climate zone j
m = total number of prototypes
n = total number of climate zones.

Table 1. Commercial Prototype Building Models

Building Category	Prototype Building
Office	Small Office
	Medium Office
	Large Office
Retail	Stand-Alone Retail
	Strip Mall
Education	Primary School
	Secondary School
Health Care	Outpatient Health Care
	Hospital
Lodging	Small Hotel
	Large Hotel
Warehouse	Non-Refrigerated Warehouse
Food Service	Quick Service Restaurant
	Full Service Restaurant
Apartment	Mid-rise Apartment
	High-rise Apartment

Based on commercial building weights developed in 2010, these prototype buildings represent 80% of the U.S. commercial building floor area, and over 70% of the energy consumed in U.S. commercial buildings (Jarnagin and Bandyopadhyay, 2010, Thornton et al., 2011). Descriptions of the prototype buildings are provided in Thornton et al. (2011). Building energy simulations model the energy characteristics of the prototype buildings in various climate zones described in ASHRAE Standard 169-2013 (ASHRAE 2013). There are eight temperature-based climate zones which are further divided into moist and dry regions, resulting in a total of 19 climate zones, 16 of which are present in the United States. For each of the 16 U.S. zones, a representative climate location (city) was selected along with a typical meteorological year (TMY3) weather file that represents typical weather conditions over the course of a year. These weather files, which are used in energy simulations, are the same set approved by SSPC 90.1 for setting the criteria for Standard 90.1. The current combination of 16 prototype buildings and 16 climate zones results in an overall set of 256 combinations for U.S. analyses (DOE, 2019). The climate zones and representative cities are shown in Table 2.

Table 2. U.S. Climate Zones and Representative Cities

Zone Number	Climate Zone	Representative City
1A	Very Hot-Humid	Honolulu, Hawaii
2A	Hot-Humid	Tampa, Florida
2B	Hot-Dry	Tucson, Arizona
3A	Warm-Humid	Atlanta, Georgia
3B	Warm-Dry	El Paso, Texas
3C	Warm-Marine	San Diego, California
4A	Mixed-Humid	New York, New York
4B	Mixed-Dry	Albuquerque, New Mexico
4C	Mixed-Marine	Seattle, Washington
5A	Cool-Humid	Buffalo, New York

5B	Cool-Dry	Denver, Colorado
5C	Cool-Marine	Port Angeles, Washington
6A	Cold-Humid	Rochester, Minnesota
6B	Cold-Dry	Great Falls, Montana
7	Very Cold	International Falls, Minnesota
8	Subarctic	Fairbanks, Alaska

1.2 Source of Construction Weight Data

To develop a comprehensive set of national weighting factors for commercial building construction, PNNL sought data that was national in scope, logically organized, defensible, and capable of disaggregation into the commercial building prototypes across climate zones. Using these criteria, two datasets were considered: Energy Information Administration (EIA) 2012 Commercial Building Energy Consumption Survey (CBECS) (EIA, 2015) and the Dodge Data & Analytics Construction Projects Starts Database (herein referred to as Dodge Data) (Dodge Data & Analytics, 2020).

The CBECS is a national, multistage probability sample of commercial buildings with basic statistical information on energy-related characteristics and energy usage of sampled buildings. While the CBECS building characteristic and operational data is valuable for certain types of building analysis, this dataset has some limitations for developing weighting factors for new construction. For example, the CBECS dataset aims to statically represent the whole spectrum of existing commercial buildings, not only recent years of new construction and the dataset is disaggregated at the census division level (i.e., nine U.S. geographic regions), not by climate zones. In addition, the dataset doesn't include mid- or high-rise residential buildings, which are included in the scope of Standard 90.1.

The Dodge Data is based on building construction permit data and includes samples for recent years of new construction, additions, and alterations. The data collection process is monitored to ensure coverage of most commercial construction nationally; the data represents a valid statistical segment of all construction projects, and according to Dodge, covers at least 90% of total projects for each year in the dataset. The Dodge Data is advantageous for the number of samples, the geographic coverage, and inclusion of mid- and high-rise apartment buildings.

Based on the above considerations, the Dodge Data was chosen as the source for developing the weighting factors for commercial building prototypes. Data for the calendar years 2003 through 2018 was acquired by DOE to calculate weighting factors. After dropping duplicate samples from the raw data PNNL obtained, this dataset includes 1,085,104 individual samples of commercial building construction across the United States, covering a total of nearly 23.2 billion square feet. Each sample in the Dodge Data includes up to 18 independent fields for a specific construction project, depending on the year.

2.0 Methodology

The core task of this analysis is to develop a set of logic procedures to categorize samples from the Dodge Data to specific categories based on each sample's characteristic features. This categorization process is essentially a classification task (Stefik, 2014), which begins with input data settings (building characteristic features) and identifies categories as solutions.

Classification approaches have been used in areas such as human factor analysis (Wiegmann and Shappell, 2017) and medical diagnostic problems (Fearon et al., 2011). In the building and HVAC system domain, Lei (2019) proposed a classification system that formalized the specification of potential control logic faults for air handling unit systems based on characteristics.

The categorization approach for the 2003-2018 commercial building weighting factors was developed by refining and extending the approach used for the original 2003-2007 weighting factors (Jarnagin and Bandyopadhyay, 2010) with the objective of establishing a more accurate, comprehensive, repeatable, and fine-granular categorization method for mapping up-to-date Dodge Data samples. It behaves as the knowledge-based mapping mechanism in a classification system paradigm (Stefik, 2014) that maps one Dodge Data sample into one of the target categories.

Target categories were defined in four aspects: 1) Prototype; 2) CBECS principal building activity (PBA); 3) CBECS principal building activity subcategory (PBAPlus); and 4) Additional Non-Prototype – a set of subcategories that do not belong to a prototype (i.e., 'No Prototype'). That is, each target category is defined by the combined values from all four aspects. For example, a sample may be categorized to "Prototype: 'Hospital'; CBECS PBA: 'Inpatient Health Care'; CBECS PBAPlus: '35: Hospital/inpatient health'; Additional Non-Prototype: 'Other'. The Prototype aspect contains 17 possible values, 16 prototype building names and a 'No Prototype' choice for samples that do not belong to any of the 16 prototype building categories. While an attempt was made to assign values in the other three aspects for all Dodge Data samples, these three aspects are mainly used to help understand weighting characteristics of non-prototype buildings which has a Prototype value of 'No Prototype'.

By using the fields offered by Dodge for its building samples, whether individually or in combination with one another, the authors developed a knowledge-based categorization approach that assigned building samples to target categories. This approach contains two types of categorizations. Every Dodge building sample has a data field called 'Project Type', which depicts the category of building or primary building activity. Many samples can be assigned a target category solely based on values of this 'Project Type'. This type of categorization is referred to as Direct mapping from Project Types. However, there are still many samples that require additional information for them to be categorized properly. Every Dodge sample has a 'Project Title' that serves as a description of the building construction project, often providing specific information on the building sample such as the business or organization occupying the building, features of construction (e.g., bathrooms), or location (e.g., north side). In some cases, data in the project title provides little to no contextual information. Dodge building samples also offer building characteristics information that can be helpful for categorization like the number of stories and square footage. This more sophisticated type of categorization that uses additional information is referred to as Expanded rule-based mapping and is further formulated into a set of logic procedures each executed against all samples to be categorized. Figure 1 illustrates the high-level design and execution flow of this categorization while simplifying other preprocessing, postprocessing and analysis procedures conducted in this analysis.

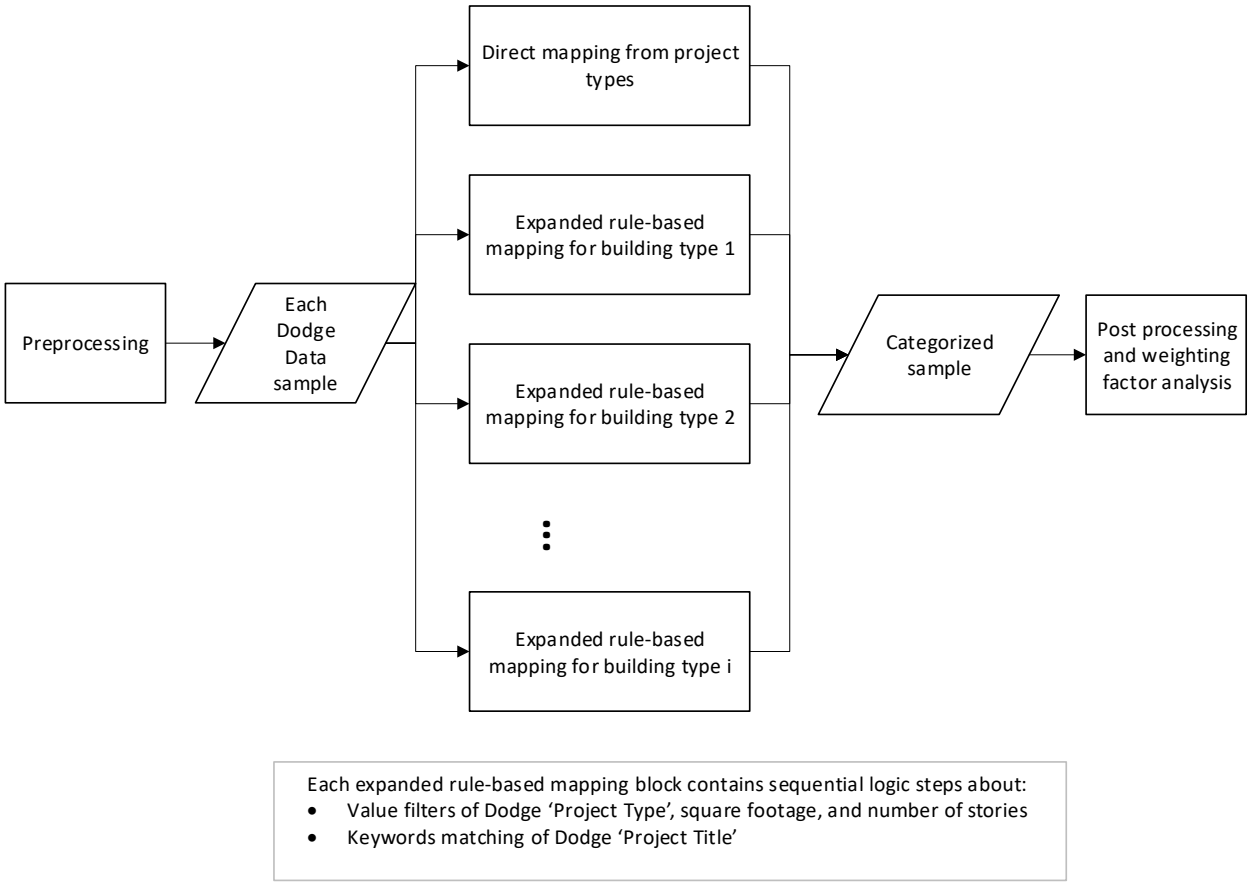

Figure 1. Categorization method design and execution flowchart

The developed knowledge-based categorization logic is organized into two layers. At a higher layer, logic sets are organized into blocks that run in parallel with each other (vertically aligned boxes illustrated in Figure 1). Each block is independent, that is, the categorization results of one block do not depend on other parallel blocks, thus the running sequence does not affect the categorization results. This enables the categorization to treat target categories "fairly" at a higher level. In this scenario, it also creates the chances of a sample being assigned multiple categories, which calls for revisions to the categorization logic with the objective of maximizing the number of samples being assigned to a single target category. At a lower layer, that is, within each expanded rule-based mapping logic block, the logic rules are sequentially organized to conduct filters of different Dodge fields and keywords matching Dodge 'Project Title', which naturally encodes our engineering knowledge of categorizing samples.

A set of prototype-specific keywords was developed to expand upon the rule-based mapping logic. The logic (sequential rules) of conducting keywords matching for each prototype is described in detail later in this section, and the developed keywords are summarized in Appendix A (Table A.3-A.5).

2.1 Workflow Overview

Incorporating the developed sample categorization approach described above, the general workflow to develop the weighting factors of commercial building prototypes from the Dodge Data consists of the following steps:

1. Clean raw dataset
2. Assign samples to categories
3. Validate categorization results
4. Map samples to ASHRAE climate zones
5. Calculate weighting factors

Details and intermediate results of each step are discussed in separate subsections. Upon the completion of the above five general steps, the following main objectives are expected to be met:

1. Assign most of the considered dataset samples (each sample corresponding to one unique new construction project) to a unique target category with an overall mapping accuracy of 90% or higher.
2. Assign correct climate zones to most of the dataset samples.
3. Extract weighting factors based on all samples being assigned unique prototype categories and climate zones.
4. Summarize weighting factors into tables that can be applied to building level energy metrics for aggregation at a state or national level.

2.2 Data Preprocessing

The Dodge Data was prepared and cleaned prior to the categorization of building samples. Data was merged from five datasets. Data was removed for building alteration samples and building construction with zero square footage. In addition, manufacturing facilities and residential buildings less than four stories were excluded from the analysis dataset.

2.2.1 Data Merge

PNNL recently acquired dataset files from Dodge Data & Analytics, covering construction projects samples from 2008 to 2018 and combined those with the 254,158 samples covering 2003 to 2007, which were used in the previous weighting factors report (Jarnagin and Bandyopadhyay, 2010). In total, 1,085,104 samples were acquired with the following 16 common features:

- Dodge Report Number (eight-digit number)
- Dwelling Units (number of dwelling units)
- New/Add/Alt (categorical: NEW / ADD / ALL)

- Ownership (categorical: County / Private / Federal / State / Municipal)
- Project Addr1 (primary string of street address)
- Project Addr2 (secondary string of street address)
- Project City (city name)
- Project County (county name)
- Project State (state name)
- Project Title (project title)
- Project Type (categorical of 133 types)
- Project Zipcode
- STRYS (number of stories)
- Square Footage ('000s)
- Start YearMo (project start date)
- Value ('000s) (cost in thousands of U.S. Dollars)

2.2.2 Discard "ALT" Construction Projects

In the raw dataset, column 'New/Add/Alt' specifies whether the construction project is a new building, an addition to an existing building, or renovation (alteration) of existing building space. To summarize information about newly constructed floor space, renovation construction projects were excluded since they did not involve an addition of new square footage. Thus, all samples having a value of 'ALT' in column 'New/Add/Alt' were removed. This operation dropped a total of 499,583 samples and kept 585,521 samples with a total area of 23,182,978 thousand square feet.

2.2.3 Drop Samples with 0 Square Footage

After the above steps, there were 2,592 building samples having a value of 0 in column 'Square Footage ('000s)'. It is unclear why these New/Add construction projects have 0 square footage; therefore, they were excluded from the analysis. After this operation, 582,929 samples were left.

2.2.4 Drop Building Samples with Excluded Project Types

Before categorizing the building samples, samples that are out of the scope of commercial building prototypes need to be excluded. Samples with value of feature 'Dodge Project Type' being one of the 81 excluded project types (various manufacturing and low-rise residential) were dropped and excluded from the following analysis. The complete list of excluded project types is provided in Appendix A (Table A.1). A total of 34,518 samples with excluded project types were dropped and 548,411 samples with a total area of 20,595,458 thousand square feet were kept for the next step of sample categorization.

2.3 Categorization Implementation

This section describes the implementation of the developed categorization approach in detail. The subsections are organized by the concept of logic blocks (vertically aligned boxes in Figure 1) with the first subsection being about direct mapping from project types and the rest of the

sections each about one of the expanded mapping logic rules. The methodology logic of each subsection is applied to all 548,411 building samples. To prevent a building sample from being assigned into multiple prototype categories or falling into none of the categories, the authors iteratively designed the methodology logic aiming at maximizing the number of samples being assigned to a unique target category, thus achieving optimal accuracy of the categorization of building samples.

2.3.1 Direct Mapping from Project Types

This is a relatively straightforward way of mapping the Dodge Data into categories, in which data in the Dodge field ‘Project Type’ is mapped directly to prototypes, CBECS PBA, CBECS PBAPlus, and Additional Non-Prototype categories. A total of 37 Dodge project types are mapped directly to corresponding categories. The direct mapping table is available in Appendix A (Table A.2). Around 45% of the Dodge samples are categorized with this direct mapping.

2.3.2 Expanded Mapping Logic for Hotels

To determine the square footage of the ‘Large Hotel’ and ‘Small Hotel’ commercial prototype buildings, data was drawn from the Dodge project types ‘Hotels/Motels (Stories Unknown or Alts)’, ‘Hotels/Motels 1-3 Stories’, ‘Hotels/Motels 4+ Stories’, and ‘Clubs and Lodges’.

For the Dodge project type ‘Clubs and Lodges’, a list of hotel keywords was developed to identify which samples with this project type to designate as hotels. This was achieved by searching the Dodge project title field for words matching those in the ‘Hotel’ keywords list, which is available in Appendix A (Table A.3).

After identifying the hotel samples from ‘Clubs and Lodges’, the comprehensive list of hotel samples was disaggregated into ‘Large Hotel’ and ‘Small Hotel’ prototypes by square footage. Samples with greater than 60,000 square feet were assigned to ‘Large Hotel’ whereas samples of 60,000 square feet or less were assigned to ‘Small Hotel’. The distinction of 60,000 square feet was based on the hotel methodology from the previous weighting factors (developed using 2003-2007 data) (Jarnagin and Bandyopadhyay, 2010).

Step-by-step logic details

1. The sample is categorized to hotel if one of the following two conditions is satisfied:
    a. Sample ‘Project Type’ is 'Hotels/Motels (Stories Unknown or Alts)', 'Hotels/Motels 1-3 Stories', or 'Hotels/Motels 4+ Stories'.
    b. Sample ‘Project Type’ is 'Clubs and Lodges' and sample ‘Project Title’ contains ‘Hotel’ keywords.
2. For a sample that is categorized to hotel:
    a. If its ‘Square Footage (000s)’ is greater than 60, assign the sample to ‘Large Hotel’.
    b. If its ‘Square Footage (000s)’ is less than or equal to 60, assign the sample to ‘Small Hotel’.

2.3.3 Expanded Mapping Logic for Apartments

To determine the square footage of the 'Mid-rise Apartment' and 'High-rise Apartment' commercial prototype buildings, data was drawn from the Dodge project types 'Apartments 5+ Units, 4+ Stories', and 'Clubs and Lodges'.

For the Dodge project type 'Clubs and Lodges', a list of apartment building keywords was developed to identify which samples with this project type to designate as apartment buildings. This was achieved by searching the Dodge project title field for words matching those in the 'Apartment' keywords list, which is available in Appendix A (Table A.3).

After identifying the apartment building samples from 'Clubs and Lodges', the comprehensive list of apartment building samples was disaggregated into 'Mid-rise Apartment' and 'High-rise Apartment' prototypes by number of stories. Samples with seven or more stories were mapped to the 'High-rise Apartment' prototype whereas samples with fewer than seven stories were mapped to the 'Mid-rise Apartment' prototype. The distinction of seven stories was based on the apartment building methodology from the previous weighting factors (developed using 2003-2007 data) (Jarnagin and Bandyopadhyay, 2010). The 'Mid-rise Apartment' protype has four floors whereas the 'High-rise Apartment' prototype has 10 floors, and seven floors is the midpoint to distinguish between the two apartment prototypes (DOE, 2019).

Step-by-step logic details

1. The sample is categorized to apartment if one of the following two conditions is satisfied:
    a. Sample 'Project Type' is 'Apartments 5+ Units, 4+ Stories'.
    b. Sample 'Project Type' is 'Clubs and Lodges' and sample 'Project Title' contains 'Apartment' keywords.
2. For a sample that is categorized to apartment:
    a. If its 'STRYS' is larger than or equal to 7, assign the sample to 'High-rise Apartment'.
    b. If its 'STRYS' is larger than 0 and smaller than 7, assign the sample to 'Mid-rise Apartment'.[1]
    c. If its STRYS' is 0, then:
        i. If its 'Square Footage (000s)' is greater than 59, assign the sample to 'High-rise Apartment'.
        ii. If its 'Square Footage (000s)' is less than or equal to 59, assign the sample to 'Mid-rise Apartment'.

[1] Dodge project type Apartments 5+ Units, 4+ Stories excludes apartment buildings with three or fewer stories, which are covered by ASHRAE 90.2, Energy-Efficient Design of Low-Rise Residential Buildings.

2.3.4 Expanded Mapping Logic for Offices

To determine the square footage of the Small, Medium, and Large Office commercial prototype buildings, data was drawn from the Dodge project types ‘Banks/Financial 1-3 Stories’, ‘Banks/Financial 4+ Stories’, Offices 1-3 Stories’, ‘Offices 4+ Stories’, ‘Armories/Military Buildings’, ‘Capitols/Court Houses/City Halls’, and ‘Communications Buildings’. From reviewing samples within these Dodge project types, a portion of the samples were recognized as data centers. As a result, data centers were identified first from these samples with ‘Data Center’ keywords list, which is available in Appendix A (Table A.3).

For the Dodge project types ‘Armories/Military Buildings’, ‘Capitols/Court Houses/City Halls’, and ‘Communications Buildings’, a list of office building keywords was developed to identify which samples within these project types to designate as office buildings. This was achieved by searching the Dodge project title field for words matching those in the ‘Office’ keywords list, which is available in Appendix A (Table A.3).

After identifying the office building samples from the ‘Armories/Military Buildings’, ‘Capitols/Court Houses/City Halls’, and ‘Communications Buildings’, the comprehensive list of office building samples was disaggregated into ‘Small Office’, ‘Medium Office’, and ‘Large Office’ prototypes by number of stories. Samples with one story were designated as ‘Small Office’, samples with two to four stories were designated as ‘Medium Office’, and samples with five or more stories were designated as ‘Large Office’. These distinctions were based on the office building methodology from the previous weighting factors (developed using 2003-2007 data) and fall at or between the number of stories for the three office prototypes (Jarnagin and Bandyopadhyay, 2010). The ‘Small Office’ prototype has one floor, ‘Medium Office’ prototype has three floors, and ‘Large Office’ prototype has 12 floors plus a basement (DOE, 2019).

Step-by-step logic details

1. The sample is categorized to ‘No Prototype’ with Additional Non-Prototype category of ‘Data Center’ if it satisfies both of the following conditions. In this case, subsequent steps are skipped.

    a. Sample ‘Project Type’ is 'Banks/Financial, 1-3 stories', 'Banks/Financial, 4+ stories', or 'Offices, 1-3 stories' or 'Offices, 4+ stories'.

    b. Sample ‘Project Title’ contains ‘Data Center’ keywords.

2. The sample is categorized to office if one of the following two conditions is satisfied:

    a. Sample ‘Project Type’ is 'Banks/Financial, 1-3 stories', 'Banks/Financial, 4+ stories', 'Offices, 1-3 stories', or 'Offices, 4+ stories'.

    b. Sample ‘Project Type’ is 'Armories/Military Buildings', 'Capitols/Court Houses/City Halls', or 'Communications Buildings'; and sample ‘Project Title’ contains the ‘Office’ keywords.

3. If the sample is not categorized to office and its ‘Project Type’ is ‘Armories/Military Buildings’, assign the sample to ‘No Prototype’ with CBECS PBA category ‘Public order and safety’ and CBECS PBAPlus category ‘17': Other public order and safety’. In this case, subsequent steps are skipped.

4. For a sample that is categorized to office:
    a. If its ‘STRYS’ is greater than 4, assign the sample to ‘Large Office’.
    b. If its ‘STRYS’ is greater than 1 and less than or equal to 4, assign the sample to ‘Medium Office’.
    c. If its ‘STRYS’ is 1, assign the sample to ‘Small Office’.
    d. If its ‘STRYS’ is 0:
        i. If its ‘Square Footage (000s)’ is greater than 150, assign the sample to ‘Large Office’.
        ii. If its ‘Square Footage (000s)’ is greater than 15 and less than or equal to 150, assign the sample to ‘Medium Office’.
        iii. If its ‘Square Footage (000s)’ is less than or equal to 15, assign the sample to ‘Small Office’.

2.3.5 Expanded Mapping Logic for Dodge ‘Clinics/Nursing Convalescent Facilities’

To determine the square footage of the ‘Hospital’ and ‘Outpatient Healthcare’ commercial prototype buildings, data was drawn from the Dodge project types ‘Clinics/Nursing Convalescent Facilities’, ‘Shopping Centers’, and ‘Stores’. A list of ‘Outpatient Healthcare’ keywords was developed to identify which samples within these project types to designate as ‘Outpatient Healthcare’. A list of ‘Hospital’ keywords was also developed, but only applied to samples with the project type ‘Clinics/Nursing Convalescent Facilities’ for designating samples as ‘Hospital’. The assignment of prototypes using keywords was achieved by searching the Dodge project title field for words matching those in the ‘Outpatient Healthcare’ and ‘Hospital’ keywords lists, which are available in Appendix A (Table A.3).

For the project type ‘Clinics/Nursing Convalescent Facilities’, there was a remainder of samples that did not contain ‘Outpatient Healthcare’ or ‘Hospital’ keywords. After reviewing the project titles for these remaining samples, it was decided to split them between the ‘Hospital’ and ‘Outpatient Healthcare’ prototypes by assigning samples with 100,000 or less square feet to ‘Outpatient Healthcare’ and samples with greater than 100,000 square feet to ‘Hospital’. The bound of 100,000 square feet was an estimate that falls between the ‘Outpatient Healthcare’ prototype area of 41,000 square feet and ‘Hospital’ prototype area of 241,000 square feet.

Step-by-step logic details

1. Proceed with subsequent steps if the sample ‘Project Type’ is ‘Clinics/Nursing Convalescent Facilities’; otherwise, skip subsequent steps.
2. If the sample ‘Project Title’ contains ‘Hospital’ keywords, categorize the sample to ‘Hospital’ and skip the subsequent steps.
3. If the sample ‘Project Title’ contains ‘Outpatient’ keywords, categorize the sample to ‘Outpatient Healthcare’ and skip the subsequent steps.

4. If the sample ‘Project Title’ contains ‘Apartment’ keywords, categorize the sample to ‘High-rise Apartment’ or ‘Mid-rise Apartment’ based on step 2 of the apartments categorization logic in Section 2.3.3, and skip the subsequent steps.

5. If the sample ‘Square Footage (000s)’ is greater than 100, categorize the sample to ‘Hospital’.

6. If the sample ‘Square Footage (000s)’ is less than or equal to 100, categorize the sample to ‘Outpatient Healthcare’.

2.3.6 Expanded Mapping Logic for Dodge ‘Food/Beverage Service’

To determine the square footage of the ‘Full Service Restaurant’ and ‘Quick Service Restaurant’ commercial prototype buildings, data was drawn from the Dodge project types ‘Food/Beverage Service’, ‘Shopping Centers’, and ‘Retail Stores’. To disaggregate the data into the two restaurant prototypes, the authors developed a Franchise Restaurant Mapping Table that mapped 254 franchise restaurants to either the ‘Full Service Restaurant’ or ‘Quick Service Restaurant’ prototype. The authors also developed an Additional Restaurant Keyword Mapping Table with keywords assigned to one of the two restaurant prototypes. The assignment of prototypes using keywords from these two mapping tables was achieved by searching the Dodge project title field for words matching those in the tables. The Franchise Restaurant Mapping Table and Additional Restaurant Keyword Mapping Table are available in Appendix A (Table A.4. and Table A.5.).

For the Dodge project type ‘Food/Beverage Service’, after using the two mapping tables to disaggregate samples into the two restaurant prototypes, there was a remainder of samples that didn’t contain keywords from either of the two mapping tables. After reviewing the Dodge project titles for these samples, the authors developed a ‘Supermarket’ keyword mapping table (available in Appendix A , Table A.3). Using the ‘Supermarket’ keywords, supermarket samples were disaggregated into the supermarket subcategory of the ‘No Prototype’ category.

After disaggregating samples using the two restaurant mapping tables and supermarket keyword mapping table, there was a remainder of samples dominated by independent restaurants. Samples with greater than 4,000 square feet were assigned to the ‘Full Service Restaurant’ prototype whereas samples with 4,000 square feet or less were designated to the ‘Quick Service Restaurant’ prototype. Similarly, the Additional Restaurant Keyword Mapping Table included four keywords (i.e., pizza, grill, bar, and wine) that mapped to ‘Full Service Restaurant’ if the square footage was greater than 4,000, or ‘Quick Service Restaurant’ if the square footage was 4,000 or less.

Step-by-step logic details

1. Proceed with subsequent steps if the sample ‘Project Type’ is ‘Food/Beverage Service’; otherwise, skip subsequent steps.

2. If the sample ‘Project Title’ contains keywords in Table A.4. Franchise restaurant mapping table, categorize the sample to ‘Quick Service Restaurant’ if the containing keyword’s mapping prototype is ‘Quick Service Restaurant’ or to ‘Full Service Restaurant’ if the containing keyword’s mapping prototype is ‘Full Service Restaurant’. In this case, skip the subsequent steps.

3. If the sample ‘Project Title’ contains keywords in Table A.5. Additional restaurant keywords mapping table, categorize following the two sub-steps and skip later steps.

    a. If the containing keyword is one of [‘pizza’, ‘wine’, ‘bar’, ‘grill’], categorize the sample to ‘Full Service Restaurant’ if its ‘Square Footage (000s)’ is greater than 4 or to ‘Quick Service Restaurant’ if its ‘Square Footage (000s)’ is less than or equal to 4.

    b. If the containing keyword is not one of [‘pizza’, ‘wine’, ‘bar’, ‘grill’], categorize the sample to ‘Quick Service Restaurant’ if the containing keyword’s mapping prototype is ‘Quick Service Restaurant’ or to ‘Full Service Restaurant’ if the containing keyword’s mapping prototype is ‘Full Service Restaurant’.

4. If the sample ‘Project Title’ contains ‘Supermarket’ keywords, categorize the sample to ‘No Prototype’ with the Additional Non-Prototype category of ‘Supermarket’. In this case, the subsequent step is skipped.

5. If the sample ‘‘Square Footage (000s)’ is greater than 4, categorize it to ‘Full Service Restaurant’; if the sample ‘‘Square Footage (000s)’ is less than or equal to 4, categorize it to ‘Quick Service Restaurant’.

2.3.7 Expanded Mapping Logic for Dodge ‘Shopping Center’ and ‘Stores’

To determine the square footage of the ‘Stand-alone Retail’ and ‘Strip Mall’ commercial prototype buildings, data was drawn from the Dodge project types ‘Shopping Centers’ and ‘Stores’. After reviewing the Dodge project titles in the samples for these two project types in the dataset, the authors discovered the data included a wide variety of building categories. Therefore, the authors developed and implemented a series of keyword lists to identify samples to assign to ‘Stand-alone Retail’ and ‘Strip Mall’ and to identify samples to assign to other prototypes and ‘No Prototype’ subcategories. The assignment of samples using keywords from keyword tables was achieved by searching the Dodge project title field for words matching those in the tables and assigning them accordingly.

First, a list of ‘Strip Mall’ keywords was developed to identify samples to designate as ‘Strip Mall’ prototype. Then, using a list of ‘Supermarket’ keywords, supermarket samples were disaggregated into the ‘Supermarket’ subcategory of the ‘No Prototype’ category to remove them from the dataset of Dodge shopping centers and stores. Then, a list of ‘Big Box Retail’ keywords was developed to designate samples as ‘Stand-alone Retail’. In addition, a list of retail keywords was developed to designate samples with less than 300,000 square feet as ‘Stand-alone Retail’, and 300,000 square feet or greater as ‘Strip Mall’. The bound of 300,000 square feet was based on a review of the data identified via the retail keyword table and observing that all samples with greater than 300,000 square feet were strip malls.

The remaining, unassigned samples in the Dodge project types ‘Shopping Centers’ and ‘Stores’ were a diverse mix of building categories. The authors developed a series of keyword lists for ‘No Prototype’ subcategories to identify and assign samples out of the ‘Shopping Centers’ and ‘Stores’ data. These subcategories included ‘Convenience Stores’, ‘Public Assembly’, ‘Auto’, ‘Laundry’, ‘Beauty’, and ‘Place of Worship’.

The authors also used keyword lists for other prototype buildings to identify and assign samples from the ‘Shopping Centers’ and ‘Stores’ data. These prototypes included ‘Full Service

Restaurant', 'Quick Service Restaurant', 'Outpatient Healthcare', 'Secondary School', and 'Warehouse'. The keyword lists for both the 'No Prototype' subcategories and prototype buildings are available in Appendix A (Table A.3).

After the preceding steps were taken to disaggregate the 'Shopping Centers' and 'Stores' data, there was a modest remainder of samples. The remaining 'Shopping Center' samples were assigned to the 'Strip Mall' prototype and the remaining 'Stores' samples were assigned to the 'Stand-alone Retail' prototype. This completed the assignment of samples for these two Dodge project types.

Step-by-step logic details for Strip Malls

1. Proceed with subsequent steps if the sample 'Project Type' is 'Shopping Centers'; otherwise, skip subsequent steps.

2. If the sample 'Project Title' contains 'Strip Mall' keywords, categorize the sample to 'Strip Mall' and skip subsequent steps.

3. If the sample 'Project Title' contains 'Supermarket' keywords, categorize the sample to 'No Prototype' with Additional Non-Prototype category of 'Supermarket' and skip subsequent steps.

4. If the sample 'Project Title' contains 'Big Box Retail' keywords, categorize the sample to 'Stand-alone Retail' and skip subsequent steps.

5. If the sample 'Project Title' contains 'Retail' keywords, categorize following the two sub-steps and skip later steps:

    a. If the sample 'Square Footage (000s)' is greater than or equal to 300, categorize the sample to 'Strip Mall' and skip subsequent steps.

    b. If the sample 'Square Footage (000s)' is less than 300, categorize the sample to 'Stand-alone Retail' and skip subsequent steps.

6. If the sample 'Project Title' contains 'Convenience Store' keywords, categorize the sample to 'No Prototype' with Additional Non-Prototype category of 'Convenience Store', and skip subsequent steps.

7. Apply steps 2 and 3 of the restaurants categorization logic in Section 2.3.6.

8. If the sample 'Project Title' contains 'Apartment' keywords, categorize the sample to 'High-rise Apartment' or 'Mid-rise Apartment' based on step 2 of the apartments categorization logic in Section 2.3.3, and skip subsequent steps.

9. If the sample 'Project Title' contains 'Outpatient' keywords, categorize the sample to 'Outpatient Healthcare' and skip subsequent steps.

10. If the sample 'Project Title' contains 'Public Assembly' keywords, categorize the sample to 'No Prototype' with CBECS PBA category 'Public Assembly' and CBECS PBAPlus category '24: Recreation', and skip subsequent steps.

11. If the sample ‘Project Title’ contains ‘Auto Service’ keywords, characterize the sample to ‘No Prototype’ with Additional Non-Prototype category of ‘Auto Service’, and skip subsequent steps.

12. If the sample ‘Project Title’ contains ‘Laundry Service’ keywords, categorize the sample to ‘No Prototype’ with Additional Non-Prototype category of ‘Laundry Service’, and skip subsequent steps.

13. If the sample ‘Project Title’ contains ‘Beauty Service’ keywords, categorize the sample to ‘No Prototype’ with Additional Non-Prototype category of ‘Beauty Service’, and skip subsequent steps.

14. If the sample ‘Project Title’ contains ‘Keep As Is’ keywords, categorize the sample to ‘Strip Mall’ and skip subsequent steps.

15. If the sample ‘Project Title’ contains ‘Worship’ keywords, categorize the sample to ‘No Prototype’ with CBECS PBA category ‘Religious Worship’ and CBECS PBAPlus category ‘21: Religious worship’, and skip subsequent steps.

16. If the sample ‘Project Title’ contains ‘Secondary School’ keywords, categorize the sample to ‘Secondary School’ and skip subsequent steps.

17. If the sample ‘Project Title’ contains ‘Warehouses’ keywords, categorize sample to ‘Non-Refrigerated Warehouse’ and skip subsequent step.

18. Categorize the sample to ‘Strip Mall’.

Step-by-step logic details for Stand-alone Retail

1. Proceed with subsequent steps if the sample ‘Project Type’ is ‘Stores’; otherwise, skip subsequent steps.

2. If the sample ‘Project Title’ contains ‘Big Box Retail’ keywords, categorize the sample to ‘Stand-alone Retail’ and skip subsequent steps.

3. If the sample ‘Project Title’ contains ‘Supermarket’ keywords, then the sample is categorized to ‘No Prototype’ with Additional Non-Prototype category of ‘Supermarket’, and subsequent steps are skipped.

4. If the sample ‘Project Title’ contains ‘Retail’ keywords, then categorize following the two sub-steps and skip later steps:

    a. If the sample ‘Square Footage (000s)’ is larger than or equal to 300, then the sample is categorized to ‘Strip Mall’, and subsequent steps are skipped.

    b. If the sample ‘Square Footage (000s)’ is smaller than 300, then the sample is categorized to ‘Stand-alone Retail’, and subsequent steps are skipped.

5. If the sample ‘Project Title’ contains ‘Strip Mall’ keywords, then the sample is categorized to ‘Strip Mall’, and subsequent steps are skipped.

6. If the sample ‘Project Title’ contains ‘Convenience Store’ keywords, then the sample is categorized to ‘No Prototype’ with Additional Non-Prototype category of ‘Convenience Store’, and subsequent steps are skipped.

7. Apply step 2 and 3 of the restaurants categorization logic in Section 2.3.6.

8. If the sample ‘Project Title’ contains ‘Apartment’ keywords, then the sample is categorized to ‘High-rise Apartment’ or ‘Mid-rise Apartment’ based on step 2 of the apartments categorization logic in Section 2.3.3, and the subsequent steps are skipped.

9. If the sample ‘Project Title’ contains ‘Outpatient’ keywords, then the sample is categorized to ‘Outpatient health care’ and the subsequent steps are skipped.

10. If the sample ‘Project Title’ contains ‘Public Assembly’ keywords, then the sample is categorized to ‘No Prototype’ with CBECS PBA category ‘Public Assembly’ and CBECS PBAPlus category ‘24: Recreation’, and subsequent steps are skipped.

11. If the sample ‘Project Title’ contains ‘Auto Service’ keywords, then the sample is categorized to ‘No Prototype’ with Additional Non-Prototype category of ‘Auto Service’, and subsequent steps are skipped.

12. If the sample ‘Project Title’ contains ‘Laundry Service’ keywords, then the sample is categorized to ‘No Prototype’ with Additional Non-Prototype category of ‘Laundry Service’, and subsequent steps are skipped.

13. If the sample ‘Project Title’ contains ‘Beauty Service’ keywords, then the sample is categorized to ‘No Prototype’ with Additional Non-Prototype category of ‘Beauty Service’, and subsequent steps are skipped.

14. If the sample ‘Project Title’ contains ‘Keep As Is’ keywords, then the sample is categorized to ‘Strip Mall’, and subsequent steps are skipped.

15. If the sample ‘Project Title’ contains ‘Worship’ keywords, then the sample is categorized to ‘No Prototype’ with CBECS PBA category ‘Religious Worship’ and CBECS PBAPlus category ‘21: Religious worship’, and subsequent steps are skipped.

16. If the sample ‘Project Title’ contains ‘Secondary School’ keywords, then the sample is categorized to ‘Secondary School’, and subsequent steps are skipped.

17. If the sample ‘Project Title’ contains ‘Warehouses’ keywords, then the sample is categorized to ‘Non-Refrigerated Warehouse’, and the subsequent step is skipped.

18. Categorize the sample to ‘Stand-alone Retail’.

2.3.8 Expanded Mapping Logic for Dodge ‘Communications Buildings’

Data centers are an energy-intense commercial building category with a growth trend in energy consumption. Given that data centers currently are not included as a prototype building, DOE has an interest in understanding their national square footage and corresponding weight to determine the extent to which they may warrant the creation of a new prototype building (Shehabi et al., 2016). To determine the square footage of data centers, data were drawn from

the Dodge project types: ‘Banks/Financial 1-3 Stories’, ‘Banks/Financial 4+ Stories’, ‘Offices 1-3 Stories, Offices 4+ Stories’, and ‘Communications Buildings’. A list of ‘Data Center’ keywords was developed to identify which samples within these project types to designate as data centers. This was achieved by searching the Dodge project title field for words matching those in the ‘Data Center’ keywords list, available in Appendix A (Table A.3). The square footage of the samples designated as data centers was summed to determine the weight for this special category of building, which was a subcategory of the samples designated as ‘No Prototype’.

Step-by-step logic details

1. Proceed with the following step if the sample ‘Project Type’ is ‘Communications Buildings’; otherwise, skip the following step.

2. If the sample ‘Project Title’ contains the ‘Data Center’ keywords, then categorize it to ‘No Prototype’ with Additional Non-Prototype category of ‘Data Center’. Otherwise, if the sample cannot be categorized to office with step 2 of the offices categorization logic in Section 2.3.4, categorize the sample to ‘No Prototype’ with CBECS PBA category of ‘Other’ and CBECS PBAPlus category of ‘49: Other'.

2.3.9 Expanded Mapping Logic for Dodge ‘Capitols/Court Houses/City Halls’

DOE has an interest in understanding the national square footage and corresponding weight of courthouses, which currently are not included as a prototype. To determine the square footage of courthouses, data was drawn from the Dodge project type ‘Capitols/Court Houses/City Halls’. A list of courthouse keywords was developed to identify which samples within this project type to designate as courthouses. This was achieved by searching the Dodge project title field for words matching those in the ‘Courthouse’ keywords list, available in Appendix A (Table A.3). The square footage of the samples designated as courthouses was summed to determine the weight for this special category of building, which was a subcategory of the samples designated as ‘No Prototype’.

Step-by-step logic details

1. Proceed with the following step if the sample ‘Project Type’ is ‘Capitols/Court Houses/City Halls’; otherwise, skip the following step.

2. If the sample ‘Project Title’ contains the ‘Court House’ keywords, categorize it to ‘No Prototype’ with Additional Non-Prototype category of ‘Court House’; otherwise, if the sample cannot be categorized to office with step 2 of the offices categorization logic in Section 2.3.4, categorize the sample to ‘No Prototype’ with CBECS PBA category of ‘Public order and safety’ and CBECS PBAPlus category of ‘17: Other public order and safety’.

2.3.10 Expanded Mapping Logic for Dodge ‘Clubs and Lodges’

After reviewing the data in the Dodge project type ‘Clubs and Lodges’, the authors discovered the samples included a wide variety of building categories. Therefore, the authors developed and implemented a series of keyword mapping lists to assign these samples to prototype buildings and no prototype subcategories. The assignment of samples using keywords from keyword mapping lists was achieved by searching the Dodge project title field for words matching those in the lists, and then assigning them accordingly.

‘Clubs and Lodges’ samples were assigned to the prototype buildings ‘Large Hotel’, ‘Small Hotel’, ‘High-rise Apartment’, and ‘Mid-rise Apartment’ using the methodologies described in the Hotels and Apartments categorization logic sections. In addition, ‘Clubs and Lodges’ samples were assigned to the ‘No Prototype’ subcategories ‘Place of Worship’ and ‘Public Assembly’ using the keyword lists for ‘Place of Worship’ and ‘Public Assembly’, which are available in Appendix A (Table A.3).

Step-by-step logic details

1. Proceed with subsequent steps if the sample ‘Project Type’ is ‘Clubs and Lodges’; otherwise, skip subsequent steps.

2. If the sample ‘Project Title’ contains ‘Apartment’ keywords or ‘Hotel’ keywords, skip subsequent steps.

3. If the sample ‘Project Title’ contains ‘Public Assembly’ keywords, categorize the sample to ‘No Prototype’ with CBECS PBA category ‘Public Assembly’ and CBECS PBAPlus category ‘24: Recreation’, and skip subsequent steps.

4. If the sample ‘Project Title’ contains ‘Worship’ keywords, categorize the sample to ‘No Prototype’ with CBECS PBA category ‘Religious Worship’ and CBECS PBAPlus category ‘21: Religious worship’, and skip subsequent step.

5. Categorize the sample to ‘No Prototype’ with CBECS PBA category ‘Public Assembly’ and CBECS PBAPlus category ‘24: Recreation’.

2.4 Categorization Results and Verification

After the execution of the direct project type mapping and expanded categorization matching, a total of 548,357 samples are mapped to unique prototype or Non-Prototype subcategories. Another 53 samples were found to meet the mapping criteria for more than one subcategory and are discarded for future analysis. There was also one sample that does not meet any of the automated mapping criteria and was manually reviewed and assigned as Mid-Rise Apartment. That is, more than 99.99% of the considered 548,411 building samples are categorized to unique categories with the logic described earlier in this section.

To verify the quality of the categorization results, 600 samples were drawn randomly from the categorized dataset and the accuracy of the categorization was manually checked. The manual check shows that 581 of the 600 randomly drawn samples are correctly categorized by the logic, showing an accuracy of 96.8%.

Since the square footage distribution of buildings in each category is interesting information to many analyses, Figure 2 depicts a box plot of sample square footage values categorized into each prototype. It was noted that most prototype categories contain samples with very small square footage area because those project samples are additions onto existing buildings rather than construction of new buildings. They represent a very small percentage of the total construction volume.

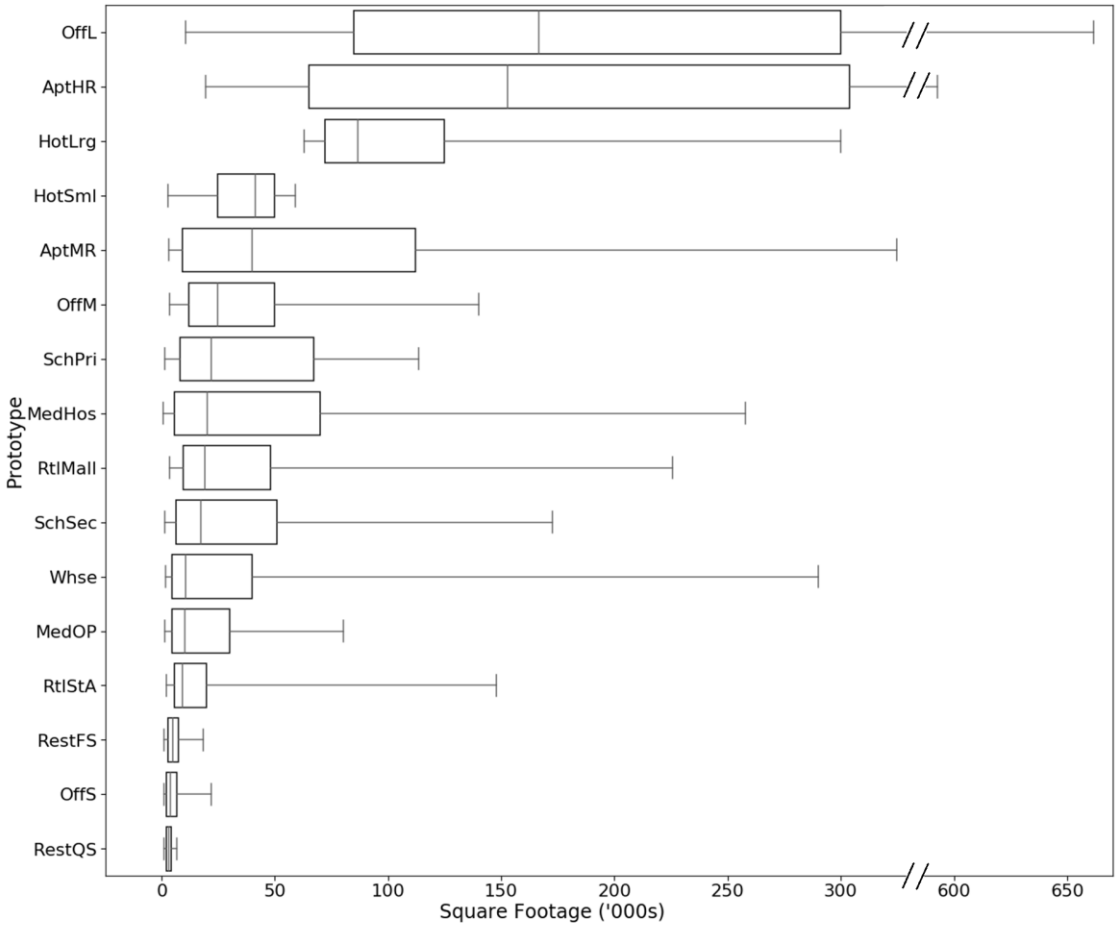

Figure 2. Box plot of square footage ranges of samples mapped to Prototypes[1]

2.5 Climate Zone Mapping

Climate zones of the building samples are identified by the project county and state information contained in the raw Dodge datasets. Building models were analyzed in standardized climate zones described in ASHRAE Standard 169-2013 (ASHRAE, 2013). Standard 169-2013 includes nine thermal zones and three moisture regimes. The U.S. climate zones by state and county are listed in Table B1 of Standard 169-2013. For this analysis, the mapping of each sample to a specific climate zone is based on this table.

Among the 548,358 samples obtained from the categorization process, 548,348 samples have climate zone information assigned. The mapping of climate zones was conducted through a look-up of the project county and state, ensuring accuracy. Ten samples cannot be assigned climate zones due to their ambiguous county information and are thus discarded.

[1] Whiskers in the box plot show the 5 and 95 percentiles respectively, that is, ranges within whiskers cover 90% of the samples for each prototype. Outliers are not shown in the plot. Y-axis label abbreviations: OffS--Small Office; OffM--Medium Office; OffL--Large Office; RtlStA--Stand-Alone Retail; RtlMall--Strip Mall; SchPri--Primary School; SchSec--Secondary School; MedOP--Outpatient Health Care; MedHos--Hospital; HotSml--Small Hotel; HotLrg--Large Hotel; Whse--Non-Refrigerated Warehouse; RestQS--Quick-service Restaurant; RestFS--Full-service Restaurant; AptMR--Mid-Rise Apartment; AptHR--High-Rise Apartment

After the building samples are assigned prototype categories and climate zones, the 548,348 building samples were aggregated by prototype category and climate zone to generate the national weighting factor matrices. Non-prototype building samples (i.e., building samples assigned to the ‘No Prototype’ category) were further classified in three aspects: Additional Non-Prototype categories, CBECS PBA, and CBECS PBAPlus.

3.0 Results

In this section, results are presented in eight tables. The national-level weighting factors are presented by climate zone and the prototype category in Section 3.1. The distributions of 'No Prototype' samples are presented in terms of CBECS PBA, CBECS PBAPlus, and the Additional Non-Prototype category in Section 3.2. Finally, a comparison of the changes of the newly obtained weighting factors with the previous ones is presented in Section 3.3.

3.1 Prototype National Weights by Climate Zone for 2003-2018

In this subsection, prototype national weighting factors by climate zone are presented in several ways: first by construction area (square footage) and then by sample count; first including 'No Prototype' and then excluding 'No Prototype'; first in terms of percentage then in terms of actual number. These three binary choice dimensions assemble a total of 8 tables as presented below (Table 3). In Appendix B, fine granular tables are presented for state-level construction area and sample count aggregated by climate zone and building category (Table B.1. – B.4.).

Table 3. Construction-area-based weighting factors (percent) aggregated by climate zone and building category (including 'No Prototype').

	1A	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8	Weights by Bldg Type
Large Office	0.08	0.41	0.05	0.41	0.19	0.17	0.85	0.00	0.18	0.36	0.12	0.00	0.07	0.00	0.01	0.00	2.89
Medium Office	0.11	0.58	0.15	0.54	0.33	0.12	0.71	0.02	0.13	0.66	0.23	0.00	0.13	0.02	0.02	0.00	3.76
Small Office	0.08	0.58	0.12	0.52	0.21	0.04	0.43	0.02	0.07	0.50	0.15	0.00	0.10	0.02	0.01	0.00	2.85
Stand-alone Retail	0.22	1.35	0.23	1.33	0.64	0.09	1.44	0.06	0.20	1.78	0.40	0.01	0.37	0.05	0.04	0.00	8.21
Strip Mall	0.12	0.48	0.10	0.52	0.32	0.07	0.50	0.01	0.07	0.46	0.09	0.00	0.04	0.01	0.01	0.00	2.79
Primary School	0.10	0.73	0.09	0.70	0.27	0.03	0.66	0.02	0.09	0.58	0.17	0.00	0.12	0.04	0.01	0.00	3.62
Secondary School	0.20	1.40	0.14	1.62	0.58	0.10	1.48	0.05	0.20	1.63	0.38	0.01	0.28	0.07	0.05	0.00	8.19
Hospital	0.07	0.56	0.08	0.47	0.24	0.07	0.69	0.02	0.10	0.71	0.18	0.01	0.15	0.02	0.02	0.00	3.39
Outpatient Healthcare	0.04	0.41	0.07	0.40	0.13	0.03	0.46	0.02	0.07	0.60	0.15	0.00	0.14	0.02	0.02	0.00	2.57
Full Service Restaurant	0.02	0.13	0.02	0.13	0.06	0.01	0.12	0.01	0.02	0.15	0.03	0.00	0.02	0.00	0.00	0.00	0.73
Quick Service Restaurant	0.01	0.05	0.01	0.05	0.02	0.00	0.04	0.00	0.00	0.05	0.01	0.00	0.01	0.00	0.00	0.00	0.25
Large Hotel	0.13	0.53	0.08	0.42	0.41	0.07	0.61	0.02	0.10	0.49	0.14	0.00	0.11	0.03	0.02	0.00	3.17
Small Hotel	0.02	0.23	0.02	0.20	0.08	0.01	0.23	0.01	0.02	0.20	0.07	0.00	0.06	0.02	0.01	0.00	1.19
Non-Refrigerated Warehouse	0.40	2.65	0.47	2.08	1.68	0.14	2.77	0.04	0.41	2.35	0.61	0.00	0.28	0.02	0.03	0.00	13.92
High-rise Apartment	1.08	0.89	0.06	0.43	0.47	0.22	2.45	0.00	0.37	1.02	0.14	0.00	0.08	0.01	0.00	0.00	7.23
Mid-rise Apartment	0.27	1.68	0.20	1.33	0.88	0.37	2.26	0.02	0.53	1.66	0.55	0.00	0.43	0.04	0.03	0.00	10.27
No Prototype	1.09	3.93	0.63	3.89	2.31	0.66	4.53	0.13	0.89	4.40	1.23	0.02	0.97	0.14	0.13	0.02	24.97
Weights by Zone	4.04	16.58	2.51	15.07	8.81	2.21	20.25	0.46	3.44	17.61	4.67	0.06	3.34	0.50	0.42	0.04	100.00

Table 4. Sample-count-based weighting factors (percent) aggregated by climate zone and building category (including 'No Prototype').

	1A	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8	Weights by Bldg Type
Large Office	0.02	0.06	0.01	0.06	0.03	0.02	0.14	0.00	0.03	0.06	0.02	0.00	0.01	0.00	0.00	0.00	0.46
Medium Office	0.09	0.47	0.08	0.53	0.24	0.06	0.61	0.02	0.14	0.61	0.25	0.00	0.15	0.03	0.02	0.00	3.31
Small Office	0.42	2.88	0.35	2.86	1.04	0.26	2.32	0.14	0.47	2.65	0.87	0.01	0.43	0.09	0.06	0.00	14.85
Stand-alone Retail	0.30	2.28	0.34	2.03	0.78	0.10	2.00	0.08	0.28	2.35	0.57	0.01	0.41	0.07	0.05	0.00	11.66
Strip Mall	0.05	0.35	0.07	0.33	0.19	0.04	0.34	0.01	0.07	0.37	0.09	0.00	0.07	0.01	0.01	0.00	1.98
Primary School	0.09	0.53	0.09	0.61	0.26	0.05	0.67	0.04	0.08	0.61	0.17	0.00	0.14	0.04	0.02	0.00	3.41
Secondary School	0.16	1.07	0.15	1.40	0.53	0.12	1.24	0.07	0.17	1.46	0.35	0.01	0.33	0.06	0.05	0.01	7.18
Hospital	0.05	0.32	0.05	0.33	0.10	0.02	0.38	0.02	0.05	0.45	0.10	0.00	0.11	0.02	0.02	0.00	2.03
Outpatient Healthcare	0.08	0.71	0.09	0.74	0.20	0.04	0.70	0.03	0.12	0.92	0.25	0.01	0.23	0.04	0.04	0.00	4.19
Full Service Restaurant	0.10	0.78	0.12	0.71	0.28	0.05	0.68	0.03	0.08	0.79	0.18	0.00	0.11	0.02	0.02	0.00	3.95
Quick Service Restaurant	0.06	0.55	0.08	0.52	0.18	0.02	0.47	0.02	0.05	0.56	0.16	0.00	0.09	0.02	0.01	0.00	2.78
Large Hotel	0.03	0.15	0.02	0.14	0.08	0.02	0.19	0.01	0.03	0.16	0.04	0.00	0.04	0.01	0.01	0.00	0.94
Small Hotel	0.03	0.24	0.02	0.19	0.08	0.02	0.23	0.01	0.02	0.21	0.07	0.00	0.07	0.02	0.01	0.00	1.23
Non-Refrigerated Warehouse	0.27	1.74	0.24	1.25	0.61	0.09	1.42	0.06	0.27	1.78	0.55	0.01	0.40	0.06	0.07	0.01	8.83
High-rise Apartment	0.11	0.12	0.01	0.06	0.05	0.04	0.62	0.00	0.07	0.15	0.02	0.00	0.01	0.00	0.00	0.00	1.27
Mid-rise Apartment	0.10	0.47	0.06	0.42	0.32	0.12	1.55	0.01	0.24	0.81	0.21	0.00	0.18	0.02	0.02	0.00	4.54
No Prototype	0.79	4.32	0.55	4.68	1.83	0.45	4.74	0.21	0.86	5.50	1.52	0.04	1.41	0.25	0.23	0.03	27.40
Weights by Zone	2.76	17.04	2.31	16.88	6.82	1.53	18.30	0.76	3.03	19.41	5.44	0.10	4.18	0.76	0.63	0.06	100.00

Table 5. Construction-area-based weighting factors (percent) aggregated by climate zone and building category (excluding 'No Prototype').

	1A	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8	Weights by Bldg Type
Large Office	0.11	0.54	0.07	0.54	0.26	0.23	1.13	0.00	0.24	0.48	0.15	0.00	0.09	0.00	0.01	0.00	3.86
Medium Office	0.14	0.78	0.19	0.73	0.45	0.16	0.95	0.03	0.17	0.88	0.31	0.00	0.17	0.03	0.02	0.00	5.01
Small Office	0.11	0.77	0.15	0.70	0.27	0.05	0.58	0.03	0.09	0.67	0.21	0.00	0.13	0.02	0.02	0.00	3.80
Stand-alone Retail	0.29	1.79	0.31	1.78	0.85	0.12	1.92	0.08	0.26	2.37	0.54	0.01	0.49	0.06	0.06	0.01	10.94
Strip Mall	0.16	0.63	0.14	0.70	0.42	0.09	0.66	0.02	0.09	0.61	0.12	0.00	0.06	0.01	0.01	0.00	3.71
Primary School	0.13	0.98	0.12	0.94	0.36	0.04	0.88	0.03	0.12	0.77	0.23	0.00	0.16	0.05	0.02	0.00	4.83
Secondary School	0.26	1.86	0.19	2.16	0.77	0.14	1.98	0.07	0.27	2.18	0.51	0.01	0.37	0.09	0.06	0.01	10.92
Hospital	0.09	0.75	0.11	0.63	0.32	0.10	0.92	0.03	0.13	0.95	0.23	0.01	0.20	0.03	0.03	0.00	4.52
Outpatient Healthcare	0.05	0.54	0.09	0.53	0.17	0.04	0.62	0.02	0.10	0.80	0.20	0.00	0.18	0.03	0.03	0.00	3.42
Full Service Restaurant	0.03	0.18	0.03	0.17	0.08	0.01	0.16	0.01	0.02	0.19	0.04	0.00	0.03	0.00	0.00	0.00	0.97
Quick Service Restaurant	0.01	0.07	0.01	0.06	0.02	0.00	0.06	0.00	0.00	0.07	0.02	0.00	0.01	0.00	0.00	0.00	0.33
Large Hotel	0.18	0.71	0.10	0.56	0.55	0.09	0.82	0.02	0.13	0.65	0.19	0.00	0.14	0.04	0.02	0.00	4.22
Small Hotel	0.03	0.30	0.02	0.27	0.11	0.02	0.30	0.01	0.03	0.27	0.10	0.00	0.08	0.03	0.02	0.00	1.59
Non-Refrigerated Warehouse	0.53	3.53	0.63	2.77	2.23	0.18	3.69	0.05	0.54	3.14	0.82	0.00	0.37	0.03	0.04	0.00	18.56
High-rise Apartment	1.44	1.19	0.08	0.57	0.63	0.29	3.26	0.00	0.49	1.36	0.19	0.00	0.11	0.01	0.00	0.00	9.64
Mid-rise Apartment	0.36	2.24	0.27	1.78	1.18	0.49	3.02	0.03	0.71	2.22	0.73	0.01	0.57	0.05	0.04	0.00	13.69
Weights by Zone	3.94	16.85	2.52	14.89	8.67	2.06	20.94	0.43	3.39	17.60	4.59	0.05	3.17	0.49	0.38	0.03	100.00

Table 6. Sample-count-based weighting factors (percent) aggregated by climate zone and building category (excluding 'No Prototype').

	1A	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8	Weights by Bldg Type
Large Office	0.02	0.08	0.01	0.09	0.04	0.03	0.20	0.00	0.04	0.08	0.03	0.00	0.02	0.00	0.00	0.00	0.64
Medium Office	0.13	0.65	0.12	0.73	0.33	0.09	0.84	0.02	0.19	0.84	0.34	0.00	0.20	0.04	0.03	0.00	4.56
Small Office	0.57	3.96	0.48	3.94	1.43	0.36	3.20	0.19	0.65	3.65	1.19	0.02	0.59	0.12	0.09	0.01	20.45
Stand-alone Retail	0.42	3.14	0.46	2.80	1.08	0.14	2.75	0.11	0.39	3.23	0.79	0.01	0.56	0.10	0.07	0.01	16.06
Strip Mall	0.07	0.48	0.10	0.45	0.26	0.05	0.46	0.01	0.10	0.50	0.12	0.00	0.09	0.01	0.01	0.00	2.73
Primary School	0.12	0.74	0.12	0.84	0.36	0.07	0.92	0.05	0.11	0.84	0.24	0.00	0.20	0.05	0.02	0.00	4.69
Secondary School	0.22	1.47	0.20	1.92	0.73	0.17	1.71	0.10	0.23	2.01	0.48	0.01	0.45	0.09	0.08	0.01	9.89
Hospital	0.06	0.45	0.06	0.46	0.14	0.03	0.53	0.03	0.07	0.61	0.14	0.00	0.16	0.03	0.02	0.00	2.79
Outpatient Healthcare	0.10	0.97	0.13	1.02	0.28	0.05	0.96	0.05	0.17	1.26	0.35	0.01	0.32	0.05	0.05	0.01	5.78
Full Service Restaurant	0.14	1.08	0.16	0.98	0.39	0.06	0.94	0.04	0.11	1.08	0.25	0.00	0.15	0.03	0.02	0.00	5.45
Quick Service Restaurant	0.09	0.75	0.10	0.72	0.24	0.03	0.65	0.02	0.07	0.77	0.22	0.00	0.12	0.02	0.01	0.00	3.83
Large Hotel	0.05	0.21	0.03	0.20	0.11	0.03	0.26	0.01	0.04	0.22	0.06	0.00	0.05	0.02	0.01	0.00	1.29
Small Hotel	0.04	0.33	0.03	0.26	0.11	0.02	0.32	0.02	0.03	0.29	0.10	0.00	0.09	0.03	0.02	0.00	1.69
Non-Refrigerated Warehouse	0.38	2.40	0.32	1.73	0.84	0.12	1.96	0.08	0.37	2.45	0.76	0.01	0.55	0.09	0.10	0.01	12.16
High-rise Apartment	0.16	0.17	0.01	0.08	0.08	0.05	0.85	0.00	0.09	0.21	0.03	0.00	0.02	0.00	0.00	0.00	1.75
Mid-rise Apartment	0.14	0.64	0.09	0.58	0.44	0.17	2.13	0.02	0.33	1.11	0.28	0.00	0.25	0.03	0.02	0.00	6.25
Weights by Zone	2.71	17.53	2.43	16.81	6.87	1.48	18.68	0.75	2.98	19.17	5.39	0.08	3.82	0.70	0.55	0.05	100.00

Table 7. Total construction area (in 1,000 square feet) of samples aggregated by climate zone and prototype category (including 'No Prototype').

	1A	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8	Sum by Bldg Type
Large Office	16868.9	84133	10300	83929.9	39669.7	35451.3	174052.1	120	36842.8	74518.9	23820	162.4	13990.2	543.7	1295.3	0	595698.2
Medium Office	21848.7	120104.5	29913.5	112127.8	68844.9	25436.2	146920.8	3930.2	26285.4	135800.4	48290.8	367.3	26562.7	4003.6	3172.6	355.8	773965.2
Small Office	17162	118476.5	23865	107666	42488.3	7232.6	89124.6	4779	14328.2	103506.7	31856.1	348.6	20126.3	3364.7	2423.4	123.3	586871.3
Stand-alone Retail	44821.4	276996.8	47518.4	274753.6	131884	18800.7	296430.9	12655	40896.3	365606.6	82967.5	1746.1	76240.9	9590.5	8943.2	978.6	1690830.5
Strip Mall	24133.5	97829.6	21386.8	107582.3	65526.1	13714.2	102063.9	2660	13523.3	93823.4	19265.5	320.7	9083.4	1277.3	1241.9	142.7	573574.6
Primary School	20212.6	150817.8	18538.4	145027.2	55388	6782.8	136250.3	5012.7	17810.8	119331.6	35831.3	275.6	24237.3	7302.9	2951.1	203.5	745973.9
Secondary School	40614.2	287327.1	29704.4	334229.3	118573.4	20879.6	305440.9	10982.6	41838.1	336475	78271.9	1356.4	56653.1	14616.9	9338.2	1007	1687308.1
Hospital	14357	115638	16770.3	97542.2	48683.2	15213.1	142347.1	3958.4	19933.8	146341.6	36183.7	1052.2	30415.3	4953.1	5087.4	353.2	698829.6
Outpatient Healthcare	8459.8	83724.7	13739	81971.1	27005.3	6808.4	95704.8	3206.7	15204.9	123690.4	31275.6	577.4	27946.6	4166.9	4450.1	322	528253.7
Full Service Restaurant	4806.4	27341.3	4221.9	25969.4	12984.3	1983.3	25253.3	1169.2	3264.8	30123.8	6946.8	99.1	4506.9	684.3	669.4	131.2	150155.4
Quick Service Restaurant	1221.9	10390.4	1466.5	10037.7	3127.6	293.3	8515.8	309.8	706.6	10452.5	2695	13	1637.2	278.9	139	4.2	51289.4
Large Hotel	27678.8	109029.4	16191.3	86868.1	84587.5	14080.2	126031.1	3666.5	20721	100465.6	29721.9	326.6	22180.4	6451	3756.5	86.2	651842.1
Small Hotel	5057.2	46920.4	3747.1	41402.8	16408.6	2357.9	47016	2112.5	4011.4	42132.1	14696	318.9	12700.3	3926.8	2436.8	157.6	245402.4
Non-Refrigerated Warehouse	82424.4	544781.6	96607.6	428770.5	344959.7	28244.9	570756.4	8114.5	83618.4	484733	125953.1	467.4	57271.5	4666.3	5637.9	316.2	2867323.4
High-rise Apartment	222690.7	184107.2	12910.4	87935.1	97550.3	45192.2	504188.6	0	76376.9	209659.8	28818.6	0	17490.5	1373	631.9	0	1488925.2
Mid-rise Apartment	55967	346765.7	41767	274789.5	181789.4	76095.8	466118.4	4005.4	109081.4	342812.1	112610.4	1021.3	88294.7	7987.3	6374.6	1.7	2115481.7
No Prototype	224132.8	809066.5	128786.2	802029.3	475399.6	136443	933449.5	27185.6	183614.4	906457.7	253023.8	4076.6	199388.4	27873.6	27616.2	3174.3	5141717.5
Sum by Zone	832457.3	3413450.5	517433.8	3102631.8	1814869.9	455009.5	4169664.5	93868.1	708058.5	3625931.2	962228	12529.6	688725.7	103060.8	86165.5	7357.5	20593442.2

Table 8. Total counts of samples aggregated by climate zone and building category (including 'No Prototype').

	1A	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8	Sum by Bldg Type
Large Office	95	325	32	354	153	103	779	1	144	333	127	2	66	5	9	0	2528
Medium Office	501	2603	462	2916	1333	343	3351	94	767	3327	1361	16	796	140	118	12	18140
Small Office	2284	15782	1909	15682	5693	1421	12727	754	2599	14547	4757	67	2342	477	350	21	81412
Stand-alone Retail	1660	12500	1838	11131	4292	575	10944	451	1543	12863	3146	42	2229	408	297	21	63940
Strip Mall	283	1899	407	1799	1027	217	1841	57	389	2008	477	5	359	48	44	3	10863
Primary School	477	2932	468	3361	1440	297	3660	206	448	3334	957	15	779	201	91	7	18673
Secondary School	872	5848	801	7655	2916	668	6820	384	921	8020	1919	50	1793	346	301	45	39359
Hospital	254	1782	256	1812	563	120	2092	102	275	2441	562	17	619	128	96	6	11125
Outpatient Healthcare	416	3869	513	4077	1119	216	3824	188	661	5025	1382	29	1255	203	193	21	22991
Full Service Restaurant	575	4293	645	3910	1560	251	3731	176	421	4306	999	12	608	106	83	7	21683
Quick Service Restaurant	345	3000	415	2877	965	114	2587	97	274	3075	858	5	489	83	45	2	15231
Large Hotel	191	843	127	780	426	114	1036	35	160	884	243	4	203	63	39	1	5149
Small Hotel	175	1314	103	1032	437	89	1286	64	120	1145	409	15	371	105	68	4	6737
Non-Refrigerated Warehouse	1498	9559	1290	6877	3349	492	7789	313	1481	9745	3013	41	2206	344	384	37	48418

High-rise Apartment	630	666	41	326	301	201	3387	0	357	843	118	0	77	7	3	0	6957
Mid-rise Apartment	544	2567	347	2318	1761	674	8490	77	1312	4415	1131	17	1001	133	85	1	24873
No Prototype	4316	23665	3036	25651	10058	2469	25977	1174	4720	30135	8351	213	7717	1389	1248	150	150269
Sum by Zone	15116	93447	12690	92558	37393	8364	100321	4173	16592	106446	29810	550	22910	4186	3454	338	548348

Table 9. Total construction area (in 1,000 square feet) of samples aggregated by climate zone and prototype category (excluding 'No Prototype').

	1A	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8	Sum by Bldg Type
Large Office	16868.9	84133	10300	83929.9	39669.7	35451.3	174052.1	120	36842.8	74518.9	23820	162.4	13990.2	543.7	1295.3	0	595698.2
Medium Office	21848.7	120104.5	29913.5	112127.8	68844.9	25436.2	146920.8	3930.2	26285.4	135800.4	48290.8	367.3	26562.7	4003.6	3172.6	355.8	773965.2
Small Office	17162	118476.5	23865	107666	42488.3	7232.6	89124.6	4779	14328.2	103506.7	31856.1	348.6	20126.3	3364.7	2423.4	123.3	586871.3
Stand-alone Retail	44821.4	276996.8	47518.4	274753.6	131884	18800.7	296430.9	12655	40896.3	365606.6	82967.5	1746.1	76240.9	9590.5	8943.2	978.6	1690830.5
Strip Mall	24133.5	97829.6	21386.8	107582.3	65526.1	13714.2	102063.9	2660	13523.3	93823.4	19265.5	320.7	9083.4	1277.3	1241.9	142.7	573574.6
Primary School	20212.6	150817.8	18538.4	145027.2	55388	6782.8	136250.3	5012.7	17810.8	119331.6	35831.3	275.6	24237.3	7302.9	2951.1	203.5	745973.9
Secondary School	40614.2	287327.1	29704.4	334229.3	118573.4	20879.6	305440.9	10982.6	41838.1	336475	78271.9	1356.4	56653.1	14616.9	9338.2	1007	1687308.1
Hospital	14357	115638	16770.3	97542.2	48683.2	15213.1	142347.1	3958.4	19933.8	146341.6	36183.7	1052.2	30415.3	4953.1	5087.4	353.2	698829.6
Outpatient Healthcare	8459.8	83724.7	13739	81971.1	27005.3	6808.4	95704.8	3206.7	15204.9	123690.4	31275.6	577.4	27946.6	4166.9	4450.1	322	528253.7
Full Service Restaurant	4806.4	27341.3	4221.9	25969.4	12984.3	1983.3	25253.3	1169.2	3264.8	30123.8	6946.8	99.1	4506.9	684.3	669.4	131.2	150155.4
Quick Service Restaurant	1221.9	10390.4	1466.5	10037.7	3127.6	293.3	8515.8	309.8	706.6	10452.5	2695	13	1637.2	278.9	139	4.2	51289.4
Large Hotel	27678.8	109029.4	16191.3	86868.1	84587.5	14080.2	126031.1	3666.5	20721	100465.6	29721.9	326.6	22180.4	6451	3756.5	86.2	651842.1
Small Hotel	5057.2	46920.4	3747.1	41402.8	16408.6	2357.9	47016	2112.5	4011.4	42132.1	14696	318.9	12700.3	3926.8	2436.8	157.6	245402.4
Non-Refrigerated Warehouse	82424.4	544781.6	96607.6	428770.5	344959.7	28244.9	570756.4	8114.5	83618.4	484733	125953.1	467.4	57271.5	4666.3	5637.9	316.2	2867323.4
High-rise Apartment	222690.7	184107.2	12910.4	87935.1	97550.3	45192.2	504188.6	0	76376.9	209659.8	28818.6	0	17490.5	1373	631.9	0	1488925.2
Mid-rise Apartment	55967	346765.7	41767	274789.5	181789.4	76095.8	466118.4	4005.4	109081.4	342812.1	112610.4	1021.3	88294.7	7987.3	6374.6	1.7	2115481.7
Sum by Zone	608324.5	2604384	388647.6	2300602.5	1339470.3	318566.5	3236215	66682.5	524444.1	2719473.5	709204.2	8453	489337.3	75187.2	58549.3	4183.2	15451724.7

Table 10. Total counts of samples aggregated by climate zone and building category (excluding 'No Prototype').

	1A	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8	Sum by Bldg Type
Large Office	95	325	32	354	153	103	779	1	144	333	127	2	66	5	9	0	2528
Medium Office	501	2603	462	2916	1333	343	3351	94	767	3327	1361	16	796	140	118	12	18140
Small Office	2284	15782	1909	15682	5693	1421	12727	754	2599	14547	4757	67	2342	477	350	21	81412
Stand-alone Retail	1660	12500	1838	11131	4292	575	10944	451	1543	12863	3146	42	2229	408	297	21	63940
Strip Mall	283	1899	407	1799	1027	217	1841	57	389	2008	477	5	359	48	44	3	10863
Primary School	477	2932	468	3361	1440	297	3660	206	448	3334	957	15	779	201	91	7	18673
Secondary School	872	5848	801	7655	2916	668	6820	384	921	8020	1919	50	1793	346	301	45	39359
Hospital	254	1782	256	1812	563	120	2092	102	275	2441	562	17	619	128	96	6	11125
Outpatient Healthcare	416	3869	513	4077	1119	216	3824	188	661	5025	1382	29	1255	203	193	21	22991
Full Service Restaurant	575	4293	645	3910	1560	251	3731	176	421	4306	999	12	608	106	83	7	21683
Quick Service Restaurant	345	3000	415	2877	965	114	2587	97	274	3075	858	5	489	83	45	2	15231
Large Hotel	191	843	127	780	426	114	1036	35	160	884	243	4	203	63	39	1	5149
Small Hotel	175	1314	103	1032	437	89	1286	64	120	1145	409	15	371	105	68	4	6737
Non-Refrigerated Warehouse	1498	9559	1290	6877	3349	492	7789	313	1481	9745	3013	41	2206	344	384	37	48418
High-rise Apartment	630	666	41	326	301	201	3387	0	357	843	118	0	77	7	3	0	6957
Mid-rise Apartment	544	2567	347	2318	1761	674	8490	77	1312	4415	1131	17	1001	133	85	1	24873
Sum by Zone	10800	69782	9654	66907	27335	5895	74344	2999	11872	76311	21459	337	15193	2797	2206	188	398079

3.2 'No Prototype' Category Details

For the purpose of gaining better understanding of buildings not covered by the prototypes ('No Prototype' buildings), they are further characterized in this section with the three categorization aspects: Additional Non-Prototype (Table 11, Table 12), CBECS PBA (Table 13, Table 14) and CBECS PBAPlus (Table 15, Table 16). With regard to each of these three aspects, two tables are used to show the distribution of 'No Prototype' samples: one table summarizes the total

counts of samples and construction area information both in actual numbers and in percentages; the other table shows a fine granular total construction area of samples aggregated by climate zone.

Table 11. Distribution of 'No Prototype' samples using Additional Non-Prototype subcategories.

Additional Non-Prototype	Total counts of samples	Sample-count-based weighting factors	Construction area	Construction-area-based weighting factors
Auto (Service)	126	0.02%	918.7	0.00%
Laundry (Service)	166	0.03%	1049.9	0.01%
Beauty (Service)	315	0.06%	1533.7	0.01%
Convenience Store	2000	0.36%	13613.1	0.07%
Court House	865	0.16%	49978.2	0.24%
Data Center	461	0.08%	70545.8	0.34%
Transit Terminal	2585	0.47%	121343.7	0.59%
Laboratory	1929	0.35%	136866	0.66%
Supermarket	5017	0.91%	197082.3	0.96%
Parking Garage	18519	3.38%	2025484.5	9.84%
Other[1]	118286	21.57%	2523301.6	12.25%
All	150269	27.40%	5141717.5	24.97%

Table 12. Total construction area (in 1,000 square feet) of 'No Prototype' samples aggregated by climate zone and Additional Non-Prototype subcategories.

Additional Non-Prototype	1A	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8	Sum by Bldg Type
Auto (Service)	10.3	221.9	21.4	201.6	47.7	9.7	107.5	0	2.6	187	31.2	0	59.5	18.3	0	0	918.7
Laundry (Service)	6	289.7	12.8	239.7	57.4	7.4	218.2	6.1	4	155.8	33.8	0.2	17.8	0	1	0	1049.9
Beauty (Service)	9.6	369.3	19.5	305	68.1	10.4	193	0	71.1	260.6	98.5	0	69.5	43.6	11.6	3.9	1533.7
Convenience Store	198.2	3084	197.3	2265.8	630.2	57.8	2211.7	144.9	197	2493.7	844.8	0	829.4	205.1	252.3	0.9	13613.1
Court House	1727	7355.9	2085.6	9193.2	4880.8	747.8	9410.6	222.6	1032.2	7313.9	3193.7	6.5	1668.7	798.6	341.1	0	49978.2
Data Center	33.4	8102.6	1944.6	14050.4	2130.5	2066.6	14851.5	1430	578.7	12240.9	11941.3	0	947.4	192.1	35.8	0	70545.8
Transit Terminal	5394.1	19929.1	957.4	14240.7	10534.9	3351.9	26302.4	429.9	3823	18389.4	8375.8	106.7	7528.2	868.6	1008.8	102.8	121343.7
Laboratory	2101.5	15786.2	2652.2	15302.5	8094.9	8751.5	32153.9	1764.1	5246.2	33047.6	6793.5	48.6	3424.2	817.4	652.1	229.6	136866
Supermarket	5845.2	34058.9	3115.3	39242.5	7921.7	2603.4	38733.2	384.8	2845.7	44007.8	8388.7	86.5	8318.9	814.3	652.4	63	197082.3
Parking Garage	145423.8	335451	56022.9	248000.9	243273.2	74906.1	356562.8	3900.3	105309.3	293698.8	85331.9	1374	63675.6	5550.7	6990.5	12.7	2025484.5
Other	63383.7	384417.9	61757.2	458987	197760.2	43930.4	452704.7	18902.9	64504.6	494662.2	127990.6	2454.1	112849.2	18564.9	17670.6	2761.4	2523301.6
Sum by Zone	224132.8	809066.5	128786.2	802029.3	475399.6	136443	933449.5	27185.6	183614.4	906457.7	253023.8	4076.6	199388.4	27873.6	27616.2	3174.3	5141717.5

Table 13. Distribution of 'No Prototype' samples using CBECS PBA subcategories.

CBECS PBA	Total counts of samples	Sample-count-based weighting factors	Construction area	Construction-area-based weighting factors
Refrigerated Warehouse	1283	0.23%	84061.5	0.41%
Other	1397	0.25%	88310.2	0.43%
Laboratory	1929	0.35%	136866	0.66%
Food Sales	7017	1.28%	210695.4	1.02%
Religious Worship	22334	4.07%	338548.4	1.64%
Lodging (dormitory)	5099	0.93%	375075.4	1.82%
Public Order and Safety	18129	3.31%	446641.1	2.17%
Public Assembly	45399	8.28%	992390.8	4.82%
Service	47682	8.70%	2469128.7	11.99%
All	150269	27.40%	5141717.5	24.97%

[1] The Additional Non-Prototype subcategory is used to identify non-prototype samples of interest for research purposes, as listed above in this table, and for samples that do not fit into any of these types, a value of 'Other' is given.

Table 14. Total construction area (in 1,000 square feet) of 'No Prototype' samples aggregated by climate zone and CBECS PBA subcategories.

CBECS PBA	1A	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8	Sum by Bldg Type
Refrigerated Warehouse	1696.4	13241.5	639.8	10572.2	4341.3	2309.6	14530.2	580.7	4105	22879.7	5845.4	0	3027.1	172.3	110.8	9.5	84061.5
Other	785.7	11607.8	2316.2	17840.1	3282.6	2138.2	18181.5	1860.9	1121.9	14637.4	12656.3	21	1258.1	446.9	131.7	23.9	88310.2
Laboratory	2101.5	15786.2	2652.2	15302.5	8094.9	8751.5	32153.9	1764.1	5246.2	33047.6	6793.5	48.6	3424.2	817.4	652.1	229.6	136866
Food Sales	6043.4	37142.9	3312.6	41508.3	8551.9	2661.2	40944.9	529.7	3042.7	46501.5	9233.5	86.5	9148.3	1019.4	904.7	63.9	210695.4
Religious Worship	5828.8	64314.8	6535.5	85234.9	15642.6	1644.1	65970.8	1859	6644.1	53773.3	17581.1	157.1	10200.8	2203	920.4	38.1	338548.4
Lodging (dormitory)	7247.4	46742.2	7238.6	71651.1	29870	9749.5	76146.1	2235.1	10237.6	77984.6	16301.7	277.4	13982.1	2211.8	2523.2	677	375075.4
Public Order and Safety	9207.6	64970	12845.9	86169.4	40317.4	6279	80445.9	5208.9	10342.7	72161.3	23525	908.5	23491.6	4762.9	5249.5	755.5	446641.1
Public Assembly	28331.2	145788.6	23281.8	156873.7	89742.5	17727.5	182576.2	6260.4	24874.6	202501.3	50588.7	654	47456.3	8236.7	6933.1	564.2	992390.8
Service	162890.8	409472.5	69963.6	316877.1	275556.4	85182.4	422500	6886.8	117999.6	382971	110498.6	1923.5	87399.9	8003.2	10190.7	812.6	2469128.7
Sum by Zone	224132.8	809066.5	128786.2	802029.3	475399.6	136443	933449.5	27185.6	183614.4	906457.7	253023.8	4076.6	199388.4	27873.6	27616.2	3174.3	5141717.5

Table 15. Distribution of 'No Prototype' samples using CBECS PBAPlus subcategories.

CBECS PBAPlus	Total counts of samples	Sample-count-based weighting factors	Construction area	Construction-area-based weighting factors
44: Post office/postal center	227	0.04%	6530.6	0.03%
12: Convenience Store	2000	0.36%	13613.1	0.07%
52: Courthouse/probation office	865	0.16%	49978.2	0.24%
24: Recreation	4940	0.90%	64882.4	0.32%
48: Other service	5103	0.93%	68844.7	0.33%
23: Library	3806	0.69%	69244.3	0.34%
20: Refrigerated warehouse	1283	0.23%	84061.5	0.41%
49: Other	1397	0.25%	88310.2	0.43%
26: Other public assembly	2585	0.47%	121343.7	0.59%
16: Fire station/police station	10414	1.90%	132052.3	0.64%
08: Laboratory	1929	0.35%	136866	0.66%
14: Grocery store/food market	5017	0.91%	197082.3	0.96%
17: Other public order and safety	6850	1.25%	264610.6	1.28%
25: Social/meeting	9792	1.79%	289578.9	1.41%
21: Religious worship	22334	4.07%	338548.4	1.64%
46: Vehicle service/repair shop	23833	4.35%	368268.9	1.79%
37: Dormitory/fraternity/sorority	5099	0.93%	375075.4	1.82%
22: Entertainment/culture	24276	4.43%	447341.5	2.17%
47: Vehicle storage/maintenance	18519	3.38%	2025484.5	9.84%
All	150269	27.40%	5141717.5	24.97%

Table 16. Total construction area (in 1,000 square feet) of 'No Prototype' samples aggregated by climate zone and CBECS PBAPlus subcategories.

CBECS PBAPlus	1A	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8	Sum by Bldg Type
44: Post office/postal center	523.6	791	67.5	1328.5	398.9	130.5	627.9	9	22.7	1163	318.6	0	1140.6	0	8.8	0	6530.6
12: Convenience Store	198.2	3084	197.3	2265.8	630.2	57.8	2211.7	144.9	197	2493.7	844.8	0	829.4	205.1	252.3	0.9	13613.1
52: Courthouse/probation office	1727	7355.9	2085.6	9193.2	4880.8	747.8	9410.6	222.6	1032.2	7313.9	3193.7	6.5	1668.7	798.6	341.1	0	49978.2
24: Recreation	3028.5	12934.2	1575.3	11404.4	3506.2	674.7	12419.6	347.2	1486.1	11187.3	3426.1	8.4	2078.1	570.9	156.4	79	64882.4
48: Other service	1441.7	7683.5	1048.1	12833.7	4351.6	5133.9	10306.2	449.9	1440.6	14866.3	3202.1	18.8	4959.7	663	375.9	69.7	68844.7
23: Library	2045.8	8091.4	1046.8	10023.3	7097.3	2824	12936.2	349.2	1240.4	15890.2	3496.1	67.5	3008.1	741.8	353.1	33.1	69244.3
20: Refrigerated warehouse	1696.4	13241.5	639.8	10572.2	4341.3	2309.6	14530.2	580.7	4105	22879.7	5845.4	0	3027.1	172.3	110.8	9.5	84061.5
49: Other	785.7	11607.8	2316.2	17840.1	3282.6	2138.2	18181.5	1860.9	1121.9	14637.4	12656.3	21	1258.1	446.9	131.7	23.9	88310.2
26: Other public assembly	5394.1	19929.1	957.4	14240.7	10534.9	3351.9	26302.4	429.9	3823	18389.4	8375.8	106.7	7528.2	868.6	1008.8	102.8	121343.7
16: Fire station/police station	3364.7	19593.4	4056.8	20783.7	10388	1801.2	21523.1	1294.2	3578.4	27313.7	6705.1	158.3	8022.2	1570	1774.5	125	132052.3
08: Laboratory	2101.5	15786.2	2652.2	15302.5	8094.9	8751.5	32153.9	1764.1	5246.2	33047.6	6793.5	48.6	3424.2	817.4	652.1	229.6	136866
14: Grocery store/food market	5845.2	34058.9	3115.3	39242.5	7921.7	2603.4	38733.2	384.8	2845.7	44007.8	8388.7	86.5	8318.9	814.3	652.4	63	197082.3
17: Other public order and safety	4115.9	38020.7	6703.5	56192.5	25048.6	3730	49512.2	3692.1	5732.1	37533.7	13626.2	743.7	13800.7	2394.3	3133.9	630.5	264610.6

25: Social/meeting	6437.1	35408.2	8174.8	56842.9	24997.4	4047.7	49581.7	1677.5	6213.2	65300.2	12849.8	202.6	13218.9	2784.8	1722.6	119.5	289578.9
21: Religious worship	5828.8	64314.8	6535.5	85234.9	15642.6	1644.1	65970.8	1859	6644.1	53773.3	17581.1	157.1	10200.8	2203	920.4	38.1	338548.4
46: Vehicle service/repair shop	15501.7	65547	12825.1	54714	27532.7	5011.9	55003.1	2527.6	11227	73242.9	21646	530.7	17624	1789.5	2815.5	730.2	368268.9
37: Dormitory/fraternity/sorority	7247.4	46742.2	7238.6	71651.1	29870	9749.5	76146.1	2235.1	10237.6	77984.6	16301.7	277.4	13982.1	2211.8	2523.2	677	375075.4
22: Entertainment/culture	11425.7	69425.7	11527.5	64362.4	43606.7	6829.2	81336.3	3456.6	12111.9	91734.2	22440.9	268.8	21623	3270.6	3692.2	229.8	447341.5
47: Vehicle storage/maintenance	145423.8	335451	56022.9	248000.9	243273.2	74906.1	356562.8	3900.3	105309.3	293698.8	85331.9	1374	63675.6	5550.7	6990.5	12.7	2025484.5
Sum by Zone	224132.8	809066.5	128786.2	802029.3	475399.6	136443	933449.5	27185.6	183614.4	906457.7	253023.8	4076.6	199388.4	27873.6	27616.2	3174.3	5141717.5

3.3 Changes in Weighting Factors from 2003-2007 to 2003-2018

The current work updated the previous weighting factors which were based on a 2003-2007 dataset, to the current weighting factors based on a 2003-2018 dataset. Table 17 shows that considering the updated data set, the percentage of new construction area represented by the prototypes is reduced from 80% to 75.5%. Figure 3 and Figure 4 show the change in construction area by building category and climate zone respectively between the two data sets.

Table 17. Comparison of the overall construction weight between 2003-2007 and 2003-2018.

Source: PNNL conducted Dodge database analysis	2003-2007	2003-2018
% covered by the 16 prototypes	80.0%	75.5%
Total construction area (thousands of ft^2 per year)	1,653,195	1,287,090

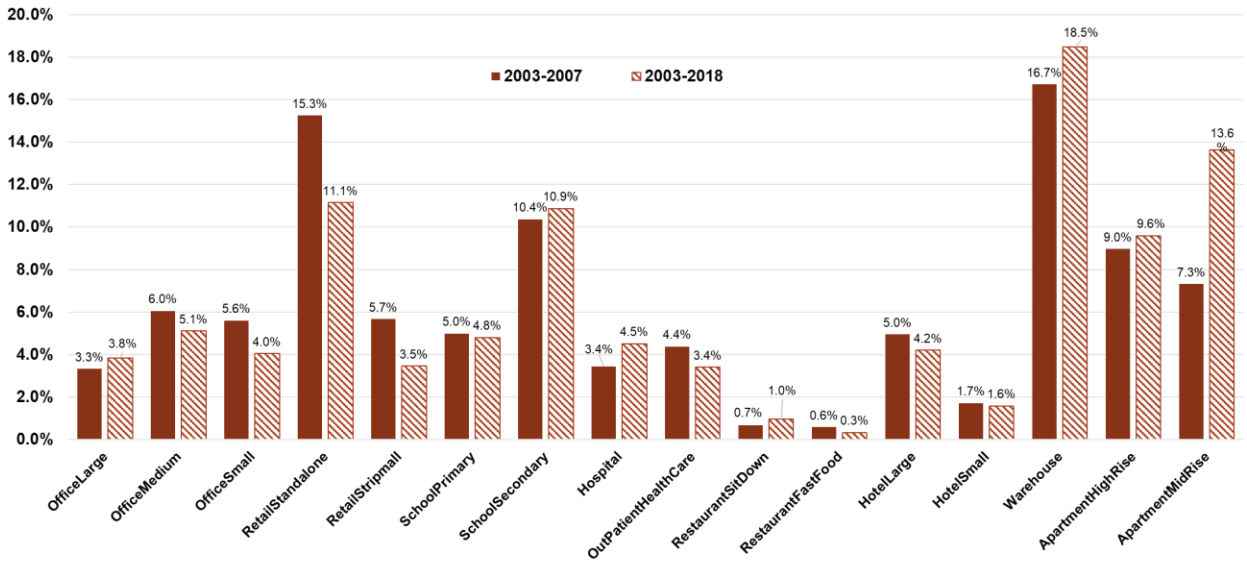

Figure 3. Comparison of the construction weight by square footage between 2003-2007 and 2003-2018 by prototype building category.

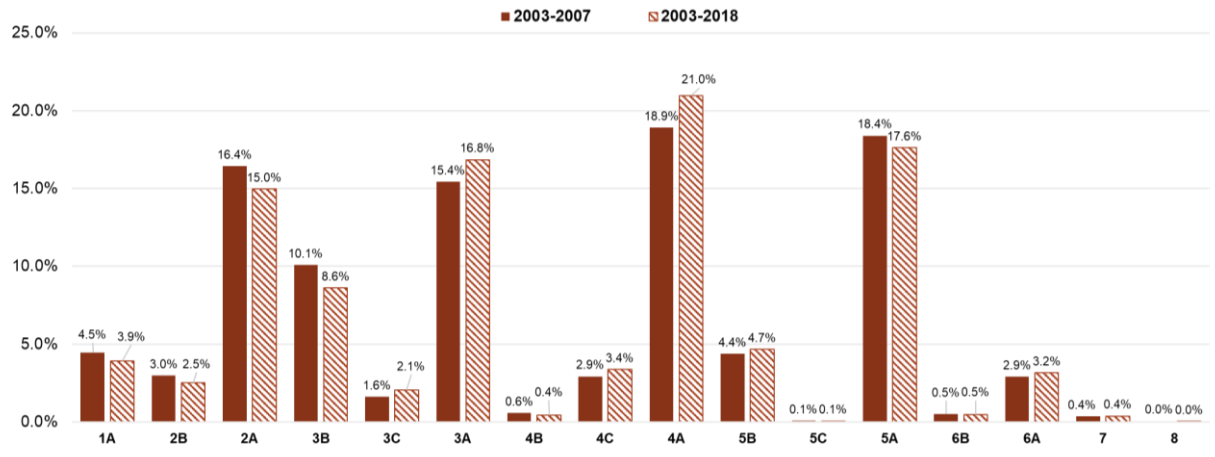

Figure 4. Comparison of the construction weight by square footage between 2003-2007 and 2003-2018 by climate zone.

4.0 Discussion

A set of new construction weighting factors of good quality, that is representative and developed based on a large number of accurate building samples, is essential to conducting bottom-up building energy impact analysis at the state and national scale. In this study, a method / framework / workflow was developed and implemented that thoroughly processed more than one million building samples from the Dodge dataset and categorized almost all of them into one of the unique commercial building categories with a high degree of accuracy.

To implement the workflow and categorization logic, a scripting language featuring popular data processing packages was utilized, thus preventing labor-intensive and error-prone manual checking. With the two equally important objectives of 1) categorizing as many buildings as possible to unique categories and 2) achieving high categorization accuracy, the development of the categorization logic rules and the associated numerous keywords is a repeated manual trial and error process that requires knowledge of both commercial building market domain and knowledge-based categorization. Many iterations of development are performed in order to achieve the final categorization rate and accuracy presented in this report. While the categorization logic procedures and workflow are specific for categorizing and weighting analysis of the Dodge Data, the general knowledge-based modeling method and the workflow are suitable for analyzing other heterogeneous building stock data.

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Appendix A Additional Tables and Figures for Data Processing

Table A.1. Dodge project types excluded from analysis.

Dodge Project Type	
Apartments 5+ units, 1-3 stories	Mfg Plants: Printing, Pub and Allied
Apartments 3 or 4 units	Mfg Plants: Railroad Equipment
Apartments Alterations, Stories Unknown	Mfg Plants: Rubber Products
Mfg Labs: Aircraft and Parts	Mfg Plants: Ship and Boat Building
Mfg Labs: Chemical Plants (Enclosed)	Mfg Plants: Stone, Clay and Glass
Mfg Labs: Classification Unknown	Mfg Plants: Textile Mill Products
Mfg Labs: Electrical Machinery	Mfg Plants: Tobacco
Mfg Labs: Food and Kindred Products	Mfg War: Aircraft and Parts
Mfg Labs: Machinery Except Electrical	Mfg War: Chemical Plants
Mfg Labs: Miscellaneous Manufacturing	Mfg War: Classification Unknown
Mfg Labs: Motor Vehicles and Equipment	Mfg War: Electrical Machinery
Mfg Labs: Petroleum and Coal Products	Mfg War: Fabricated Metal Products
Mfg Labs: Plastic Plants	Mfg War: Food and Kindred Products
Mfg Labs: Precision Goods	Mfg War Furniture and Fixtures
Mfg Labs: Primary Non-Ferrous Metals	Mfg War: Industrial Service Plants
Mfg Labs: Railroad Equipment	Mfg War: Leather and Leather Products
Mfg Labs: Rubber Products	Mfg War: Lumber and Wood ex Furniture
Mfg Labs: Stone, Clay, and Glass	Mfg War: Machinery, ex Electrical
Mfg Plants: Aircraft and Parts	Mfg War: Miscellaneous Manufacturing
Mfg Plants: Chemical	Mfg War: Motor Vehicles and Equipment
Mfg Plants: Chemical (Outdoors)	Mfg War: Ordnance and Accessories
Mfg Plants: Electrical Machinery	Mfg War: Paper and Allied Products
Mfg Plants: Fabricated Metal Products	Mfg War: Petroleum and Coal Products
Mfg Plants: Food and Kindred	Mfg War: Plastic Plants
Mfg Plants: Furniture and Fixtures	Mfg War: Precision Goods
Mfg Plants: Industrial Service	Mfg War: Primary Ferrous Metals
Mfg Plants: Industry Unknown	Mfg War: Primary Non-Ferrous Metals
Mfg Plants: Leather	Mfg War: Printing, Publishing
Mfg Plants: Lumber and Wood ex Furniture	Mfg War: Rubber Products
Mfg Plants: Machinery except Electrical	Mfg War: Ship and Boat Building
Mfg Plants: Miscellaneous Manufacturing	Mfg War: Stone, Clay and Glass
Mfg Plants: Motor Vehicles and Equip.	Mfg War: Textile Mill Products
Mfg Plants: Ordnance and Acc.	Miscellaneous Non-Residential Buildings
Mfg Plants: Other Transportation N.E.C.	Mfg Labs: Classification Unknown
Mfg Plants: Paper and Allied Products	Mfg War: Primary Ferrous Metal
Mfg Plants: Petroleum and Coal Prod.	Mfg War: Furniture and Fixtures
Mfg Plants: Petroleum Refineries	Mfg War: Primary Non-Ferrous Metal
Mfg Plants: Plastic Plants	Mfg Labs: Furniture and Fixtures
Mfg Plants: Precision Goods	Mfg Labs: Fabricated Metal Products
Mfg Plants: Primary Ferrous Metals	Mfg Labs: Ordnance and Accessories
Mfg Plants: Primary Non-Ferrous Metals	

Table A.2. Prototype direct mapping table.

Dodge Project Type	CBECS PBA	CBECS PBAPlus	Prototype	Additional Non-Prototype Category
Hospitals	Inpatient Health Care	35: Hospital/inpatient health	Hospital	Other
Dormitories	Lodging	37: Dormitory/fraternity/sorority	No Prototype	Other
Arenas/Coliseums	Public Assembly	22: Entertainment/culture	No Prototype	Other
Auditoriums	Public Assembly	25: Social/meeting	No Prototype	Other
Bowling Alleys	Public Assembly	22: Entertainment/culture	No Prototype	Other
Exhibition Halls	Public Assembly	25: Social/meeting	No Prototype	Other
Gyms/Field Houses/Indoor Pools	Public Assembly	25: Social/meeting	No Prototype	Other
Libraries	Public Assembly	23: Library	No Prototype	Other
Miscellaneous Amusement/Recreational	Public Assembly	22: Entertainment/culture	No Prototype	Other
Museums	Public Assembly	22: Entertainment/culture	No Prototype	Other
Theaters	Public Assembly	22: Entertainment/culture	No Prototype	Other
*YMCA/YWCA	Public Assembly	24: Recreation	No Prototype	Other
Detention Facilities	Public Order & Safety	17: Other public order and safety	No Prototype	Other
Police/Fire Stations	Public Order & Safety	16: Fire station/police station	No Prototype	Other
Refrigerated Warehouses	Refrigerated Warehouse	20: Refrigerated warehouse	No Prototype	Other
Houses of Worship, Other Religious Bldgs	Religious Worship	21: Religious worship	No Prototype	Other
*Sunday Schools now in STC 53	Religious Worship	21: Religious worship	No Prototype	Other
Aircraft Service	Service	46: Vehicle service/repair shop	No Prototype	Other
Animal/Fish/Plant Facilities	Service	48: Other service	No Prototype	Other
Auto Service	Service	46: Vehicle service/repair shop	No Prototype	Other
Bus and Truck Service	Service	46: Vehicle service/repair shop	No Prototype	Other
Funeral/Internment Facilities	Service	48: Other service	No Prototype	Other
Post Offices	Service	44: Post office/postal center	No Prototype	Other
Railroad/Boat/Other Vehicle Service	Service	46: Vehicle service/repair shop	No Prototype	Other
Primary Schools	Education	28: Elementary/middle school	Primary School	Other
Colleges/Universities Except Community	Education	27: College/university	Secondary School	Other
Community Colleges	Education	27: College/university	Secondary School	Other
Junior High Schools	Education	28: Elementary/middle school	Secondary School	Other
Senior High Schools	Education	29: High school	Secondary School	Other
Special Schools	Education	31: Other classroom education	Secondary School	Other
Vocational Schools	Education	27: College/university	Secondary School	Other

Dodge Project Type	CBECS PBA	CBECS PBAPlus	Prototype	Additional Non-Prototype Category
Warehouses (Non-refrigerated)	Non-refrigerated Warehouse	10: Non-refrigerated warehouse	Non-Refrigerated Warehouse	Other
Airline Terminals	Public Assembly	26: Other public assembly	No Prototype	Transit Terminal
Bus, Truck and Railroad Terminals	Public Assembly	26: Other public assembly	No Prototype	Transit Terminal
Freight Terminals, Truck Rail and Marine	Public Assembly	26: Other public assembly	No Prototype	Transit Terminal
Parking Garages	Service	47: Vehicle storage/maintenance	No Prototype	Parking Garage
Laboratories/Testing/R&D	Laboratory	08: Laboratory	No Prototype	Laboratory

Table A.3. Prototype keywords mapping lists.

Keywords Category	Keywords List
Apartment (22)	Apartment; Apartments; Condominium; Condominiums; Condos; Residence; Residences; Multifamily; Residential; Townhouse; Retirement; Housing; Independent Living; Elderly; Senior; Home; Community; Apts; Adult Care; Town Homes; Townhomes; Lofts
Auto Service (3)	Oil; Auto Service; Tire
Beauty Service (4)	Beauty Service; Salon; Beauty Parlor; Spa
Big Box Retail (53)	BJ's Wholesale Club; Costco; Fred Meyer; Kmart; Target; Walmart; T.J. Maxx; Sam's Club; Dollar General; Dollar Tree; Family Dollar; Big Lots; Hobby Lobby; Marshalls; Walgreen; Menards; Menard; Lowe's; Home Depot; Ikea; Meijer; Kohl's; JC Penny; Office Depot; Office Max; Petsmart; Petco; Staples; Sport Authority; Dick's Sporting Goods; Sears; Macy's; Crate & Barrel; Nordstrom's; Neiman Marcus; Borders; Burlington Coat Factory; Bed Bath & Beyond; Bass Pro Shops; Autozone; O'reilly; Barnes and Noble; Bass Pro Shop; Best Buy; Bed, Bath, and Beyond; Bed, Bath and Beyond; TJ Maxx; T J Maxx; Babies R Us; Cabela's; Camping World; Circuit City; Nordstrom
Convenience Store (25)	Convenience; Express; Mart; C-Store; Gas; Fuel; Repair; Wash; Quik; Trip; Travel; 7-Eleven; 7 Eleven; 7 - Eleven; 7-11; Circle K; Exxon; Kum and Go; Pump; Racetrac; Sheetz; Speedway; Sunoco; Truck Stop; Kwik
Courthouse (5)	Court; Courthouse; Justice; Judicial; Public Safety
Data Center (6)	Data Center; Data Centers; iCloud; Data Storage; Data Hall; Cloud Center
Hospital (11)	Hospital; Medical Center; Urgent Care; Emergency; Medical Facility; Inpatient; Surgery; Ambulatory; Cancer; Cardiac; Brain
Hotel (5)	Resort; Suites; Hotel; Inn; Motel
Keep As Is (4)	Mixed; Commercial; Development; Multitenant
Laundry Service (5)	Laundry; Laundromat; Laundries; Laundrette; Cleaner
Non-refrigerated Warehouse (2)	Warehouse; Storage
Office (4)	Office; Headquarters; Administration; Bank
Outpatient Healthcare (39)	Outpatient; Assisted Living; Clinic; Treatment; Wellness; Dentistry; Nursing; Eye; Therapy; Dental; Hospice; Behavioral; Podiatry; Skilled; Chiropract; Allergy; Asthma; Dialysis; Rehab; Specialist; Medical Office; Health Center; Optical; Family; Dentist; Sports Medicine; Out Patient; Physician; Pharmacy; Obgyn; Urology; Orthodontist; Doctors Office; Imaging; Vision; Dr Office; Foot Care; Foot & Ankle; Foot and Ankle
Place of Worship (11)	Church; Bible; Parish; Chapel; Christian; Baptist; Temple; Synagogue; Mosque; Buddhist; Tao
Public Assembly (25)	Public Assembly; Airport; Campground; Zoo; Fitness; Amusement; Theater; Theatre; Golf; Pool; Recreation; Wedding; Club; Clubhouse; Gym; Community Center; Lodge; American Legion; Marina; Hall; Swim; Tennis; Racquet; Youth Center; Athletic Facility

Keywords Category	Keywords List
Retail (62)	Pharmacy; Mercantile; Retail; Store; Hardware; Sport; Appliance; Galleria; Electronics; Fashion; Furniture; Drug; Outfitter; Mattress; Goodwill; Bicycle; Bike; Sew; Floor; Clothing; Carpet; Apothecary; Showroom; Bait; Jewelry; Jeweler; Video; Sleep; Plumbing Supplies; Liquor; Spirit; Lumber; Auto Parts; Autoparts; Books; Cabinet; Nursery; Boots; Boot; CVS; Shoes; Equipment; Footwear; Flower Shop; Florist; Guitar; Guns; Gun Shop; Tools; Gallery; Pawn; Retail; Retail; Rite Aid; Ross Dress for Less; Stewart's; Verizon; Print Shop; Photography; Studio; Eyeglass; Eyeglasses
Secondary School (9)	Hall; University; High; Middle; Secondary; College; Highschool; Student; Alumni
Strip Mall (26)	Strip; Complex; Shopping Center; Mall; Plaza; Outlets; Promenade; Marketplace; Shoppes; Outlet; Outlot; Shops at; Shopping Centre; The Shops; The Village @; Shopping Ctr; Village Center; Town Center; Shop Center; Shops @; Village at; Towne Center; Town Centre; Shopping Village; Shoppingtown; Business Park
Supermarket (31)	Grocer; Grocery; Supermarket; Super Market; Pantry; Produce; Vegetable; Meat; Superette; Foods; Fresh; Trader Joe's; Kroger; Publix; Safeway; Smith's; Albertsons; Piggly Wiggly; Aldi; Food Co-op; Farmer's Market; Farmers Market; Food Lion; Food City; Food Market; Seafood Market; King Soopers; New Seasons; Winn Dixie; Farm Market; Trader Joes;

Table A.4. Franchise restaurant mapping table.

Franchise Keywords	Mapping Prototype	Franchise Keywords	Mapping Prototype
A&W	Quick Service Restaurant	Logan's	Full Service Restaurant
Abuelo's	Full Service Restaurant	Long John Silver's	Quick Service Restaurant
Anthony's Coal Fired Pizza	Full Service Restaurant	LongHorn Steakhouse	Full Service Restaurant
Applebee's	Full Service Restaurant	Luby's	Quick Service Restaurant
Arby's	Quick Service Restaurant	Lucille's	Full Service Restaurant
Au Bon Pain	Quick Service Restaurant	Maggiano's	Full Service Restaurant
Auntie Anne's	Quick Service Restaurant	Marco's Pizza	Quick Service Restaurant
Bahama Breeze	Full Service Restaurant	Marie Callender's	Full Service Restaurant
Baja Fresh	Quick Service Restaurant	Mastro's	Full Service Restaurant
Bar Louie	Full Service Restaurant	McAlister's	Quick Service Restaurant
Baskin	Quick Service Restaurant	McCormick & Schmick's	Full Service Restaurant
Beef 'O' Brady's	Full Service Restaurant	McDonald's	Quick Service Restaurant
Benihana	Full Service Restaurant	Mellow Mushroom	Full Service Restaurant
Bertucci's	Full Service Restaurant	Menchie's	Quick Service Restaurant
Big Boy	Full Service Restaurant	Miller's	Full Service Restaurant
Biggby	Quick Service Restaurant	Mimi's	Full Service Restaurant
Bill Miller	Full Service Restaurant	MOD Pizza	Quick Service Restaurant
BJ's	Full Service Restaurant	Moe's	Quick Service Restaurant
Black Angus	Full Service Restaurant	Morton's	Full Service Restaurant
Black Bear	Full Service Restaurant	Mountain Mike's	Quick Service Restaurant
Blaze Pizza	Quick Service Restaurant	Newk's	Quick Service Restaurant
Bob Evans	Full Service Restaurant	Ninety Nine Restaurants	Full Service Restaurant

Franchise Keywords	Mapping Prototype	Franchise Keywords	Mapping Prototype
Bojangles	Quick Service Restaurant	Noodles & Company	Quick Service Restaurant
Bonefish	Full Service Restaurant	O'Charley's	Full Service Restaurant
Boston Market	Quick Service Restaurant	Old Chicago	Full Service Restaurant
Braum's	Quick Service Restaurant	Old Country Buffet	Quick Service Restaurant
Bravo!	Full Service Restaurant	HomeTown Buffet	Quick Service Restaurant
Brio Tuscan	Full Service Restaurant	Olive Garden	Full Service Restaurant
Bruegger's	Quick Service Restaurant	On The Border Mexican Grill & Cantina	Full Service Restaurant
Bubba Gump	Full Service Restaurant	Outback Steakhouse	Full Service Restaurant
Buca di Beppo	Full Service Restaurant	P.F. Chiang's	Full Service Restaurant
Buffalo Wild Wings	Full Service Restaurant	Panda Express	Quick Service Restaurant
Burger King	Quick Service Restaurant	Panera	Quick Service Restaurant
BurgerFi	Quick Service Restaurant	Saint Louis Bread	Quick Service Restaurant
Cafe Rio	Quick Service Restaurant	Papa Gino's Pizzeria	Quick Service Restaurant
California Pizza	Full Service Restaurant	Papa John's	Quick Service Restaurant
Cantina Laredo	Full Service Restaurant	Papa Murphy's Pizza	Quick Service Restaurant
Captain D's	Quick Service Restaurant	Pappadeaux	Full Service Restaurant
Caribou	Quick Service Restaurant	Pappasito's	Full Service Restaurant
Carl's Jr.	Quick Service Restaurant	PDQ	Quick Service Restaurant
Carrabba's	Full Service Restaurant	Peet's	Quick Service Restaurant
Charleys	Quick Service Restaurant	Pei Wei	Quick Service Restaurant
Chart House	Full Service Restaurant	Penn Station	Quick Service Restaurant
Checkers	Quick Service Restaurant	Perkins	Full Service Restaurant
Cheddar's	Full Service Restaurant	Pieology	Quick Service Restaurant
Chick-fil-A	Quick Service Restaurant	Pizza Hut	Quick Service Restaurant
Chili's	Full Service Restaurant	Pizza Pro	Quick Service Restaurant
Chipotle	Quick Service Restaurant	Pizza Ranch	Quick Service Restaurant
Chuck E. Cheese's	Quick Service Restaurant	Pollo Tropical	Quick Service Restaurant
Church's Chicken	Quick Service Restaurant	Ponderosa	Quick Service Restaurant
Chuy's	Full Service Restaurant	Bonanza	Quick Service Restaurant
Cicis	Quick Service Restaurant	Popeyes	Quick Service Restaurant
Cinnabon	Quick Service Restaurant	Portillo's	Quick Service Restaurant
Claim Jumper	Full Service Restaurant	Potbelly	Quick Service Restaurant
Cold Stone	Quick Service Restaurant	Pret a Manger	Quick Service Restaurant
Cooper's Hawk	Full Service Restaurant	Qdoba	Quick Service Restaurant

Franchise Keywords	Mapping Prototype	Franchise Keywords	Mapping Prototype
Corner Bakery	Quick Service Restaurant	Quaker Steak & Lube	Full Service Restaurant
Country Pride	Full Service Restaurant	Quiznos	Quick Service Restaurant
Cracker Barrel	Full Service Restaurant	Rainforest Cafe	Full Service Restaurant
Culver's	Quick Service Restaurant	Raising Cane's	Quick Service Restaurant
Dairy Queen	Quick Service Restaurant	Rally's	Quick Service Restaurant
Orange Julius	Quick Service Restaurant	Red Lobster	Full Service Restaurant
Dave & Buster's	Full Service Restaurant	Red Robin	Full Service Restaurant
Del Frisco's	Full Service Restaurant	Rita's Ice	Quick Service Restaurant
Del Taco	Quick Service Restaurant	Romano's	Full Service Restaurant
Denny's	Full Service Restaurant	Roosters	Full Service Restaurant
Dickey's	Quick Service Restaurant	Rosati's	Quick Service Restaurant
Domino's	Quick Service Restaurant	Round Table	Quick Service Restaurant
Donatos Pizza	Quick Service Restaurant	Rubio's	Quick Service Restaurant
Duffy's	Full Service Restaurant	Ruby Tuesday	Full Service Restaurant
Dunkin' Donuts	Quick Service Restaurant	Ruth's Chris	Full Service Restaurant
Dutch Bros	Quick Service Restaurant	Ryan's	Quick Service Restaurant
Eat'n Park	Full Service Restaurant	Saltgrass	Full Service Restaurant
Einstein Bros	Quick Service Restaurant	Sarku Japan	Quick Service Restaurant
El Pollo Loco	Quick Service Restaurant	Sbarro	Quick Service Restaurant
El Torito	Full Service Restaurant	Schlotzsky's	Quick Service Restaurant
Famous Dave's	Full Service Restaurant	Seasons 52	Full Service Restaurant
Farmer Boys	Quick Service Restaurant	Shake Shack	Quick Service Restaurant
Fazoli's	Quick Service Restaurant	Shari's	Full Service Restaurant
Firebirds Wood Fired	Full Service Restaurant	Shoney's	Full Service Restaurant
Firehouse Subs	Quick Service Restaurant	Sizzler	Quick Service Restaurant
First Watch	Full Service Restaurant	Smashburger	Quick Service Restaurant
Five Guys	Quick Service Restaurant	Smokey Bones	Full Service Restaurant
Fleming's	Full Service Restaurant	Smoothie King	Quick Service Restaurant
Fogo de Chao	Full Service Restaurant	Sonic	Quick Service Restaurant
Freddy's	Quick Service Restaurant	Sonny's	Full Service Restaurant
Firebirds World Burrito	Quick Service Restaurant	Souplantation	Quick Service Restaurant
Friendly's	Full Service Restaurant	Starbucks	Quick Service Restaurant
Fuddruckers	Quick Service Restaurant	Steak 'n Shake	Quick Service Restaurant
Fuzzy's Taco Shop	Quick Service Restaurant	Subway	Quick Service Restaurant

Franchise Keywords	Mapping Prototype	Franchise Keywords	Mapping Prototype
Godfather's Pizza	Quick Service Restaurant	Taco Bell	Quick Service Restaurant
Golden Chick	Quick Service Restaurant	Taco Bueno	Quick Service Restaurant
Golden Corral	Quick Service Restaurant	Taco Cabana	Quick Service Restaurant
Grand Lux Cafe	Full Service Restaurant	Taco John's	Quick Service Restaurant
Granite City Food & Brewery	Full Service Restaurant	Texas de Brazil Churrascaria	Full Service Restaurant
Great American Cookies	Quick Service Restaurant	Texas Roadhouse	Full Service Restaurant
Hard Rock	Full Service Restaurant	TGI Fridays	Full Service Restaurant
Hardee's	Quick Service Restaurant	Capital Grille	Full Service Restaurant
Hooters	Full Service Restaurant	Cheesecake Factory	Full Service Restaurant
Houlihan's	Full Service Restaurant	Coffee Bean	Quick Service Restaurant
Houston's	Full Service Restaurant	Habit Burger	Quick Service Restaurant
Huddle House	Full Service Restaurant	Melting Pot	Full Service Restaurant
Hungry Howie's	Quick Service Restaurant	Pancake House	Full Service Restaurant
IHOP	Full Service Restaurant	Tijuana Flats	Quick Service Restaurant
In-N-Out Burger	Quick Service Restaurant	Tilted Kilt	Full Service Restaurant
Islands Fine Burgers & Drinks	Full Service Restaurant	Tim Hortons	Quick Service Restaurant
J. Alexander's	Full Service Restaurant	Togo's	Quick Service Restaurant
Jack in the Box	Quick Service Restaurant	Tropical Smoothie Cafe	Quick Service Restaurant
Jack's	Quick Service Restaurant	Twin Peaks	Full Service Restaurant
Jamba Juice	Quick Service Restaurant	Uncle Julio's	Full Service Restaurant
Jason's Deli	Quick Service Restaurant	Uno Pizzeria	Full Service Restaurant
Jersey Mike's	Quick Service Restaurant	Villa Fresh	Quick Service Restaurant
Jet's	Quick Service Restaurant	Village Inn	Full Service Restaurant
Margaritaville	Full Service Restaurant	WaBa Grill	Quick Service Restaurant
Jimmy John's	Quick Service Restaurant	Waffle House	Full Service Restaurant
Joe's Crab Shack	Full Service Restaurant	Wendy's	Quick Service Restaurant
Johnny Carino's	Full Service Restaurant	Wetzel's Pretzels	Quick Service Restaurant
Johnny Rockets	Full Service Restaurant	Whataburger	Quick Service Restaurant
KFC	Quick Service Restaurant	Which Wich	Quick Service Restaurant
Kona Grill	Full Service Restaurant	White Castle	Quick Service Restaurant
Krispy Kreme	Quick Service Restaurant	Wienerschnitzel	Quick Service Restaurant
Krystal Company	Quick Service Restaurant	Wild Wing Cafe	Full Service Restaurant
la Madeleine	Quick Service Restaurant	Wingstop	Quick Service Restaurant
LaRosa's	Full Service Restaurant	Yard House	Full Service Restaurant

Franchise Keywords	Mapping Prototype	Franchise Keywords	Mapping Prototype
Le Pain Quotidien	Quick Service Restaurant	Yogurtland	Quick Service Restaurant
Legal Sea Foods	Full Service Restaurant	Zaxby's	Quick Service Restaurant
Little Caesars	Quick Service Restaurant	Zoes Kitchen	Quick Service Restaurant

Table A.5. Additional restaurant keywords mapping table.

Keywords	Mapping prototype	Keywords	Mapping prototype
Brewery	Full Service Restaurant	Donut	Quick Service Restaurant
Coffee	Quick Service Restaurant	Tavern	Full Service Restaurant
Steakhouse	Full Service Restaurant	Taco	Quick Service Restaurant
Ice Cream	Quick Service Restaurant	Cafe	Quick Service Restaurant
Concession	Quick Service Restaurant	Wine	Full / Quick Service Restaurant*
Deli	Quick Service Restaurant	Wings	Quick Service Restaurant
Bakery	Quick Service Restaurant	Bar	Full / Quick Service Restaurant*
Pizza	Full / Quick Service Restaurant*	Grill	Full / Quick Service Restaurant*
Burger	Quick Service Restaurant	Restaurant	Full Service Restaurant
Diner	Full Service Restaurant	Brew Pub	Full Service Restaurant
Cafeteria	Full Service Restaurant	Dining	Full Service Restaurant
Hot Dogs	Quick Service Restaurant	Roadhouse	Full Service Restaurant
Drive thru	Quick Service Restaurant		
* Full service restaurant if larger than 4,000 square feet, otherwise quick service restaurant.			

Appendix B Tables for State-level Construction Area and Sample Count

Table B.1. State-level total construction area (in 1,000 square feet) of samples aggregated by climate zone and building category.

State Code	Climate Zone	Large Office	Medium Office	Small Office	Stand-alone Retail	Strip Mall	Primary School	Secondary School	Hospital	Outpatient Healthcare	Full Service Rest-aurant	Quick Service Rest-aurant	Large Hotel	Small Hotel	Non-Refrigerated Warehouse	High-rise Apartment	Mid-rise Apartment	No Prototype	All Total
AK	5C	0	36.4	6.8	0	0	64	53.8	97	41.4	0	0	0	31.7	27.1	0	8.5	182.5	549.2
AK	6A	0	0	9.6	104.9	0	1.1	370.7	69.5	115.8	0	0	0	1.3	182.3	0	40.1	848.2	1743.5
AK	7	1095.3	1527.7	825.2	2964.3	213.5	476.1	2203.5	983.7	1595.8	239.4	24.3	848.5	409.5	2019.1	0	531.6	8567.6	24525.1
AK	8	0	355.8	123.3	978.6	142.7	203.5	1007	353.2	322	131.2	4.2	86.2	157.6	316.2	0	1.7	3174.3	7357.5
AL	2A	620	870.3	2081.4	5614.6	3316.6	2914.7	4997.5	949.9	1006.1	511.8	167.6	1801.2	1511.2	4499.4	6434.6	1949.7	11205.9	50452.5
AL	3A	4092.4	7662	9720.7	23429.5	9330.6	8125.4	29498.9	7639.4	4596.6	2257.6	1149.3	7047.4	4530.7	18118.8	1963.7	10461.3	64324.4	213948.7
AR	3A	651.4	3185	4195.8	12418.7	3511.7	6657	20828	4635.7	4527.8	899.6	301	2407.1	2449.3	4922.2	581.4	1848.8	27875.4	101895.9
AR	4A	690.6	3103.8	2040.5	5977.7	854.6	2952.2	6506.8	1995.8	1447.9	467.2	191.1	1080.6	996.7	3395.9	124.6	2170.2	10133.1	44129.3
AZ	2B	10300	29379.1	23242.3	43545.8	19659.5	15469.7	23946.7	16129.7	13229.5	3857.4	1368.1	15528.4	2817.1	93507.4	12910.4	41686.9	123067.2	489645.2
AZ	3B	0	315.8	636.5	3854.2	412.8	406.1	1073.2	915.8	432.1	170.5	75.4	522.7	729.6	1964.1	0	138	3850.6	15497.4
AZ	4B	0	72.8	258.7	2098.1	76.3	315.8	682.9	492.6	352.7	77.9	28.3	418.8	225.4	589.3	0	328	1720.5	7738.1
AZ	5B	0	335.3	599.8	1617.5	306.5	574.6	1905.8	538.9	867	103	58.7	602.8	928.9	842.3	238.2	1381.6	5819	16719.9
CA	2B	0	76.8	148.3	1580.7	1087.3	198.1	615.4	159.9	124.1	92.7	14.7	60.3	144.9	448.3	0	0	722.9	5474.4
CA	3B	35367.3	55587.2	27654.8	93309.6	52813.3	37492.5	88613.8	34958.7	18723.9	8012.9	1884.6	43249.9	9252.8	303509.2	71372.2	164675.4	356313.4	1402792
CA	3C	35451.3	25436.2	7232.6	18800.7	13714.2	6782.8	20879.6	15213.1	6808.4	1983.3	293.3	14080.2	2357.9	28244.9	45192.2	76095.8	136443	455009.5
CA	4B	0	408.3	851.6	1553.3	411.6	249.3	457.3	801	276.9	85.2	10.3	534.6	146.7	1622.1	0	952.1	4458.8	12819.1
CA	4C	0	18	5.5	329.8	0	33.9	721.2	112	136	13.3	1	169.7	77.2	54.7	0	37.6	898.6	2608.5
CA	5B	0	149.7	185.6	346.4	26.2	60.6	475.2	81.1	144.8	4.5	6.7	225.1	221.9	435.4	0	548	1151.5	4062.7
CA	6B	0	45.2	0	0	0	6.8	2.7	58.4	0	0	0	228	0	12.1	0	281.8	301.3	936.3
CO	4B	0	0	31	69.6	11	60.6	145.5	53.5	76.5	4.5	0	100	52.8	7.9	0	4	472.9	1089.8
CO	5B	14097.7	22224.4	12315.3	36119.9	9379.2	10448.1	26656.6	20200.9	13372.5	3585.1	1354	16895.1	5994.3	54033.1	23255	70325.6	118810.3	459067.1
CO	6B	0	523	219.9	767.2	185.6	518.5	1326.3	620	258	36.3	6.7	1064.3	406.3	392.8	390.2	2339.9	3024.9	12079.9
CO	7	0	312.7	226.9	714.4	209.9	244	1139.8	418.6	110.5	114.8	13.2	1013.9	177.3	585.6	631.9	2510.2	3766.9	12190.6
CT	5A	2804.3	6237.5	3677	17005.5	5429.7	7291.5	19267.9	4035	6104.4	1427.6	469.7	5039.3	1191.9	23545	8127.6	20815.3	44501.5	176970.7
DC	4A	31806.2	1280.2	667.5	2755.2	2328.1	1598.4	4628.5	1946.2	388.1	242.8	19	5493.9	155.9	1113.8	41236.9	19735	36465.5	151861.2
DE	4A	1204.2	1886.8	935.7	3959.2	2450.3	2254.3	5259.3	3528.2	719.9	460.1	76.9	1316.7	673.8	3973.9	1300.1	3780.7	12222.4	46002.5
FL	1A	16144.4	18855.1	11305.4	30551.1	17651.5	12833.2	24962.6	11780.3	5793.6	3361.4	868.1	23179.5	3248.6	73353.3	200690.7	50578.1	186627.8	691784.7
FL	2A	12370.9	40678	48812.4	102173.7	46750.5	42847.9	70258.4	39938.1	30524.5	9394.7	3981.7	41808.6	13709.4	162254.7	92285.5	130479.2	269403.6	1157672
GA	2A	107.4	1733.9	2815.4	6238.2	2196.1	7272.4	10739.8	3444.2	1342	662	233.6	3494.9	2425.1	27970.7	275	2837.5	21075.7	94863.9
GA	3A	20318.9	18476.4	21622.9	55099.5	30431.5	35916.8	80650.9	19809.4	13711	5395.4	1944.3	14562.3	6781.4	142240.4	35843.6	76658.2	174480.7	753943.6
HI	1A	525.9	1912.6	1479.6	3621.1	4062.9	1415.3	2526.5	1180.8	895.1	234.1	61.9	3168.8	299.9	2949	21115.1	4792.3	27368.5	77609.4
IA	5A	2695.4	9606.9	9863.6	19666.7	5018	10299.9	22611.1	6792.6	8211.4	1319.7	602.3	6949.7	3654.7	20143.8	1832.5	14978.8	56369.6	200616.7
IA	6A	0	64	222.4	775.5	2.1	280.9	1804.9	676.4	417.4	19.7	20	0	336.4	1257.7	0	249.8	2909.3	9036.5
ID	5B	1412.6	4304.3	5479.5	7891.5	1700	3421.1	7647.7	2564.6	3353.8	750.1	287	2248.1	1102.2	8028.8	534.9	5980.2	16192.9	72899.3
ID	6B	265.3	1007.2	917.7	1905.6	199.6	1477.1	2153.7	960.4	695.9	126.8	49.4	873.3	373.6	1144.5	472	2084.7	6010.8	20717.6
IL	4A	80	1160.1	1348.4	7260.3	864.3	2251.4	6193.5	2857	2833	392.6	136.8	564.4	933.6	14004	282.4	1437.4	7077.1	49676.3
IL	5A	21306.9	13985.1	15448.1	62639.4	19946.2	17775.3	46984.2	26375.4	17594.3	4019.4	1520.7	17519.5	3732	142638.1	107173.6	62141.4	151087.2	731886.8
IN	4A	1118.5	7095	8352.9	20170.9	3439.8	6092.7	15447.1	12321.2	7648.1	1738.5	1101.7	5729.4	3067.8	63766.3	3882.7	15443.4	50836.9	227252.9
IN	5A	1736.4	7108.4	12319.8	26389.4	5591.4	8060.7	20587	12270.2	10720.6	1865.6	1161.3	4157.2	3989.8	53828.1	1964.9	10724.9	49825.6	232301.3
KS	4A	2703.6	8471.1	6840.9	20666.3	3383.5	10556.5	20016.2	7527.6	7302.3	1699.4	662.3	3848	4688.3	34933.5	830.9	14280.2	43381.3	191791.9
KS	5A	0	0	67.9	194.6	0	92.5	250.3	66.5	70	5.5	0	0	239	6.9	0	41	295.6	1329.8
KY	4A	1979.7	12883.6	9027	25213.5	5483.6	12539.2	21383.6	9655.4	10056.7	2903.7	1046.6	5981.3	4683.4	61629.3	3110.2	10907.5	66436.2	264920.5
LA	2A	1476.4	7026.3	13321.8	23304	4881.7	9045.1	17913.8	11218.2	7353.2	2224.1	884.3	7457.3	5171.4	19961.9	3942.2	10006.2	54308.6	199496.5
LA	3A	150	730.1	1350.4	5748.5	1305	1296	6053.2	852.1	1842.7	460.3	218.4	1374.3	1290.7	4230	36	873.6	14599.8	42411.1
MA	5A	15515.5	14503.4	5652	26290.7	8853.8	9034.2	34918.9	10855.6	7169.8	2872.7	541	12870.3	2637	22957.9	37007.3	80307.8	121609.3	413597.2
MD	4A	23475.3	25808.1	10823.1	21937.8	11373.2	13238.6	29220.6	11841.1	6530.5	2246.3	653.1	12858.4	2617.4	55139.6	32483.8	86298.3	115159.9	461705.1
MD	5A	0	0	116.1	460.7	0	34	652	684.5	0	27.2	8.3	98.7	82.6	25.1	0	74.5	632.6	2896.3
ME	6A	608.2	2305.2	1563.9	7319.2	978	3363.6	4974.9	2371.9	2237.4	567.7	157.5	1200.5	1607.4	4992.4	203.6	2695.5	17972.9	55119.8
ME	7	0	46.8	22.1	200.8	0	142.2	128.8	0	102.4	25.9	7.4	0	58.5	44.9	0	3.6	281.6	1065
MI	5A	3825.5	17370.1	12080.1	42669.1	6933.9	9821.6	31282.9	16525.4	16580.9	4742.4	1508	10136.2	3770.9	30087.6	9605.3	20625.5	87706.6	325272
MI	6A	0	723.7	1219.2	7244.9	269.3	940.7	3068.3	1929	1610.7	197.5	96.2	1524.2	618.8	1589.9	0	1041.1	7895.5	29969
MI	7	0	124	88.1	552.9	0	49.1	169.9	941.6	74.4	33.7	0	320.9	103.3	70.3	0	214	1335.9	4078.1
MN	5A	0	19	27.2	110.1	94.5	8.9	399.6	80	105.7	0	7.9	0	50	58	0	66.8	533.7	1561.4
MN	6A	12243.5	10710.2	8709	29326	4640.8	10554.6	22545.4	12700.1	11009.7	1826	785.9	9356.9	2448.3	28555.4	16523.8	64948.7	100905.8	347790.1

State Code	Climate Zone	Large Office	Medium Office	Small Office	Stand-alone Retail	Strip Mall	Primary School	Secondary School	Hospital	Outpatient Healthcare	Full Service Rest-aurant	Quick Service Rest-aurant	Large Hotel	Small Hotel	Non-Refrigerated Warehouse	High-rise Apartment	Mid-rise Apartment	No Prototype	All Total
MN	7	200	550.7	669	2882.6	141.7	1021	3904.9	1484.7	1840.9	142.8	43	912	789	1941.8	0	1845.5	7622.9	25992.5
MO	3A	0	0	40	6.3	0	61	221.9	7	6.4	10	0	0	0	10.7	0	0	114	477.3
MO	4A	8872	9747.9	7813.8	36879.3	9635.8	10899.4	29801.9	16427.2	9488.7	2496.9	867.6	9626.8	4197.8	35245.5	11433.8	30193	78587.5	312214.9
MO	5A	0	17.8	149.6	946.7	15	366.6	943.4	582.9	183.7	22.1	5.7	0	123.4	422.8	0	123.2	1764.2	5667.1
MS	2A	0	591.8	2063	2493.2	831.6	1232.4	2923.7	1085.6	727.4	775	72.9	2234.6	627.1	2072.9	1931.6	724	10995.7	31382.5
MS	3A	977.2	2845.1	3952	11576.3	4766.4	4547.1	11825.3	5557.2	2657.7	782.3	257.5	2883.7	3081.7	29977.5	100	2452.1	27043.1	115282.2
MT	6B	278.4	1598.3	1403.4	4211	612.5	1664.6	4045.9	1761.4	1624.8	342.2	101.4	2186.1	1365.1	1787.9	240	1160.1	9359.4	33742.5
NC	3A	23249.3	28092.8	21017.8	50944.7	22790	24901.4	53899.7	18919	15593.9	4325.7	1508.3	14377.8	5425.4	65192.9	19129.7	69708.6	160821.5	599898.5
NC	4A	77	1360.6	1421.2	4917.3	2013.8	1661.4	4071.7	2287.9	1295	397.7	171.9	2174	796.6	1709.3	362.5	4109.5	10479.3	39306.7
NC	5A	0	52.6	92.3	902.5	0	224.1	1117.8	43.5	142	124.3	25	129.7	68.8	10.2	0	280.5	1631.6	4844.9
ND	6A	184.8	2324.3	1640.6	4877.7	674.9	2220	4872.7	2260.8	2185.4	315.2	48.6	1840.6	1906.8	2750.8	176.9	3684.6	10976.9	42941.6
ND	7	0	381.8	535.2	1587.7	273	418.7	1520.3	1140	635.8	101.2	51.1	593.7	590.5	898.2	0	1209.2	5101.2	15037.6
NE	5A	1761.2	8379	4641.5	12819.3	4285.4	5856.3	13539.1	8085.3	5324.7	1135.6	316.3	3315.6	2199.5	8953.4	3635.9	8694	39166.6	132108.7
NH	5A	301.4	3658.6	964	7757.9	1695.7	961.3	4390.8	1741.6	2007.7	690.9	168.1	860.3	724.4	6162.5	420	5592.1	11955.1	50052.4
NH	6A	55	383	198.2	2955.6	273.2	177.3	2135.9	569.8	943	142.4	34.8	824.9	601.5	916.6	0	1899.6	5328.7	17439.5
NJ	4A	3761.1	10349.7	3362.9	18680.8	12489.9	12030.6	26387.3	7232.5	6052.1	1757.9	483.4	11161	1745.6	84378.6	39861	52573.7	77907.9	370216
NJ	5A	1956.8	4732.7	1443.6	8390.4	5794.2	4277.9	7884.5	2653.7	3302.7	784.6	149.6	3514.9	616.6	11130.9	5255.3	19871.4	27857.8	109617.6
NM	3B	0	595.7	1063.9	2689.2	417.7	1861.2	3041.8	859.8	766.4	330.7	73.1	1126.6	1189.2	1054.6	0	281.1	6332.8	21683.8
NM	4B	0	2805.5	2133.8	4517.3	2034.9	3388.8	5240.9	1241.6	1314	711	185	1676	746.5	2839.5	0	2184.5	13950.3	44969.6
NM	5B	275	1015.1	1155	2762.7	215.3	2786.2	4440.6	1772.4	1150.2	175.6	78	1112	786.6	1157.5	0	689.3	7804.1	27375.6
NV	3B	3218.7	8561.8	8096.8	19173.1	7291.7	6637.5	8036.5	5526.1	2704.6	2933.9	372.6	35774	644.3	28355.5	26028.1	12721.7	73788.3	249865.2
NV	4B	120	332.4	817.6	1403.5	42.7	224.8	505.3	592.8	161	77.2	16.3	239	132.4	2131.5	0	28.4	1868.1	8693
NV	5B	1.1	1263.9	1731.8	3843.3	1922.5	728.6	2375.8	1010.3	893.3	263.8	51.1	1394.9	528	15407.5	1314.1	2600.2	11979.1	47309.3
NY	4A	52246.2	8116.4	3614.8	22881.5	12050.6	8873.8	24549.1	13296.1	6210.5	1330.5	168.8	31131.9	8590.5	23369.9	299657.5	88701.8	79495.2	684285.1
NY	5A	3482.9	10340.4	8449.3	30544.6	7753.1	3605.6	20954	9651.7	10406.4	2624.2	852.8	10159.8	5412.9	24278.6	10082.1	30429.7	75881.8	264909.9
NY	6A	5.5	1242.5	732.8	7271.3	438.2	587.4	3206.3	1981.4	1503	404.7	160.1	2851.8	1912.2	5013.4	175	3174	15197.3	45856.9
OH	4A	7049.8	14992.7	7934.4	24272.5	5627.7	12755.4	20693.8	13604.5	11543.6	2296.3	882.5	8343.3	2912.9	54768.2	6355.2	22819.2	68143.9	284995.9
OH	5A	3573.8	11575.9	14230.9	45680.1	7476	21980.1	55275.8	19878.5	17614.4	3431.8	1650.5	6100	5430	45900.1	5693.1	15942.3	73519.9	354953.2
OK	3A	4208	6890	9678.4	20236.8	4837	12844.9	24167.4	9234.8	8634.3	2967.8	832.6	8285.1	5009	24458.9	1326.7	7407.8	67538.6	218558.1
OK	4B	0	0	116.4	178.3	0	10.3	102.1	0	44	0	1.2	0	26.5	0	0	2.8	164.6	646.2
OK	4A	104.9	624.1	462.7	1045.2	173.1	985.6	2162.7	343.8	777.2	85.1	46.8	1579.7	443.2	3733.6	142	759.4	6035.6	19504.7
OR	4C	5606.3	9080.2	5413.1	15905.3	4060.4	5238.5	13405.2	9074.6	6689.6	1086	262.3	4860.4	2093	32258.6	16621.5	29639.8	50189.9	211484.7
OR	5B	0	1607.8	892.2	2663.6	482.1	1345.8	2038.4	1317.6	1164.2	232.1	21.4	548.9	886.3	2323.7	0	937.7	8679.1	25140.9
PA	4A	10073.7	11761.2	5276.6	23679.3	10166.5	14174	30235.3	16711.7	7990.9	2189.6	424.5	8918	2465.5	57526.4	18677.9	37118.1	75478.9	332868.1
PA	5A	7737.3	10245.8	5786.9	26085	8555.7	11184.8	29439.7	9989	5893.7	2358.3	681.3	10919.9	4386.9	59805.4	6115	16333.7	68825.5	284343.9
RI	5A	502	3342.4	548.5	4098.8	926.4	627.5	3972.6	746.3	873.2	387.6	50.2	1837.7	519.5	2765.8	1583.2	3953.2	13095.8	39830.7
SC	2A	0	774.6	676.5	1511.7	1381.3	615.9	1958.1	336.9	589	258.9	44.3	472.5	440.1	1063.2	0	792.1	4399.9	15315
SC	3A	3285.1	14792.5	11100.7	32274.3	9527.6	15817.3	38893.5	8300	8374.1	2903.1	1226.1	9488.6	3792	52564.7	14021.9	32835	72843.2	332039.7
SD	5A	0	10.9	142.8	613.3	0	191.3	768.2	126.8	200.9	35.1	7	109	59.6	682.9	0	82.4	1351.3	4381.5
SD	6A	192	3436.8	2518.7	5625.6	663.1	2856.2	5682	2832.3	2070.5	344	107	1249.6	1260.6	2651.7	216.2	3172.2	11920	46798.5
TN	3A	12824.3	11200.4	10741	24003.3	8445.4	9210.7	19014.7	8732.8	8507.6	2764.8	1058	13458.8	3376.4	38288.5	9127.9	29445.3	84946.3	295146.2
TN	4A	759.3	5208.3	5764.6	19205.9	5153.2	6548.4	15841.8	4918.8	6132.2	1483.5	821	3673.8	3248.5	32309.4	1404	9012	34221.4	155706.1
TX	1A	198.6	1081	4377	10649.2	2419.1	5964.1	13125.1	1395.9	1771.1	1210.9	291.9	1330.5	1508.7	6122.1	884.9	596.6	10136.5	63063.2
TX	2B	0	457.6	474.4	2391.9	640	2870.6	5142.3	480.7	385.4	271.8	83.7	602.6	785.1	2651.9	0	80.1	4996.1	22314.2
TX	2A	69558.3	68429.6	48706	135661.4	38471.8	86889.4	178535.8	58665.1	42182.5	13514.8	5006	51760.3	23036.1	326958.8	79238.3	199977	437677.1	1864268
TX	3B	1083.7	3085.8	4577.8	12039.7	4091.3	8107.2	15058	5882	3808.7	1462.2	670.7	3295.4	3984	8172.9	150	3204.1	32513.6	111187.1
TX	3A	11845	14273	9457.6	30561	8277.2	22182.3	42898.6	10479.8	10696	2234.2	1279.9	8389.3	4448.4	39230.7	2373.9	29625.4	75259.8	323512.1
TX	4B	0	311.2	569.9	2834.9	83.5	763.1	3848.6	776.9	981.6	213.4	68.7	698.1	782.2	924.2	0	505.6	4550.4	17912.3
UT	3B	0	698.6	458.5	818.2	499.3	883.5	2750.1	540.8	569.6	74.1	51.2	618.9	608.7	1903.4	0	769.1	2600.9	13844.9
UT	5B	7620.8	14364	7344	20200.6	3611.7	12205	22844.2	6677.7	8050.3	1353.9	662.2	3421.1	2439.1	32909.8	2708.6	26902.9	58416.1	231732
UT	6B	0	477.2	259.2	887.4	173.5	862.4	1954.9	281.7	386.7	69.5	20.1	1205.8	382.6	396.9	270.8	1834.4	3186.9	12650
VA	3A	2328.3	3980.5	4788.7	8454.7	4359.9	3467.3	6277.2	3375	2823	968.6	262.3	4593.7	1217.8	9535.2	3430.3	13473.4	32182.5	105518.4
VA	4A	27996.8	21967.1	12894.8	31476.9	13603.6	14464.6	37923.7	14084.5	8706.8	2681.7	627.4	11949.6	4159.8	37399.1	43043.1	66580.7	153568.5	503128.7
VA	5A	0	7	4.4	14.7	0	15	125.3	2.2	0	4.4	6.3	0	40	12.9	0	0	81.9	314.1
VT	6A	0	1746.2	726.5	2052.7	331.1	264.1	2134.4	797	988.8	217.8	51.3	1012	760.2	2851	0	4256.2	9257.2	27446.5
WA	4C	31236.5	17187.2	8909.6	24661.2	9462.9	12538.4	27711.7	10747.2	8379.3	2165.5	443.3	15690.9	1841.2	51305.1	59755.4	79404	132525.9	493965.3
WA	5B	412.8	2558.3	1916.2	6547.4	1602.4	3602.9	9013.1	1873	2141.8	407.1	150	3114.8	1396.1	10082.7	767.8	3230.9	20881.8	69699.1
WA	5C	162.4	330.9	341.8	1746.1	320.7	211.6	1302.6	955.2	536	99.1	13	326.6	287.2	440.3	0	1012.8	3894.1	11980.4
WA	6B	0	5.3	53.8	17.8	0	75.3	12.3	88	130.8	0	0	62	4.8	64.7	0	9.9	485.9	1010.6
WI	5A	6744	13817.2	7432.3	29273.3	4645.5	6423.5	18165.4	13065	11059.5	2085	675.1	5880.9	2734.9	29601.9	10589	30963.8	73244.4	266400.7
WI	6A	701.2	3626.8	2585.4	8687.5	812.7	2991.4	5857.6	4227.1	4864.9	471.9	175.8	2319.9	1246.8	6510.3	195	3132.9	16176.6	64583.8
WV	4A	53.2	1104.1	542.8	5451.3	972.3	2373.8	5118	1767.6	581.3	383.5	134.4	600.3	638.7	2360.1	0	198.3	7818.9	30098.6
WV	5A	575.5	789.7	368.8	3053.8	808.9	1199	2944.5	2089.9	124.4	159.8	45.4	866.9	467.7	1715.1	575	769.8	5520.1	22074.3

State Code	Climate Zone	Large Office	Medium Office	Small Office	Stand-alone Retail	Strip Mall	Primary School	Secondary School	Hospital	Outpatient Healthcare	Full Service Rest-aurant	Quick Service Rest-aurant	Large Hotel	Small Hotel	Non-Refrigerated Warehouse	High-rise Apartment	Mid-rise Apartment	No Prototype	All Total
WY	5B	0	468	236.7	974.6	19.6	658.4	874.5	147.2	137.7	71.6	25.9	159.1	412.6	732.3	0	14	3289.9	8222.1
WY	6B	0	347.4	510.7	1801.5	106.1	2698.2	5121.1	1183.2	1070.7	109.5	101.3	831.5	1394.4	867.4	0	276.5	5504.4	21923.9
WY	7	0	228.9	56.9	40.5	403.8	600	271	118.8	90.3	11.6	0	67.5	308.7	78	0	60.5	940.1	3276.6

Table B.2. State-level construction-area-based weighting factors (percent) aggregated by climate zone and building category.

State Code	Climate Zone	Large Office	Medium Office	Small Office	Stand-alone Retail	Strip Mall	Primary School	Secondary School	Hospital	Outpatient Healthcare	Full Service Rest-aurant	Quick Service Rest-aurant	Large Hotel	Small Hotel	Non-Refrigerated Warehouse	High-rise Apartment	Mid-rise Apartment	No Prototype	All Total
AK	5C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AK	6A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
AK	7	0.01	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.04	0.12
AK	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.04
AL	2A	0.00	0.00	0.01	0.03	0.02	0.01	0.02	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.01	0.05	0.24
AL	3A	0.02	0.04	0.05	0.11	0.05	0.04	0.14	0.04	0.02	0.01	0.01	0.03	0.02	0.09	0.01	0.05	0.31	1.04
AR	3A	0.00	0.02	0.02	0.06	0.02	0.03	0.10	0.02	0.02	0.00	0.00	0.01	0.01	0.02	0.00	0.01	0.14	0.49
AR	4A	0.00	0.02	0.01	0.03	0.00	0.01	0.03	0.01	0.01	0.00	0.00	0.01	0.00	0.02	0.00	0.01	0.05	0.21
AZ	2B	0.05	0.14	0.11	0.21	0.10	0.08	0.12	0.08	0.06	0.02	0.01	0.08	0.01	0.45	0.06	0.20	0.60	2.38
AZ	3B	0.00	0.00	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.08
AZ	4B	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04
AZ	5B	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.08
CA	2B	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
CA	3B	0.17	0.27	0.13	0.45	0.26	0.18	0.43	0.17	0.09	0.04	0.01	0.21	0.04	1.47	0.35	0.80	1.73	6.81
CA	3C	0.17	0.12	0.04	0.09	0.07	0.03	0.10	0.07	0.03	0.01	0.00	0.07	0.01	0.14	0.22	0.37	0.66	2.21
CA	4B	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.06
CA	4C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
CA	5B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02
CA	6B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO	4B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
CO	5B	0.07	0.11	0.06	0.18	0.05	0.05	0.13	0.10	0.06	0.02	0.01	0.08	0.03	0.26	0.11	0.34	0.58	2.23
CO	6B	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.01	0.06
CO	7	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.06
CT	5A	0.01	0.03	0.02	0.08	0.03	0.04	0.09	0.02	0.03	0.01	0.00	0.02	0.01	0.11	0.04	0.10	0.22	0.86
DC	4A	0.15	0.01	0.00	0.01	0.01	0.01	0.02	0.01	0.00	0.00	0.00	0.03	0.00	0.01	0.20	0.10	0.18	0.74
DE	4A	0.01	0.01	0.00	0.02	0.01	0.01	0.03	0.02	0.00	0.00	0.00	0.01	0.00	0.02	0.01	0.02	0.06	0.22
FL	1A	0.08	0.09	0.05	0.15	0.09	0.06	0.12	0.06	0.03	0.02	0.00	0.11	0.02	0.36	0.97	0.25	0.91	3.36
FL	2A	0.06	0.20	0.24	0.50	0.23	0.21	0.34	0.19	0.15	0.05	0.02	0.20	0.07	0.79	0.45	0.63	1.31	5.62
GA	2A	0.00	0.01	0.01	0.03	0.01	0.04	0.05	0.02	0.01	0.00	0.00	0.02	0.01	0.14	0.00	0.01	0.10	0.46
GA	3A	0.10	0.09	0.10	0.27	0.15	0.17	0.39	0.10	0.07	0.03	0.01	0.07	0.03	0.69	0.17	0.37	0.85	3.66
HI	1A	0.00	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.02	0.00	0.01	0.10	0.02	0.13	0.38
IA	5A	0.01	0.05	0.05	0.10	0.02	0.05	0.11	0.03	0.04	0.01	0.00	0.03	0.02	0.10	0.01	0.07	0.27	0.97
IA	6A	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.04
ID	5B	0.01	0.02	0.03	0.04	0.01	0.02	0.04	0.01	0.02	0.00	0.00	0.01	0.01	0.04	0.00	0.03	0.08	0.35
ID	6B	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.03	0.10
IL	4A	0.00	0.01	0.01	0.04	0.00	0.01	0.03	0.01	0.01	0.00	0.00	0.00	0.00	0.07	0.00	0.01	0.03	0.24
IL	5A	0.10	0.07	0.08	0.30	0.10	0.09	0.23	0.13	0.09	0.02	0.01	0.09	0.02	0.69	0.52	0.30	0.73	3.55
IN	4A	0.01	0.03	0.04	0.10	0.02	0.03	0.08	0.06	0.04	0.01	0.01	0.03	0.01	0.31	0.02	0.07	0.25	1.10
IN	5A	0.01	0.03	0.06	0.13	0.03	0.04	0.10	0.06	0.05	0.01	0.01	0.02	0.02	0.26	0.01	0.05	0.24	1.13
KS	4A	0.01	0.04	0.03	0.10	0.02	0.05	0.10	0.04	0.04	0.01	0.00	0.02	0.02	0.17	0.00	0.07	0.21	0.93
KS	5A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
KY	4A	0.01	0.06	0.04	0.12	0.03	0.06	0.10	0.05	0.05	0.01	0.01	0.03	0.02	0.30	0.02	0.05	0.32	1.29
LA	2A	0.01	0.03	0.06	0.11	0.02	0.04	0.09	0.05	0.04	0.01	0.00	0.04	0.03	0.10	0.02	0.05	0.26	0.97
LA	3A	0.00	0.00	0.01	0.03	0.01	0.01	0.03	0.00	0.01	0.00	0.00	0.01	0.01	0.02	0.00	0.00	0.07	0.21
MA	5A	0.08	0.07	0.03	0.13	0.04	0.04	0.17	0.05	0.03	0.01	0.00	0.06	0.01	0.11	0.18	0.39	0.59	2.01
MD	4A	0.11	0.13	0.05	0.11	0.06	0.06	0.14	0.06	0.03	0.01	0.00	0.06	0.01	0.27	0.16	0.42	0.56	2.24
MD	5A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
ME	6A	0.00	0.01	0.01	0.04	0.00	0.02	0.02	0.01	0.01	0.00	0.00	0.01	0.01	0.02	0.00	0.01	0.09	0.27
ME	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01

State Code	Climate Zone	Large Office	Medium Office	Small Office	Stand-alone Retail	Strip Mall	Primary School	Secondary School	Hospital	Outpatient Healthcare	Full Service Rest-aurant	Quick Service Rest-aurant	Large Hotel	Small Hotel	Non-Refrigerated Warehouse	High-rise Apartment	Mid-rise Apartment	No Prototype	All Total
MI	5A	0.02	0.08	0.06	0.21	0.03	0.05	0.15	0.08	0.08	0.02	0.01	0.05	0.02	0.15	0.05	0.10	0.43	1.58
MI	6A	0.00	0.00	0.01	0.04	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.01	0.04	0.15
MI	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02
MN	5A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
MN	6A	0.06	0.05	0.04	0.14	0.02	0.05	0.11	0.06	0.05	0.01	0.00	0.05	0.01	0.14	0.08	0.32	0.49	1.69
MN	7	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.04	0.13
MO	3A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MO	4A	0.04	0.05	0.04	0.18	0.05	0.05	0.14	0.08	0.05	0.01	0.00	0.05	0.02	0.17	0.06	0.15	0.38	1.52
MO	5A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03
MS	2A	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.05	0.15
MS	3A	0.00	0.01	0.02	0.06	0.02	0.02	0.06	0.03	0.01	0.00	0.00	0.01	0.01	0.15	0.00	0.01	0.13	0.56
MT	6B	0.00	0.01	0.01	0.02	0.00	0.01	0.02	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.00	0.01	0.05	0.16
NC	3A	0.11	0.14	0.10	0.25	0.11	0.12	0.26	0.09	0.08	0.02	0.01	0.07	0.03	0.32	0.09	0.34	0.78	2.91
NC	4A	0.00	0.01	0.01	0.02	0.01	0.01	0.02	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.02	0.05	0.19
NC	5A	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02
ND	6A	0.00	0.01	0.01	0.02	0.00	0.01	0.02	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.00	0.02	0.05	0.21
ND	7	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.07
NE	5A	0.01	0.04	0.02	0.06	0.02	0.03	0.07	0.04	0.03	0.01	0.00	0.02	0.01	0.04	0.02	0.04	0.19	0.64
NH	5A	0.00	0.02	0.00	0.04	0.01	0.00	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.03	0.00	0.03	0.06	0.24
NH	6A	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.08
NJ	4A	0.02	0.05	0.02	0.09	0.06	0.06	0.13	0.04	0.03	0.01	0.00	0.05	0.01	0.41	0.19	0.26	0.38	1.80
NJ	5A	0.01	0.02	0.01	0.04	0.03	0.02	0.04	0.01	0.02	0.00	0.00	0.02	0.00	0.05	0.03	0.10	0.14	0.53
NM	3B	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.03	0.11
NM	4B	0.00	0.01	0.01	0.02	0.01	0.02	0.03	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.01	0.07	0.22
NM	5B	0.00	0.00	0.01	0.01	0.00	0.01	0.02	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.04	0.13
NV	3B	0.02	0.04	0.04	0.09	0.04	0.03	0.04	0.03	0.01	0.01	0.00	0.17	0.00	0.14	0.13	0.06	0.36	1.21
NV	4B	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.04
NV	5B	0.00	0.01	0.01	0.02	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.07	0.01	0.01	0.06	0.23
NY	4A	0.25	0.04	0.02	0.11	0.06	0.04	0.12	0.06	0.03	0.01	0.00	0.15	0.04	0.11	1.46	0.43	0.39	3.32
NY	5A	0.02	0.05	0.04	0.15	0.04	0.02	0.10	0.05	0.05	0.01	0.00	0.05	0.03	0.12	0.05	0.15	0.37	1.29
NY	6A	0.00	0.01	0.00	0.04	0.00	0.00	0.02	0.01	0.01	0.00	0.00	0.01	0.01	0.02	0.00	0.02	0.07	0.22
OH	4A	0.03	0.07	0.04	0.12	0.03	0.06	0.10	0.07	0.06	0.01	0.00	0.04	0.01	0.27	0.03	0.11	0.33	1.38
OH	5A	0.02	0.06	0.07	0.22	0.04	0.11	0.27	0.10	0.09	0.02	0.01	0.03	0.03	0.22	0.03	0.08	0.36	1.72
OK	3A	0.02	0.03	0.05	0.10	0.02	0.06	0.12	0.04	0.04	0.01	0.00	0.04	0.02	0.12	0.01	0.04	0.33	1.06
OK	4A	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.03	0.09
OK	4B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OR	4C	0.03	0.04	0.03	0.08	0.02	0.03	0.07	0.04	0.03	0.01	0.00	0.02	0.01	0.16	0.08	0.14	0.24	1.03
OR	5B	0.00	0.01	0.00	0.01	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.04	0.12
PA	4A	0.05	0.06	0.03	0.11	0.05	0.07	0.15	0.08	0.04	0.01	0.00	0.04	0.01	0.28	0.09	0.18	0.37	1.62
PA	5A	0.04	0.05	0.03	0.13	0.04	0.05	0.14	0.05	0.03	0.01	0.00	0.05	0.02	0.29	0.03	0.08	0.33	1.38
RI	5A	0.00	0.02	0.00	0.02	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.02	0.06	0.19
SC	2A	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.07
SC	3A	0.02	0.07	0.05	0.16	0.05	0.08	0.19	0.04	0.04	0.01	0.01	0.05	0.02	0.26	0.07	0.16	0.35	1.61
SD	5A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02
SD	6A	0.00	0.02	0.01	0.03	0.00	0.01	0.03	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.00	0.02	0.06	0.23
TN	3A	0.06	0.05	0.05	0.12	0.04	0.04	0.09	0.04	0.04	0.01	0.01	0.07	0.02	0.19	0.04	0.14	0.41	1.43
TN	4A	0.00	0.03	0.03	0.09	0.03	0.03	0.08	0.02	0.03	0.01	0.00	0.02	0.02	0.16	0.01	0.04	0.17	0.76
TX	1A	0.00	0.01	0.02	0.05	0.01	0.03	0.06	0.01	0.01	0.01	0.00	0.01	0.01	0.03	0.00	0.00	0.05	0.31
TX	2A	0.34	0.33	0.24	0.66	0.19	0.42	0.87	0.28	0.20	0.07	0.02	0.25	0.11	1.59	0.38	0.97	2.13	9.05
TX	2B	0.00	0.00	0.00	0.01	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.11
TX	3A	0.06	0.07	0.05	0.15	0.04	0.11	0.21	0.05	0.05	0.01	0.01	0.04	0.02	0.19	0.01	0.14	0.37	1.57
TX	3B	0.01	0.01	0.02	0.06	0.02	0.04	0.07	0.03	0.02	0.01	0.00	0.02	0.02	0.04	0.00	0.02	0.16	0.54
TX	4B	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.09
UT	3B	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.07
UT	5B	0.04	0.07	0.04	0.10	0.02	0.06	0.11	0.03	0.04	0.01	0.00	0.02	0.01	0.16	0.01	0.13	0.28	1.13
UT	6B	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.02	0.06
VA	3A	0.01	0.02	0.02	0.04	0.02	0.02	0.03	0.02	0.01	0.00	0.00	0.02	0.01	0.05	0.02	0.07	0.16	0.51
VA	4A	0.14	0.11	0.06	0.15	0.07	0.07	0.18	0.07	0.04	0.01	0.00	0.06	0.02	0.18	0.21	0.32	0.75	2.44
VA	5A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VT	6A	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.02	0.04	0.13
WA	4C	0.15	0.08	0.04	0.12	0.05	0.06	0.13	0.05	0.04	0.01	0.00	0.08	0.01	0.25	0.29	0.39	0.64	2.40
WA	5B	0.00	0.01	0.01	0.03	0.01	0.02	0.04	0.01	0.01	0.00	0.00	0.02	0.01	0.05	0.00	0.02	0.10	0.34
WA	5C	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.06

State Code	Climate Zone	Large Office	Medium Office	Small Office	Stand-alone Retail	Strip Mall	Primary School	Secondary School	Hospital	Outpatient Healthcare	Full Service Rest-aurant	Quick Service Rest-aurant	Large Hotel	Small Hotel	Non-Refrigerated Warehouse	High-rise Apartment	Mid-rise Apartment	No Prototype	All Total
WA	6B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WI	5A	0.03	0.07	0.04	0.14	0.02	0.03	0.09	0.06	0.05	0.01	0.00	0.03	0.01	0.14	0.05	0.15	0.36	1.29
WI	6A	0.00	0.02	0.01	0.04	0.00	0.01	0.03	0.02	0.02	0.00	0.00	0.01	0.01	0.03	0.00	0.02	0.08	0.31
WV	4A	0.00	0.01	0.00	0.03	0.00	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.04	0.15
WV	5A	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.03	0.11
WY	5B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.04
WY	6B	0.00	0.00	0.00	0.01	0.00	0.01	0.02	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.03	0.11
WY	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02

Table B.3. State-level total counts of samples aggregated by climate zone and building category.

State Code	Climate Zone	Large Office	Medium Office	Small Office	Stand-alone Retail	Strip Mall	Primary School	Secondary School	Hospital	Outpatient Healthcare	Full Service Rest-aurant	Quick Service Rest-aurant	Large Hotel	Small Hotel	Non-Refrigerated Warehouse	High-rise Apartment	Mid-rise Apartment	No Prototype	All Total
AK	5C	0	3	1	0	0	3	8	3	4	0	0	0	5	5	0	1	24	57
AK	6A	0	0	7	1	0	2	6	3	10	0	0	0	3	17	0	2	57	108
AK	7	8	40	137	85	13	15	80	20	65	21	9	9	12	176	0	13	338	1041
AK	8	0	12	21	21	3	7	45	6	21	7	2	1	4	37	0	1	150	338
AL	2A	1	29	339	193	39	66	144	34	77	81	54	17	39	150	23	51	492	1829
AL	3A	17	237	1599	808	145	262	689	124	313	328	302	61	112	500	13	154	2240	7904
AR	3A	7	105	654	432	63	219	738	95	237	145	98	30	65	223	3	82	1443	4639
AR	4A	6	87	244	228	17	69	158	33	81	67	51	14	24	85	2	37	388	1591
AZ	2B	32	445	1811	1699	389	403	682	240	480	598	390	120	77	1236	41	343	2765	11751
AZ	3B	0	12	118	109	8	20	56	18	32	31	22	6	20	119	0	9	218	798
AZ	4B	0	3	44	59	6	15	42	19	23	14	7	5	7	22	0	5	108	379
AZ	5B	0	13	102	59	8	21	65	12	35	17	19	8	26	52	1	15	206	659
CA	2B	0	2	16	44	5	9	16	5	7	16	5	1	4	14	0	0	41	185
CA	3B	133	1024	3847	2818	742	1051	2153	297	623	991	584	299	248	2475	256	1588	7163	26292
CA	3C	103	343	1421	575	217	297	668	120	216	251	114	114	89	492	201	674	2469	8364
CA	4B	0	13	226	78	11	22	38	13	21	14	4	5	9	82	0	15	205	756
CA	4C	0	1	2	11	0	3	16	2	6	2	1	2	3	6	0	2	35	92
CA	5B	0	5	57	31	1	7	20	7	15	1	2	3	9	41	0	8	96	303
CA	6B	0	1	0	0	0	1	1	2	0	0	0	1	0	5	0	3	22	36
CO	4B	0	0	4	7	1	5	10	2	6	1	0	1	1	2	0	1	27	68
CO	5B	64	582	1998	1373	240	301	674	242	495	501	453	119	167	1272	89	631	3434	12635
CO	6B	0	14	29	30	10	12	34	12	9	6	3	7	15	22	2	28	126	359
CO	7	0	22	32	38	14	11	28	12	3	13	6	9	10	37	3	28	179	445
CT	5A	13	218	906	744	144	185	446	100	254	243	152	34	40	608	36	286	1683	6092
DC	4A	108	29	56	70	26	33	62	16	11	15	7	29	5	13	168	207	503	1358
DE	4A	6	45	152	139	39	65	109	42	25	49	26	13	16	96	9	40	344	1215
FL	1A	90	404	1338	1082	189	270	453	172	193	331	250	167	112	1041	567	477	3126	10262
FL	2A	65	1027	6545	4567	809	903	1655	698	1531	1491	1139	311	420	4084	366	1107	9441	36159
GA	2A	2	62	464	295	35	139	234	84	88	137	63	37	58	217	1	44	810	2770
GA	3A	66	474	2961	2345	453	647	1368	346	662	906	571	124	174	1458	107	518	4707	17887
HI	1A	3	56	239	102	47	79	140	20	32	38	15	11	22	179	59	45	564	1651
IA	5A	14	221	1051	739	130	317	705	186	378	212	175	72	104	678	13	223	2157	7375
IA	6A	0	3	22	38	1	13	83	19	27	3	6	0	9	29	0	5	153	411
ID	5B	11	172	876	406	37	104	208	54	218	123	91	24	26	416	4	69	774	3613
ID	6B	2	34	107	91	8	43	57	24	50	25	16	9	10	81	1	32	305	895
IL	4A	2	32	207	217	29	81	175	68	122	60	38	5	21	147	1	37	443	1685
IL	5A	54	333	1897	1842	337	496	963	290	566	583	409	116	93	1187	367	740	3856	14129
IN	4A	7	196	1044	1040	138	186	392	154	369	295	367	49	82	1282	16	195	2154	7966
IN	5A	11	227	1873	1372	175	217	491	185	539	337	379	45	108	1808	9	140	2708	10624
KS	4A	16	193	968	668	125	365	526	182	341	260	186	43	117	441	7	163	1573	6174
KS	5A	0	0	10	3	0	5	10	8	10	1	0	0	7	2	0	3	34	93
KY	4A	17	350	1307	1031	122	401	621	190	428	419	331	60	114	767	13	171	2597	8939
LA	2A	12	286	2307	1140	178	288	675	193	484	402	301	55	148	1060	22	156	2520	10227
LA	3A	2	32	201	249	29	65	208	56	104	61	75	11	30	108	1	30	671	1933

State Code	Climate Zone	Large Office	Medium Office	Small Office	Stand-alone Retail	Strip Mall	Primary School	Secondary School	Hospital	Outpatient Healthcare	Full Service Rest-aurant	Quick Service Rest-aurant	Large Hotel	Small Hotel	Non-Refrigerated Warehouse	High-rise Apartment	Mid-rise Apartment	No Prototype	All Total
MA	5A	75	387	816	924	181	201	657	180	294	355	175	96	89	594	137	911	2817	8889
MD	4A	99	416	1379	826	173	345	521	133	226	317	166	93	67	724	112	569	2279	8445
MD	5A	0	0	10	13	0	1	9	4	0	4	2	1	2	2	0	2	30	80
ME	6A	7	93	249	271	30	68	165	53	126	99	47	13	51	265	3	77	725	2342
ME	7	0	3	5	7	0	1	3	0	10	2	2	0	1	12	0	2	27	75
MI	5A	28	376	1707	1366	207	413	957	295	674	596	460	98	99	834	57	318	3120	11605
MI	6A	0	29	222	167	10	54	116	66	105	33	24	11	24	394	0	24	593	1872
MI	7	0	2	29	14	0	6	10	8	5	4	0	3	2	5	0	3	39	130
MN	5A	0	1	7	6	2	2	12	1	5	0	4	0	1	7	0	1	34	83
MN	6A	47	285	863	748	191	320	608	207	417	250	240	81	65	626	68	581	2902	8499
MN	7	1	20	82	106	5	34	112	39	78	22	14	10	18	84	0	23	395	1043
MO	3A	0	0	3	1	0	2	10	1	1	1	0	0	0	4	0	0	8	31
MO	4A	35	221	1146	1236	191	410	855	256	369	357	249	75	104	481	54	341	2519	8899
MO	5A	0	2	20	29	1	15	59	17	16	3	2	0	4	23	0	7	87	285
MS	2A	0	29	397	137	13	41	95	33	40	56	25	12	16	123	9	23	497	1546
MS	3A	6	85	614	395	55	154	439	95	178	116	74	32	72	233	1	56	1092	3697
MT	6B	3	54	257	176	17	65	120	48	74	51	30	27	35	138	1	32	488	1616
NC	3A	102	658	3382	1942	372	556	1157	340	716	638	427	142	128	1120	69	513	4278	16540
NC	4A	1	44	279	154	26	43	116	37	66	53	38	20	22	74	4	46	406	1429
NC	5A	0	3	11	29	0	12	26	3	5	7	7	2	2	3	0	4	52	166
ND	6A	2	66	124	118	19	73	118	31	90	33	14	24	48	108	1	49	458	1376
ND	7	0	16	53	43	7	13	60	12	28	19	14	7	17	59	0	14	207	569
NE	5A	10	168	868	424	85	209	379	162	256	144	100	35	59	378	11	105	1242	4635
NH	5A	5	122	175	275	33	38	121	50	87	87	52	10	21	192	2	85	535	1890
NH	6A	1	29	39	107	7	18	54	19	37	15	11	8	16	61	0	26	198	646
NJ	4A	21	204	550	667	152	298	605	103	189	224	146	64	50	531	140	584	1838	6366
NJ	5A	9	93	279	284	56	145	252	44	86	93	42	32	15	184	22	186	789	2611
NM	3B	0	17	195	110	9	55	106	32	55	47	25	13	29	53	0	15	317	1078
NM	4B	0	56	315	176	33	125	170	29	78	100	57	15	20	134	0	43	504	1855
NM	5B	1	29	171	82	14	95	148	24	72	30	33	7	24	58	0	43	455	1286
NV	3B	14	166	736	605	114	123	117	71	108	245	121	60	29	330	44	89	1049	4021
NV	4B	1	14	107	32	3	8	18	10	13	14	7	2	5	30	0	3	129	396
NV	5B	1	35	315	109	18	31	62	25	37	41	21	10	14	120	5	28	340	1212
NY	4A	269	330	614	930	176	221	444	184	236	184	66	238	284	614	2601	4838	1815	14044
NY	5A	21	299	1332	1200	191	169	794	220	438	429	248	102	159	834	61	473	2693	9663
NY	6A	1	42	110	256	15	34	157	63	80	42	44	21	53	141	1	46	638	1744
OH	4A	40	258	1134	918	157	199	425	165	390	402	285	76	87	663	42	270	2040	7551
OH	5A	15	283	1967	1799	218	425	950	319	724	610	501	59	133	1279	33	252	3553	13120
OK	3A	28	227	1296	833	106	470	917	182	406	395	222	73	117	770	12	117	2504	8675
OK	4A	1	13	63	62	6	49	118	14	42	12	15	18	10	46	2	17	304	792
OK	4B	0	0	1	4	0	1	4	0	1	0	1	0	1	0	0	1	9	23
OR	4C	32	272	950	652	105	149	348	121	328	164	105	43	62	642	82	392	1620	6067
OR	5B	0	69	115	116	21	37	90	36	69	22	11	7	29	135	0	26	335	1118
PA	4A	39	258	646	772	137	300	513	203	258	260	130	87	69	498	82	391	1770	6413
PA	5A	41	211	663	807	120	205	578	166	244	290	158	92	110	492	30	198	1895	6300
RI	5A	3	53	77	128	21	35	96	20	37	44	16	18	15	67	10	60	346	1046
SC	2A	0	33	123	89	19	14	37	14	26	38	12	5	13	62	0	20	245	750
SC	3A	20	449	1659	1529	187	323	756	156	497	455	355	96	100	951	67	304	3199	11103
SD	5A	0	2	19	11	0	10	28	9	8	2	2	1	2	25	0	2	93	214
SD	6A	3	78	316	153	36	80	161	54	94	51	30	15	34	173	2	47	608	1935
TN	3A	49	327	1510	1163	193	209	451	175	409	386	338	98	90	896	30	262	2498	9084
TN	4A	8	208	1005	831	113	157	353	107	330	268	250	40	78	544	7	119	1571	5989
TX	1A	2	41	707	476	47	128	279	62	191	206	80	13	41	278	4	22	626	3203
TX	2A	245	1137	5607	6079	806	1481	3008	726	1623	2088	1406	406	620	3863	245	1166	9660	40166
TX	2B	0	15	82	95	13	56	103	11	26	31	20	6	22	40	0	4	230	754
TX	3A	45	216	1142	1087	139	396	804	185	463	339	331	76	111	372	8	167	2154	8035
TX	3B	6	81	682	608	145	174	433	138	273	233	199	40	95	333	1	51	1177	4669
TX	4B	0	8	57	95	3	30	102	29	46	33	21	7	21	43	0	9	192	696
UT	3B	0	33	115	42	9	17	51	7	28	13	14	8	16	39	0	9	134	535
UT	5B	47	351	767	697	107	249	398	95	299	193	181	38	63	560	13	248	1890	6196
UT	6B	0	18	26	37	6	20	29	7	17	7	7	7	10	30	3	22	148	394
VA	3A	12	106	661	347	57	58	118	57	91	140	84	37	33	242	15	115	857	3030
VA	4A	103	437	1855	1004	203	346	680	167	304	418	196	105	118	743	127	456	3115	10377

State Code	Climate Zone	Large Office	Medium Office	Small Office	Stand-alone Retail	Strip Mall	Primary School	Secondary School	Hospital	Outpatient Healthcare	Full Service Rest-aurant	Quick Service Rest-aurant	Large Hotel	Small Hotel	Non-Refrigerated Warehouse	High-rise Apartment	Mid-rise Apartment	No Prototype	All Total
VA	5A	0	1	1	2	0	1	5	1	0	1	1	0	1	4	0	0	12	30
VT	6A	0	75	114	110	18	29	97	25	58	25	16	10	35	162	0	82	465	1321
WA	4C	112	494	1647	880	284	296	557	152	327	255	168	115	55	833	275	918	3065	10433
WA	5B	3	92	312	246	29	94	236	57	133	59	37	25	40	334	6	62	725	2490
WA	5C	2	13	66	42	5	12	42	14	25	12	5	4	10	36	0	16	189	493
WA	6B	0	1	3	3	0	4	4	2	5	0	0	1	1	7	0	2	33	66
WI	5A	31	306	812	804	99	196	395	164	394	240	177	60	69	526	52	411	2242	6978
WI	6A	5	96	276	260	32	88	228	79	211	57	57	20	33	230	2	62	920	2656
WV	4A	1	30	78	151	11	92	147	38	37	71	40	7	18	40	0	9	318	1088
WV	5A	3	21	46	62	8	37	87	17	10	25	13	11	12	18	3	8	157	538
WY	5B	0	13	44	27	2	18	18	10	9	12	10	2	11	25	0	1	96	298
WY	6B	0	18	55	71	7	56	101	33	48	17	27	11	34	61	0	14	267	820
WY	7	0	15	12	4	5	11	8	5	4	2	0	1	8	11	0	2	63	151

Table B.4. State-level sample-count-based weighting factors (percent) aggregated by climate zone and building category.

State Code	Climate Zone	Large Office	Medium Office	Small Office	Stand-alone Retail	Strip Mall	Primary School	Secondary School	Hospital	Outpatient Healthcare	Full Service Rest-aurant	Quick Service Rest-aurant	Large Hotel	Small Hotel	Non-Refrigerated Warehouse	High-rise Apartment	Mid-rise Apartment	No Prototype	All Total
AK	5C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
AK	6A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02
AK	7	0.00	0.01	0.02	0.02	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.06	0.19
AK	8	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.03	0.06
AL	2A	0.00	0.01	0.06	0.04	0.01	0.01	0.03	0.01	0.01	0.01	0.01	0.00	0.01	0.03	0.00	0.01	0.09	0.33
AL	3A	0.00	0.04	0.29	0.15	0.03	0.05	0.13	0.02	0.06	0.06	0.06	0.01	0.02	0.09	0.00	0.03	0.41	1.44
AR	3A	0.00	0.02	0.12	0.08	0.01	0.04	0.13	0.02	0.04	0.03	0.02	0.01	0.01	0.04	0.00	0.01	0.26	0.85
AR	4A	0.00	0.02	0.04	0.04	0.00	0.01	0.03	0.01	0.01	0.01	0.01	0.00	0.00	0.02	0.00	0.01	0.07	0.29
AZ	2B	0.01	0.08	0.33	0.31	0.07	0.07	0.12	0.04	0.09	0.11	0.07	0.02	0.01	0.23	0.01	0.06	0.50	2.14
AZ	3B	0.00	0.00	0.02	0.02	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.04	0.15
AZ	4B	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.07
AZ	5B	0.00	0.00	0.02	0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.04	0.12
CA	2B	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03
CA	3B	0.02	0.19	0.70	0.51	0.14	0.19	0.39	0.05	0.11	0.18	0.11	0.05	0.05	0.45	0.05	0.29	1.31	4.79
CA	3C	0.02	0.06	0.26	0.10	0.04	0.05	0.12	0.02	0.04	0.05	0.02	0.02	0.02	0.09	0.04	0.12	0.45	1.53
CA	4B	0.00	0.00	0.04	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.04	0.14
CA	4C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02
CA	5B	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.06
CA	6B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
CO	4B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
CO	5B	0.01	0.11	0.36	0.25	0.04	0.05	0.12	0.04	0.09	0.09	0.08	0.02	0.03	0.23	0.02	0.12	0.63	2.30
CO	6B	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.07
CO	7	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.03	0.08
CT	5A	0.00	0.04	0.17	0.14	0.03	0.03	0.08	0.02	0.05	0.04	0.03	0.01	0.01	0.11	0.01	0.05	0.31	1.11
DC	4A	0.02	0.01	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.03	0.04	0.09	0.25
DE	4A	0.00	0.01	0.03	0.03	0.01	0.01	0.02	0.01	0.00	0.01	0.00	0.00	0.00	0.02	0.00	0.01	0.06	0.22
FL	1A	0.02	0.07	0.24	0.20	0.03	0.05	0.08	0.03	0.04	0.06	0.05	0.03	0.02	0.19	0.10	0.09	0.57	1.87
FL	2A	0.01	0.19	1.19	0.83	0.15	0.16	0.30	0.13	0.28	0.27	0.21	0.06	0.08	0.74	0.07	0.20	1.72	6.59
GA	2A	0.00	0.01	0.08	0.05	0.01	0.03	0.04	0.02	0.02	0.02	0.01	0.01	0.01	0.04	0.00	0.01	0.15	0.51
GA	3A	0.01	0.09	0.54	0.43	0.08	0.12	0.25	0.06	0.12	0.17	0.10	0.02	0.03	0.27	0.02	0.09	0.86	3.26
HI	1A	0.00	0.01	0.04	0.02	0.01	0.01	0.03	0.00	0.01	0.01	0.00	0.00	0.00	0.03	0.01	0.01	0.10	0.30
IA	5A	0.00	0.04	0.19	0.13	0.02	0.06	0.13	0.03	0.07	0.04	0.03	0.01	0.02	0.12	0.00	0.04	0.39	1.34
IA	6A	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.03	0.07
ID	5B	0.00	0.03	0.16	0.07	0.01	0.02	0.04	0.01	0.04	0.02	0.02	0.00	0.00	0.08	0.00	0.01	0.14	0.66
ID	6B	0.00	0.01	0.02	0.02	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.06	0.16
IL	4A	0.00	0.01	0.04	0.04	0.01	0.01	0.03	0.01	0.02	0.01	0.01	0.00	0.00	0.03	0.00	0.01	0.08	0.31
IL	5A	0.01	0.06	0.35	0.34	0.06	0.09	0.18	0.05	0.10	0.11	0.07	0.02	0.02	0.22	0.07	0.13	0.70	2.58
IN	4A	0.00	0.04	0.19	0.19	0.03	0.03	0.07	0.03	0.07	0.05	0.07	0.01	0.01	0.23	0.00	0.04	0.39	1.45
IN	5A	0.00	0.04	0.34	0.25	0.03	0.04	0.09	0.03	0.10	0.06	0.07	0.01	0.02	0.33	0.00	0.03	0.49	1.94

State Code	Climate Zone	Large Office	Medium Office	Small Office	Stand-alone Retail	Strip Mall	Primary School	Secondary School	Hospital	Outpatient Healthcare	Full Service Rest-aurant	Quick Service Rest-aurant	Large Hotel	Small Hotel	Non-Refrigerated Warehouse	High-rise Apartment	Mid-rise Apartment	No Prototype	All Total
KS	4A	0.00	0.04	0.18	0.12	0.02	0.07	0.10	0.03	0.06	0.05	0.03	0.01	0.02	0.08	0.00	0.03	0.29	1.13
KS	5A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02
KY	4A	0.00	0.06	0.24	0.19	0.02	0.07	0.11	0.03	0.08	0.08	0.06	0.01	0.02	0.14	0.00	0.03	0.47	1.63
LA	2A	0.00	0.05	0.42	0.21	0.03	0.05	0.12	0.04	0.09	0.07	0.05	0.01	0.03	0.19	0.00	0.03	0.46	1.87
LA	3A	0.00	0.01	0.04	0.05	0.01	0.01	0.04	0.01	0.02	0.01	0.01	0.00	0.01	0.02	0.00	0.01	0.12	0.35
MA	5A	0.01	0.07	0.15	0.17	0.03	0.04	0.12	0.03	0.05	0.06	0.03	0.02	0.02	0.11	0.02	0.17	0.51	1.62
MD	4A	0.02	0.08	0.25	0.15	0.03	0.06	0.10	0.02	0.04	0.06	0.03	0.02	0.01	0.13	0.02	0.10	0.42	1.54
MD	5A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
ME	6A	0.00	0.02	0.05	0.05	0.01	0.01	0.03	0.01	0.02	0.02	0.01	0.00	0.01	0.05	0.00	0.01	0.13	0.43
ME	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
MI	5A	0.01	0.07	0.31	0.25	0.04	0.08	0.17	0.05	0.12	0.11	0.08	0.02	0.02	0.15	0.01	0.06	0.57	2.12
MI	6A	0.00	0.01	0.04	0.03	0.00	0.01	0.02	0.01	0.02	0.01	0.00	0.00	0.00	0.07	0.00	0.00	0.11	0.34
MI	7	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02
MN	5A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02
MN	6A	0.01	0.05	0.16	0.14	0.03	0.06	0.11	0.04	0.08	0.05	0.04	0.01	0.01	0.11	0.01	0.11	0.53	1.55
MN	7	0.00	0.00	0.01	0.02	0.00	0.01	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.07	0.19
MO	3A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
MO	4A	0.01	0.04	0.21	0.23	0.03	0.07	0.16	0.05	0.07	0.07	0.05	0.01	0.02	0.09	0.01	0.06	0.46	1.62
MO	5A	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.05
MS	2A	0.00	0.01	0.07	0.02	0.00	0.01	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.09	0.28
MS	3A	0.00	0.02	0.11	0.07	0.01	0.03	0.08	0.02	0.03	0.02	0.01	0.01	0.01	0.04	0.00	0.01	0.20	0.67
MT	6B	0.00	0.01	0.05	0.03	0.00	0.01	0.02	0.01	0.01	0.01	0.01	0.00	0.01	0.03	0.00	0.01	0.09	0.29
NC	3A	0.02	0.12	0.62	0.35	0.07	0.10	0.21	0.06	0.13	0.12	0.08	0.03	0.02	0.20	0.01	0.09	0.78	3.02
NC	4A	0.00	0.01	0.05	0.03	0.00	0.01	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.07	0.26
NC	5A	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03
ND	6A	0.00	0.01	0.02	0.02	0.00	0.01	0.02	0.01	0.02	0.01	0.00	0.00	0.01	0.02	0.00	0.01	0.08	0.25
ND	7	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.04	0.10
NE	5A	0.00	0.03	0.16	0.08	0.02	0.04	0.07	0.03	0.05	0.03	0.02	0.01	0.01	0.07	0.00	0.02	0.23	0.85
NH	5A	0.00	0.02	0.03	0.05	0.01	0.01	0.02	0.01	0.02	0.02	0.01	0.00	0.00	0.04	0.00	0.02	0.10	0.34
NH	6A	0.00	0.01	0.01	0.02	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.04	0.12
NJ	4A	0.00	0.04	0.10	0.12	0.03	0.05	0.11	0.02	0.03	0.04	0.03	0.01	0.01	0.10	0.03	0.11	0.34	1.16
NJ	5A	0.00	0.02	0.05	0.05	0.01	0.03	0.05	0.01	0.02	0.02	0.01	0.01	0.00	0.03	0.00	0.03	0.14	0.48
NM	3B	0.00	0.00	0.04	0.02	0.00	0.01	0.02	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.06	0.20
NM	4B	0.00	0.01	0.06	0.03	0.01	0.02	0.03	0.01	0.01	0.02	0.01	0.00	0.00	0.02	0.00	0.01	0.09	0.34
NM	5B	0.00	0.01	0.03	0.01	0.00	0.02	0.03	0.00	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.08	0.23
NV	3B	0.00	0.03	0.13	0.11	0.02	0.02	0.02	0.01	0.02	0.04	0.02	0.01	0.01	0.06	0.01	0.02	0.19	0.73
NV	4B	0.00	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.07
NV	5B	0.00	0.01	0.06	0.02	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.02	0.00	0.01	0.06	0.22
NY	4A	0.05	0.06	0.11	0.17	0.03	0.04	0.08	0.03	0.04	0.03	0.01	0.04	0.05	0.11	0.47	0.88	0.33	2.56
NY	5A	0.00	0.05	0.24	0.22	0.03	0.03	0.14	0.04	0.08	0.08	0.05	0.02	0.03	0.15	0.01	0.09	0.49	1.76
NY	6A	0.00	0.01	0.02	0.05	0.00	0.01	0.03	0.01	0.01	0.01	0.01	0.00	0.01	0.03	0.00	0.01	0.12	0.32
OH	4A	0.01	0.05	0.21	0.17	0.03	0.04	0.08	0.03	0.07	0.07	0.05	0.01	0.02	0.12	0.01	0.05	0.37	1.38
OH	5A	0.00	0.05	0.36	0.33	0.04	0.08	0.17	0.06	0.13	0.11	0.09	0.01	0.02	0.23	0.01	0.05	0.65	2.39
OK	3A	0.01	0.04	0.24	0.15	0.02	0.09	0.17	0.03	0.07	0.07	0.04	0.01	0.02	0.14	0.00	0.02	0.46	1.58
OK	4A	0.00	0.00	0.01	0.01	0.00	0.01	0.02	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.06	0.14
OK	4B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OR	4C	0.01	0.05	0.17	0.12	0.02	0.03	0.06	0.02	0.06	0.03	0.02	0.01	0.01	0.12	0.01	0.07	0.30	1.11
OR	5B	0.00	0.01	0.02	0.02	0.00	0.01	0.02	0.01	0.01	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.06	0.20
PA	4A	0.01	0.05	0.12	0.14	0.02	0.05	0.09	0.04	0.05	0.05	0.02	0.02	0.01	0.09	0.01	0.07	0.32	1.17
PA	5A	0.01	0.04	0.12	0.15	0.02	0.04	0.11	0.03	0.04	0.05	0.03	0.02	0.02	0.09	0.01	0.04	0.35	1.15
RI	5A	0.00	0.01	0.01	0.02	0.00	0.01	0.02	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.01	0.06	0.19
SC	2A	0.00	0.01	0.02	0.02	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.04	0.14
SC	3A	0.00	0.08	0.30	0.28	0.03	0.06	0.14	0.03	0.09	0.08	0.06	0.02	0.02	0.17	0.01	0.06	0.58	2.02
SD	5A	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.04
SD	6A	0.00	0.01	0.06	0.03	0.01	0.01	0.03	0.01	0.02	0.01	0.01	0.00	0.01	0.03	0.00	0.01	0.11	0.35
TN	3A	0.01	0.06	0.28	0.21	0.04	0.04	0.08	0.03	0.07	0.07	0.06	0.02	0.02	0.16	0.01	0.05	0.46	1.66
TN	4A	0.00	0.04	0.18	0.15	0.02	0.03	0.06	0.02	0.06	0.05	0.05	0.01	0.01	0.10	0.00	0.02	0.29	1.09
TX	1A	0.00	0.01	0.13	0.09	0.01	0.02	0.05	0.01	0.03	0.04	0.01	0.00	0.01	0.05	0.00	0.00	0.11	0.58
TX	2A	0.04	0.21	1.02	1.11	0.15	0.27	0.55	0.13	0.30	0.38	0.26	0.07	0.11	0.70	0.04	0.21	1.76	7.32
TX	2B	0.00	0.00	0.01	0.02	0.00	0.01	0.02	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.04	0.14
TX	3A	0.01	0.04	0.21	0.20	0.03	0.07	0.15	0.03	0.08	0.06	0.06	0.01	0.02	0.07	0.00	0.03	0.39	1.47
TX	3B	0.00	0.01	0.12	0.11	0.03	0.03	0.08	0.03	0.05	0.04	0.04	0.01	0.02	0.06	0.00	0.01	0.21	0.85
TX	4B	0.00	0.00	0.01	0.02	0.00	0.01	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.04	0.13

State Code	Climate Zone	Large Office	Medium Office	Small Office	Stand-alone Retail	Strip Mall	Primary School	Secondary School	Hospital	Outpatient Healthcare	Full Service Rest-aurant	Quick Service Rest-aurant	Large Hotel	Small Hotel	Non-Refrigerated Warehouse	High-rise Apartment	Mid-rise Apartment	No Prototype	All Total
UT	3B	0.00	0.01	0.02	0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.10
UT	5B	0.01	0.06	0.14	0.13	0.02	0.05	0.07	0.02	0.05	0.04	0.03	0.01	0.01	0.10	0.00	0.05	0.34	1.13
UT	6B	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.03	0.07
VA	3A	0.00	0.02	0.12	0.06	0.01	0.01	0.02	0.01	0.02	0.03	0.02	0.01	0.01	0.04	0.00	0.02	0.16	0.55
VA	4A	0.02	0.08	0.34	0.18	0.04	0.06	0.12	0.03	0.06	0.08	0.04	0.02	0.02	0.14	0.02	0.08	0.57	1.89
VA	5A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
VT	6A	0.00	0.01	0.02	0.02	0.00	0.01	0.02	0.00	0.01	0.00	0.00	0.00	0.01	0.03	0.00	0.01	0.08	0.24
WA	4C	0.02	0.09	0.30	0.16	0.05	0.05	0.10	0.03	0.06	0.05	0.03	0.02	0.01	0.15	0.05	0.17	0.56	1.90
WA	5B	0.00	0.02	0.06	0.04	0.01	0.02	0.04	0.01	0.02	0.01	0.01	0.00	0.01	0.06	0.00	0.01	0.13	0.45
WA	5C	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.03	0.09
WA	6B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
WI	5A	0.01	0.06	0.15	0.15	0.02	0.04	0.07	0.03	0.07	0.04	0.03	0.01	0.01	0.10	0.01	0.07	0.41	1.27
WI	6A	0.00	0.02	0.05	0.05	0.01	0.02	0.04	0.01	0.04	0.01	0.01	0.00	0.01	0.04	0.00	0.01	0.17	0.48
WV	4A	0.00	0.01	0.01	0.03	0.00	0.02	0.03	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.06	0.20
WV	5A	0.00	0.00	0.01	0.01	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.10
WY	5B	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.05
WY	6B	0.00	0.00	0.01	0.01	0.00	0.01	0.02	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.05	0.15
WY	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03

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