

# Development of National New Construction Weighting Factors for the Commercial Building Prototype Analyses (2008-2022)

August 2024

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

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## Executive Summary

The U.S. Department of Energy (DOE) tasked Pacific Northwest National Laboratory (PNNL) with updating commercial building<sup>1</sup> 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 2020 using disaggregate construction volume data acquired from the Dodge Data & Analytics database (formerly McGraw Hill) for the years 2003-2018 (Lei et al, 2020). 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 2008-2022.

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 2008-2022 commercial building weighting factors were derived using the same approach employed to develop the 2003-2018 set (Lei et al, 2020). 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.

The methodology used to develop the updated construction weights in this report is almost identical to that described in the previous report (Lei et al, 2020), and only the differences are noted here. For additional details, consult that report.

**Table ES.1. Square footage percentage weighting factors aggregated by climate zone (CZ) and prototype category (including 'No Prototype<sup>2</sup>').**

	1A	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8	Weights by Bldg Type
Large Office	0.06	0.46	0.04	0.45	0.15	0.22	0.76	0.00	0.24	0.41	0.13	0.00	0.06	0.00	0.00	0.00	2.99
Medium Office	0.07	0.58	0.09	0.48	0.20	0.13	0.58	0.01	0.11	0.52	0.21	0.00	0.10	0.02	0.01	0.00	3.13
Small Office	0.04	0.39	0.05	0.32	0.10	0.02	0.30	0.01	0.05	0.34	0.10	0.00	0.07	0.01	0.01	0.00	1.83
Stand-alone Retail	0.14	0.85	0.09	0.71	0.29	0.05	0.84	0.02	0.11	0.91	0.20	0.00	0.19	0.03	0.03	0.00	4.46
Strip Mall	0.07	0.22	0.04	0.25	0.18	0.04	0.30	0.01	0.03	0.21	0.05	0.00	0.02	0.00	0.01	0.00	1.43
Primary School	0.06	0.64	0.06	0.56	0.21	0.03	0.56	0.02	0.10	0.50	0.16	0.00	0.12	0.04	0.02	0.00	3.07
Secondary School	0.13	1.28	0.10	1.37	0.46	0.11	1.24	0.05	0.19	1.34	0.35	0.01	0.27	0.06	0.04	0.00	7.00
Hospital	0.07	0.54	0.07	0.43	0.19	0.07	0.64	0.01	0.07	0.57	0.13	0.00	0.14	0.02	0.02	0.00	2.98
Outpatient Healthcare	0.04	0.41	0.05	0.36	0.11	0.03	0.44	0.01	0.06	0.52	0.13	0.00	0.14	0.02	0.02	0.00	2.35
Full Service Restaurant	0.02	0.13	0.01	0.10	0.05	0.01	0.10	0.00	0.01	0.11	0.03	0.00	0.02	0.00	0.00	0.00	0.60
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	0.15	0.58	0.07	0.47	0.27	0.07	0.57	0.01	0.10	0.42	0.15	0.00	0.10	0.03	0.02	0.00	3.00
Small Hotel	0.02	0.21	0.02	0.18	0.07	0.01	0.21	0.01	0.02	0.17	0.07	0.00	0.06	0.02	0.01	0.00	1.07
Non-Refrigerated Warehouse	0.48	4.37	0.80	2.89	1.96	0.18	4.20	0.05	0.54	3.31	0.92	0.00	0.42	0.03	0.03	0.00	20.21
High-rise Apartment	0.94	0.77	0.09	0.47	0.38	0.25	2.83	0.00	0.46	0.98	0.21	0.00	0.12	0.00	0.00	0.00	7.52
Mid-rise Apartment	0.31	2.75	0.33	1.99	1.07	0.51	2.95	0.02	0.68	2.23	0.86	0.01	0.69	0.04	0.04	0.00	14.47
No Prototype	1.03	4.00	0.55	3.61	2.08	0.71	4.33	0.12	0.86	3.87	1.21	0.02	1.00	0.12	0.12	0.01	23.63
<b>Weights by Zone</b>	<b>3.64</b>	<b>18.23</b>	<b>2.48</b>	<b>14.70</b>	<b>7.79</b>	<b>2.43</b>	<b>20.88</b>	<b>0.38</b>	<b>3.61</b>	<b>16.48</b>	<b>4.94</b>	<b>0.05</b>	<b>3.53</b>	<b>0.46</b>	<b>0.37</b>	<b>0.02</b>	<b>100.00</b>

<sup>1</sup> 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.

<sup>2</sup> '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
<b>Large Office</b>	0.08	0.60	0.05	0.59	0.20	0.29	0.99	0.00	0.31	0.54	0.17	0.00	0.08	0.00	0.00	0.00	3.92
<b>Medium Office</b>	0.09	0.76	0.11	0.63	0.26	0.17	0.76	0.02	0.14	0.69	0.28	0.00	0.13	0.03	0.02	0.00	4.09
<b>Small Office</b>	0.05	0.51	0.07	0.42	0.13	0.02	0.39	0.02	0.07	0.45	0.14	0.00	0.09	0.02	0.01	0.00	2.39
<b>Stand-alone Retail</b>	0.18	1.11	0.12	0.93	0.38	0.06	1.10	0.03	0.14	1.19	0.26	0.00	0.25	0.04	0.04	0.00	5.85
<b>Strip Mall</b>	0.09	0.29	0.05	0.32	0.23	0.05	0.39	0.01	0.04	0.28	0.07	0.00	0.03	0.01	0.01	0.00	1.87
<b>Primary School</b>	0.08	0.84	0.07	0.74	0.27	0.04	0.73	0.03	0.13	0.66	0.21	0.00	0.16	0.05	0.02	0.00	4.02
<b>Secondary School</b>	0.17	1.68	0.13	1.80	0.60	0.14	1.62	0.06	0.25	1.75	0.46	0.01	0.36	0.08	0.05	0.00	9.17
<b>Hospital</b>	0.09	0.70	0.10	0.56	0.25	0.09	0.83	0.02	0.09	0.75	0.18	0.01	0.18	0.03	0.03	0.00	3.90
<b>Outpatient Healthcare</b>	0.06	0.54	0.07	0.47	0.15	0.04	0.58	0.02	0.07	0.68	0.17	0.00	0.18	0.03	0.03	0.00	3.08
<b>Full Service Restaurant</b>	0.03	0.17	0.02	0.13	0.06	0.01	0.13	0.00	0.02	0.15	0.04	0.00	0.02	0.00	0.00	0.00	0.79
<b>Quick Service Restaurant</b>	0.01	0.07	0.01	0.06	0.02	0.00	0.05	0.00	0.00	0.06	0.02	0.00	0.01	0.00	0.00	0.00	0.32
<b>Large Hotel</b>	0.19	0.76	0.10	0.62	0.36	0.10	0.74	0.02	0.13	0.54	0.19	0.00	0.14	0.04	0.02	0.00	3.93
<b>Small Hotel</b>	0.03	0.27	0.02	0.23	0.09	0.01	0.27	0.01	0.02	0.23	0.09	0.00	0.08	0.02	0.02	0.00	1.40
<b>Non-Refrigerated Warehouse</b>	0.63	5.72	1.05	3.79	2.57	0.24	5.50	0.07	0.71	4.34	1.21	0.00	0.56	0.04	0.04	0.00	26.46
<b>High-rise Apartment</b>	1.24	1.01	0.12	0.62	0.50	0.33	3.71	0.00	0.60	1.28	0.28	0.00	0.15	0.00	0.00	0.00	9.85
<b>Mid-rise Apartment</b>	0.41	3.60	0.43	2.60	1.40	0.66	3.86	0.03	0.89	2.93	1.13	0.01	0.90	0.06	0.05	0.00	18.95
<b>Weights by Zone</b>	3.42	18.63	2.53	14.52	7.47	2.25	21.67	0.34	3.60	16.51	4.88	0.05	3.32	0.44	0.34	0.02	100.00

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## Acronyms and Abbreviations

ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
CBECS	Commercial Buildings Energy Consumption Survey
DOE	U.S. Department of Energy
PBA	principal building activity
PNNL	Pacific Northwest National Laboratory

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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., 2016). In those analyses, weighting factors developed by Jarnagin and Bandyopadhyay (2010) for commercial buildings constructed from 2003 to 2007 were used. A similar activity was last completed by PNNL in 2020 using disaggregate construction volume data acquired from the Dodge Data & Analytics database (formerly McGraw Hill) for the years 2003-2018 (Lei et al, 2020). 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 to develop new construction weighting factors using the latest dataset, which includes data from 2003 to 2022. Preliminary analysis indicated that the results derived from the most recent 15-year dataset (2008-2022) closely align with those obtained from the full 2003-2022 dataset. Therefore, the most recent 15-year dataset was used for the final analysis presented in this report, covering 5 codes cycles.

## 2.0 Methodology

The categorization approach for the 2003-2018 commercial building weighting factors was used to develop the 2008-2022 weighting factors, and the methodology described here only includes differences from that used for the former approach.

The 2008-2022 dataset includes new project types not present in the 2003-2018 dataset, necessitating updates in Table A.1 and Table A.2 of the previous report (Lei et al., 2020). Table 1 presents a summary of the dataset at each stage of the data preprocessing process.

Table 1. Summary of the data preprocessing

Data preprocessing	Number of samples	Thousand square feet
2008-2022 Dodge dataset	1,197,812	23,106,687
Discard “alt” construction projects	468,892	23,106,603
Drop samples with 0 square footage	466,208	23,106,603
Drop building samples with excluded project types	409,852	18,919,891

After the execution of the direct project type mapping and expanded categorization matching, 409,817 samples were mapped to unique prototype or Non-Prototype subcategories. Another 35 samples were found to meet the mapping criteria for more than one subcategory and are discarded for future analysis. Therefore, more than 99.99% of the considered 409,852 building samples are categorized into unique categories with the logic described earlier in this section.

To verify the quality of the categorization results, 1,000 samples were drawn randomly from the categorized dataset and the accuracy of the categorization was manually checked. The manual check shows that 52 of the 1,000 randomly drawn samples are incorrectly categorized by the logic, showing an accuracy of 94.8%.

Since the square footage distribution of buildings in each category is interesting information to many analyses, Figure 1 depicts a box plot of sample square footage values categorized for each prototype. It should be noted that most prototype categories contain samples with very small square footage areas because those project samples are additions onto existing buildings rather than the construction of new buildings. They represent a very small percentage of the total construction volume.

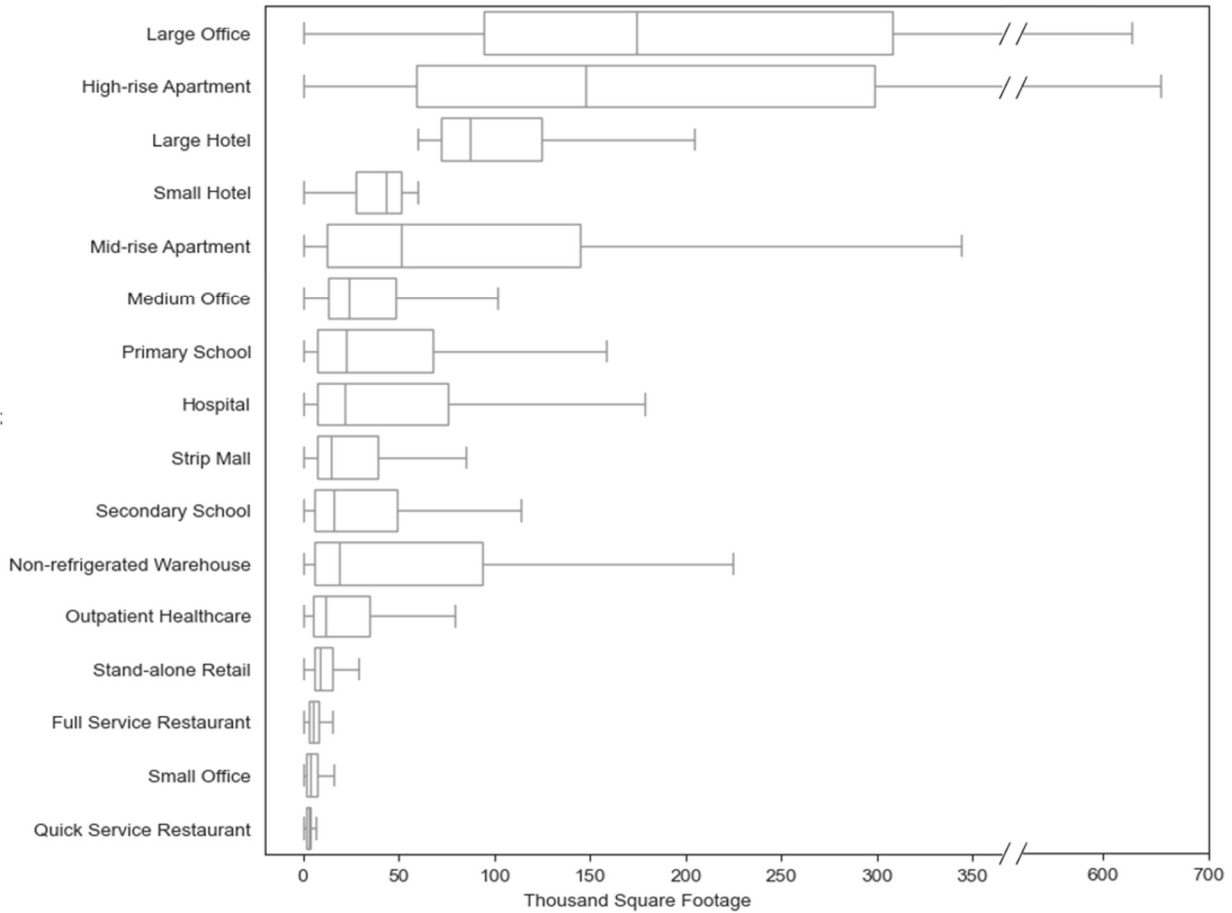


Figure 1. Box plot of square footage ranges of samples mapped to Prototypes<sup>1</sup>

<sup>1</sup> 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.

### 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 2008-2022

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 2 – 9). 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 2. 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	0.06	0.46	0.04	0.45	0.15	0.22	0.76	0.00	0.24	0.41	0.13	0.00	0.06	0.00	0.00	0.00	2.99
Medium Office	0.07	0.58	0.09	0.48	0.20	0.13	0.58	0.01	0.11	0.52	0.21	0.00	0.10	0.02	0.01	0.00	3.13
Small Office	0.04	0.39	0.05	0.32	0.10	0.02	0.30	0.01	0.05	0.34	0.10	0.00	0.07	0.01	0.01	0.00	1.83
Stand-alone Retail	0.14	0.85	0.09	0.71	0.29	0.05	0.84	0.02	0.11	0.91	0.20	0.00	0.19	0.03	0.03	0.00	4.46
Strip Mall	0.07	0.22	0.04	0.25	0.18	0.04	0.30	0.01	0.03	0.21	0.05	0.00	0.02	0.00	0.01	0.00	1.43
Primary School	0.06	0.64	0.06	0.56	0.21	0.03	0.56	0.02	0.10	0.50	0.16	0.00	0.12	0.04	0.02	0.00	3.07
Secondary School	0.13	1.28	0.10	1.37	0.46	0.11	1.24	0.05	0.19	1.34	0.35	0.01	0.27	0.06	0.04	0.00	7.00
Hospital	0.07	0.54	0.07	0.43	0.19	0.07	0.64	0.01	0.07	0.57	0.13	0.00	0.14	0.02	0.02	0.00	2.98
Outpatient Healthcare	0.04	0.41	0.05	0.36	0.11	0.03	0.44	0.01	0.06	0.52	0.13	0.00	0.14	0.02	0.02	0.00	2.35
Full Service Restaurant	0.02	0.13	0.01	0.10	0.05	0.01	0.10	0.00	0.01	0.11	0.03	0.00	0.02	0.00	0.00	0.00	0.60
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	0.15	0.58	0.07	0.47	0.27	0.07	0.57	0.01	0.10	0.42	0.15	0.00	0.10	0.03	0.02	0.00	3.00
Small Hotel	0.02	0.21	0.02	0.18	0.07	0.01	0.21	0.01	0.02	0.17	0.07	0.00	0.06	0.02	0.01	0.00	1.07
Non-Refrigerated Warehouse	0.48	4.37	0.80	2.89	1.96	0.18	4.20	0.05	0.54	3.31	0.92	0.00	0.42	0.03	0.03	0.00	20.21
High-rise Apartment	0.94	0.77	0.09	0.47	0.38	0.25	2.83	0.00	0.46	0.98	0.21	0.00	0.12	0.00	0.00	0.00	7.52
Mid-rise Apartment	0.31	2.75	0.33	1.99	1.07	0.51	2.95	0.02	0.68	2.23	0.86	0.01	0.69	0.04	0.04	0.00	14.47
No Prototype	1.03	4.00	0.55	3.61	2.08	0.71	4.33	0.12	0.86	3.87	1.21	0.02	1.00	0.12	0.12	0.01	23.63
Weights by Zone	3.64	18.23	2.48	14.70	7.79	2.43	20.88	0.38	3.61	16.48	4.94	0.05	3.53	0.46	0.37	0.02	100.00

Table 3. 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	0.08	0.01	0.08	0.03	0.03	0.16	0.00	0.04	0.08	0.03	0.00	0.01	0.00	0.00	0.00	0.56
Medium Office	0.08	0.62	0.06	0.56	0.18	0.06	0.61	0.02	0.12	0.59	0.24	0.00	0.14	0.03	0.03	0.00	3.36
Small Office	0.25	2.28	0.24	1.94	0.61	0.10	1.65	0.09	0.40	1.89	0.76	0.01	0.36	0.08	0.06	0.00	10.70
Stand-alone Retail	0.27	2.21	0.22	1.75	0.56	0.07	1.86	0.06	0.20	1.95	0.46	0.01	0.38	0.07	0.05	0.00	10.13
Strip Mall	0.04	0.26	0.04	0.23	0.15	0.03	0.30	0.01	0.05	0.28	0.08	0.00	0.06	0.01	0.01	0.00	1.55
Primary School	0.08	0.54	0.07	0.56	0.27	0.06	0.68	0.03	0.10	0.63	0.18	0.00	0.19	0.04	0.02	0.00	3.48
Secondary School	0.15	1.22	0.13	1.49	0.59	0.15	1.36	0.07	0.20	1.55	0.38	0.01	0.40	0.07	0.06	0.01	7.85
Hospital	0.05	0.35	0.05	0.32	0.11	0.02	0.38	0.02	0.04	0.42	0.11	0.00	0.11	0.03	0.02	0.00	2.03
Outpatient Healthcare	0.06	0.78	0.08	0.70	0.20	0.04	0.71	0.03	0.11	0.87	0.26	0.01	0.25	0.04	0.03	0.00	4.18
Full Service Restaurant	0.09	0.82	0.09	0.63	0.21	0.04	0.60	0.03	0.06	0.64	0.17	0.00	0.10	0.02	0.01	0.00	3.49
Quick Service Restaurant	0.07	0.74	0.09	0.66	0.22	0.02	0.58	0.02	0.05	0.64	0.20	0.00	0.12	0.02	0.01	0.00	3.44
Large Hotel	0.05	0.21	0.03	0.19	0.09	0.03	0.22	0.01	0.04	0.18	0.06	0.00	0.04	0.01	0.01	0.00	1.16
Small Hotel	0.03	0.26	0.02	0.19	0.08	0.01	0.25	0.01	0.02	0.21	0.08	0.00	0.08	0.02	0.02	0.00	1.29
Non-Refrigerated Warehouse	0.25	1.94	0.25	1.27	0.54	0.08	1.56	0.05	0.27	1.80	0.62	0.01	0.45	0.07	0.06	0.00	9.23
High-rise Apartment	0.13	0.12	0.01	0.08	0.07	0.05	0.90	0.00	0.11	0.19	0.04	0.00	0.02	0.00	0.00	0.00	1.73
Mid-rise Apartment	0.11	0.70	0.09	0.59	0.44	0.19	2.28	0.02	0.36	1.16	0.32	0.00	0.31	0.03	0.02	0.00	6.62
No Prototype	0.83	4.90	0.53	4.82	1.77	0.48	5.12	0.21	0.88	5.73	1.67	0.04	1.68	0.28	0.24	0.02	29.19
Weights by Zone	2.57	18.03	2.00	16.05	6.10	1.48	19.22	0.66	3.06	18.82	5.67	0.09	4.70	0.83	0.66	0.05	100.00

Table 4. 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	0.08	0.60	0.05	0.59	0.20	0.29	0.99	0.00	0.31	0.54	0.17	0.00	0.08	0.00	0.00	0.00	3.92
Medium Office	0.09	0.76	0.11	0.63	0.26	0.17	0.76	0.02	0.14	0.69	0.28	0.00	0.13	0.03	0.02	0.00	4.09
Small Office	0.05	0.51	0.07	0.42	0.13	0.02	0.39	0.02	0.07	0.45	0.14	0.00	0.09	0.02	0.01	0.00	2.39
Stand-alone Retail	0.18	1.11	0.12	0.93	0.38	0.06	1.10	0.03	0.14	1.19	0.26	0.00	0.25	0.04	0.04	0.00	5.85
Strip Mall	0.09	0.29	0.05	0.32	0.23	0.05	0.39	0.01	0.04	0.28	0.07	0.00	0.03	0.01	0.01	0.00	1.87
Primary School	0.08	0.84	0.07	0.74	0.27	0.04	0.73	0.03	0.13	0.66	0.21	0.00	0.16	0.05	0.02	0.00	4.02
Secondary School	0.17	1.68	0.13	1.80	0.60	0.14	1.62	0.06	0.25	1.75	0.46	0.01	0.36	0.08	0.05	0.00	9.17
Hospital	0.09	0.70	0.10	0.56	0.25	0.09	0.83	0.02	0.09	0.75	0.18	0.01	0.18	0.03	0.03	0.00	3.90
Outpatient Healthcare	0.06	0.54	0.07	0.47	0.15	0.04	0.58	0.02	0.07	0.68	0.17	0.00	0.18	0.03	0.03	0.00	3.08
Full Service Restaurant	0.03	0.17	0.02	0.13	0.06	0.01	0.13	0.00	0.02	0.15	0.04	0.00	0.02	0.00	0.00	0.00	0.79
Quick Service Restaurant	0.01	0.07	0.01	0.06	0.02	0.00	0.05	0.00	0.00	0.06	0.02	0.00	0.01	0.00	0.00	0.00	0.32
Large Hotel	0.19	0.76	0.10	0.62	0.36	0.10	0.74	0.02	0.13	0.54	0.19	0.00	0.14	0.04	0.02	0.00	3.93
Small Hotel	0.03	0.27	0.02	0.23	0.09	0.01	0.27	0.01	0.02	0.23	0.09	0.00	0.08	0.02	0.02	0.00	1.40
Non-Refrigerated Warehouse	0.63	5.72	1.05	3.79	2.57	0.24	5.50	0.07	0.71	4.34	1.21	0.00	0.56	0.04	0.04	0.00	26.46
High-rise Apartment	1.24	1.01	0.12	0.62	0.50	0.33	3.71	0.00	0.60	1.28	0.28	0.00	0.15	0.00	0.00	0.00	9.85
Mid-rise Apartment	0.41	3.60	0.43	2.60	1.40	0.66	3.86	0.03	0.89	2.93	1.13	0.01	0.90	0.06	0.05	0.00	18.95
Weights by Zone	3.42	18.63	2.53	14.52	7.47	2.25	21.67	0.34	3.60	16.51	4.88	0.05	3.32	0.44	0.34	0.02	100.00

Table 5. 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	0.11	0.01	0.12	0.04	0.05	0.22	0.00	0.05	0.12	0.04	0.00	0.02	0.00	0.00	0.00	0.80
Medium Office	0.11	0.88	0.09	0.79	0.26	0.09	0.86	0.02	0.17	0.84	0.35	0.00	0.20	0.05	0.04	0.00	4.74
Small Office	0.35	3.22	0.34	2.73	0.86	0.14	2.33	0.12	0.57	2.67	1.07	0.01	0.51	0.12	0.09	0.00	15.12
Stand-alone Retail	0.38	3.12	0.31	2.47	0.79	0.10	2.63	0.09	0.29	2.76	0.65	0.01	0.54	0.09	0.08	0.00	14.30
Strip Mall	0.06	0.36	0.06	0.33	0.21	0.05	0.42	0.01	0.07	0.40	0.12	0.00	0.08	0.02	0.01	0.00	2.19
Primary School	0.11	0.76	0.10	0.79	0.38	0.09	0.96	0.05	0.15	0.89	0.26	0.00	0.26	0.06	0.03	0.00	4.91
Secondary School	0.22	1.72	0.18	2.10	0.84	0.22	1.93	0.10	0.28	2.19	0.54	0.01	0.57	0.10	0.08	0.01	11.09
Hospital	0.07	0.50	0.06	0.45	0.16	0.03	0.54	0.02	0.06	0.60	0.15	0.00	0.16	0.04	0.03	0.00	2.87
Outpatient Healthcare	0.09	1.10	0.11	0.99	0.28	0.06	1.01	0.05	0.15	1.23	0.36	0.01	0.36	0.06	0.05	0.01	5.91
Full Service Restaurant	0.13	1.16	0.13	0.88	0.29	0.05	0.84	0.04	0.08	0.90	0.24	0.00	0.14	0.03	0.02	0.00	4.93
Quick Service Restaurant	0.10	1.04	0.12	0.94	0.31	0.03	0.82	0.03	0.07	0.90	0.28	0.00	0.16	0.03	0.01	0.00	4.85
Large Hotel	0.07	0.29	0.04	0.27	0.13	0.04	0.31	0.01	0.05	0.25	0.08	0.00	0.06	0.02	0.01	0.00	1.64
Small Hotel	0.05	0.37	0.03	0.27	0.12	0.02	0.36	0.01	0.03	0.29	0.12	0.00	0.11	0.03	0.02	0.00	1.82
Non-Refrigerated Warehouse	0.36	2.74	0.35	1.79	0.76	0.12	2.21	0.06	0.39	2.54	0.87	0.01	0.63	0.10	0.09	0.01	13.04
High-rise Apartment	0.19	0.17	0.02	0.11	0.10	0.08	1.26	0.00	0.15	0.28	0.06	0.00	0.03	0.00	0.00	0.00	2.44
Mid-rise Apartment	0.16	0.99	0.12	0.83	0.62	0.26	3.22	0.02	0.50	1.64	0.46	0.01	0.44	0.05	0.03	0.00	9.35
Weights by Zone	2.46	18.54	2.08	15.86	6.12	1.41	19.92	0.64	3.07	18.50	5.65	0.07	4.28	0.79	0.58	0.03	100.00

Table 6. 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	12213.3	86538.7	7892.7	85826.5	29271.5	42087.5	143472.1	0	44609.2	77956	24019.5	0	11422	695.3	581.2	0	566585.5
Medium Office	12385.3	109579.1	16429.4	90899.9	38213.6	24534.1	110417.4	2655.3	20276.8	99122.3	40329.1	165.4	19383.4	4220.7	2710.2	138.7	591460.7
Small Office	7494.1	73174.5	10301	61276.3	19006.2	3255.6	56785.6	2217.9	9432	64862.7	19666.1	180.6	13695	2586.9	1803	42.5	345780
Stand-alone Retail	26193.6	160919.3	17447.1	134059.8	54381.3	9250.4	159629.2	4707.1	20276.8	171944.7	37934.8	611.7	36168.8	5510.8	5326.7	132.2	844494.3
Strip Mall	13204.1	42535.6	7748.3	46894.6	33224.4	7233	56248.5	1267.2	39843.7	9954.4	292.2	4675.8	729.2	1142.5	53.9	270424.8	
Primary School	11717.6	120644	10469.1	106461.4	38831.7	5635.9	105630.1	4283.3	18207.3	94908.3	30459.6	267.3	23440.8	6637	3295.9	36.2	580925.5
Secondary School	23893.7	243013.6	18974.8	259829.7	86895.6	20302.4	233960.2	9236.9	36151.7	253354.3	65813.6	1078.1	51847.8	12000.8	7435.5	617.7	1324406
Hospital	12921.8	101352	13821.8	80460.6	36638.9	12558.9	120509.8	2727.5	13022.5	108255.8	25400.4	923.2	25603.3	4399.3	4506	266	563367.8
Outpatient Healthcare	8038	77724.5	10125.3	67823.3	21337.5	5443	83746	2717.7	10514.7	98529.1	24980.6	641.4	25939.8	3689.1	3690.5	380.7	445321.2
Full Service Restaurant	4120.9	24543.3	2418.6	19475.1	8677.7	1474.6	18926.9	706.4	2283.7	21038	5344.8	82.1	3290.7	690.7	453	111.7	113638.2
Quick Service Restaurant	1050.7	9968.3	1144	9205.1	2939	267.6	7857.2	290.3	565.4	8977.1	2496	14.8	1565.9	311	93.6	0	46746
Large Hotel	27663.9	109165.3	14176.2	89448	51886.8	13728.8	106898.9	2285.6	18283.4	78730.6	27492	486.6	19508.5	5279.1	2881.2	0	567914.9
Small Hotel	4331.9	39667.4	3552.2	33820.1	13334.8	1741.2	38825.9	1210.6	3274.1	32997.8	12866.1	126.7	11233.7	2857.1	2260	142.7	202242.3
Non-Refrigerated Warehouse	91346	826612.5	151877.4	547281.2	370967.1	34145.6	794248.7	10307.1	102391.3	626551.6	174904.8	471.5	80285.5	5985.7	5246.2	360.6	3822983
High-rise Apartment	178732.9	145861.2	17378.8	89852.2	72241.9	47960.9	535368.8	26.6	86815.2	185591.3	40315.9	0	22034.2	633.8	374.8	0	1423189
Mid-rise Apartment	59123.8	520006.3	62228.4	375871.4	201995.5	95830.8	558382.6	4531.2	128246.1	422704.6	163543.3	1274.3	129627.9	7992.4	6663.6	0	2738022
No Prototype	194707.4	756645.8	103570.5	682827	392990.3	134284.1	819538	22432	163266.9	732816.5	228467.6	3570.1	188943.3	22611.6	22188.3	2013	4470872
Sum by Zone	689139	3447951	469555.6	2781312	1472834	459734.4	3950446	71602.7	682994.5	3118184	933988.6	10186	668666.4	86830.5	70652.2	4295.9	18918374

Table 7. 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	68	311	25	340	107	139	640	0	156	340	125	0	53	6	4	0	2314
Medium Office	308	2555	265	2282	744	248	2496	67	507	2438	1003	9	590	139	103	5	13759
Small Office	1007	9342	985	7935	2484	408	6767	358	1640	7735	3105	29	1479	337	248	10	43869
Stand-alone Retail	1108	9055	893	7161	2286	287	7638	255	837	8002	1890	22	1575	270	221	9	41509
Strip Mall	176	1047	166	956	607	138	1213	32	194	1156	339	3	234	48	33	1	6343
Primary School	319	2219	296	2307	1112	262	2791	135	424	2591	752	13	762	180	96	2	14261
Secondary School	633	4999	525	6092	2426	626	5587	303	826	6357	1567	33	1640	297	240	28	32179
Hospital	189	1451	187	1304	452	89	1561	68	180	1738	433	14	466	117	74	3	8326
Outpatient Healthcare	265	3201	333	2883	807	163	2922	131	441	3562	1051	22	1037	164	140	18	17140
Full Service Restaurant	381	3353	378	2562	846	152	2444	105	229	2617	701	9	396	81	52	4	14310
Quick Service Restaurant	292	3026	359	2722	894	99	2366	96	206	2619	811	6	475	86	30	0	14087
Large Hotel	199	849	121	771	373	117	911	24	153	733	242	5	179	54	33	0	4764
Small Hotel	134	1064	84	789	338	52	1041	36	92	843	342	6	313	74	63	3	5274
Non-Refrigerated Warehouse	1035	7956	1020	5207	2207	337	6412	188	1126	7380	2538	29	1830	294	261	18	37838

	1A	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8	Sum by Bldg Type
High-rise Apartment	545	482	49	310	284	218	3668	1	445	799	177	0	96	3	5	0	7082
Mid-rise Apartment	471	2886	350	2399	1789	769	9341	69	1455	4770	1321	17	1288	133	85	0	27143
No Prototype	3405	20094	2159	19734	7258	1955	20975	849	3618	23464	6855	158	6868	1131	1002	86	119611
<b>Sum by Zone</b>	<b>10535</b>	<b>73890</b>	<b>8195</b>	<b>65754</b>	<b>25014</b>	<b>6059</b>	<b>78773</b>	<b>2717</b>	<b>12529</b>	<b>77144</b>	<b>23252</b>	<b>375</b>	<b>19281</b>	<b>3414</b>	<b>2690</b>	<b>187</b>	<b>409809</b>

Table 8. 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	12213.3	86538.7	7892.7	85826.5	29271.5	42087.5	143472.1	0	44609.2	77956	24019.5	0	11422	695.3	581.2	0	566585.5
Medium Office	12385.3	109579.1	16429.4	90899.9	38213.6	24534.1	1110417.4	2655.3	20276.8	99122.3	40329.1	165.4	19383.4	4220.7	2710.2	138.7	591460.7
Small Office	7494.1	73174.5	10301	61276.3	19006.2	3255.6	56785.6	2217.9	9432	64862.7	19666.1	180.6	13695	2586.9	1803	42.5	345780
Stand-alone Retail	26193.6	160919.3	17447.1	134059.8	54381.3	9250.4	159629.2	4707.1	20276.8	171944.7	37934.8	611.7	36168.8	5510.8	5326.7	132.2	844494.3
Strip Mall	13204.1	42535.6	7748.3	46894.6	33224.4	7233	56248.5	1267.2	5377.4	39843.7	9954.4	292.2	4675.8	729.2	1142.5	53.9	270424.8
Primary School	11717.6	120644	10469.1	106461.4	38831.7	5635.9	105630.1	4283.3	18207.3	94908.3	30459.6	267.3	23440.8	6637	3295.9	36.2	580925.5
Secondary School	23893.7	243013.6	18974.8	259829.7	86895.6	20302.4	233960.2	9236.9	36151.7	253354.3	65813.6	1078.1	51847.8	12000.8	7435.5	617.7	1324406
Hospital	12921.8	101352	13821.8	80460.6	36638.9	12558.9	120509.8	2727.5	13022.5	108255.8	25400.4	923.2	25603.3	4399.3	4506	266	563367.8
Outpatient Healthcare	8038	77724.5	10125.3	67823.3	21337.5	5443	83746	2717.7	10514.7	98529.1	24980.6	641.4	25939.8	3689.1	3690.5	380.7	445321.2
Full Service Restaurant	4120.9	24543.3	2418.6	19475.1	8677.7	1474.6	18926.9	706.4	2283.7	21038	5344.8	82.1	3290.7	690.7	453	111.7	113638.2
Quick Service Restaurant	1050.7	9968.3	1144	9205.1	2939	267.6	7857.2	290.3	565.4	8977.1	2496	14.8	1565.9	311	93.6	0	46746
Large Hotel	27663.9	109165.3	14176.2	89448	51886.8	13728.8	106898.9	2285.6	18283.4	78730.6	27492	486.6	19508.5	5279.1	2881.2	0	567914.9
Small Hotel	4331.9	39667.4	3552.2	33820.1	13334.8	1741.2	38825.9	1210.6	3274.1	32997.8	12866.1	126.7	11233.7	2857.1	2260	142.7	202242.3
Non-Refrigerated Warehouse	913468	26612.5	151877.4	547281.2	370967.1	34145.6	6794248.7	10307.1	1102391.3	626551.6	174904.8	471.5	80285.5	5985.7	5246.2	360.6	3822983
High-rise Apartment	178732.9	145861.2	17378.8	89852.2	72241.9	47960.9	9535368.8	26.6	86815.2	185591.3	40315.9	0	22034.2	633.8	374.8	0	1423189
Mid-rise Apartment	59123.8	520006.3	62228.4	375871.4	201995.5	95830.8	8558382.6	4531.2	128246.1	422704.6	163543.3	1274.3	129627.9	7992.4	6663.6	0	2738022
<b>Sum by Zone</b>	<b>494431.6</b>	<b>2691306</b>	<b>365985.1</b>	<b>2098485</b>	<b>1079844</b>	<b>325450.3</b>	<b>3130908</b>	<b>49170.7</b>	<b>519727.6</b>	<b>2385368</b>	<b>705521</b>	<b>6615.9</b>	<b>9479723.1</b>	<b>64218.9</b>	<b>48463.9</b>	<b>2282.9</b>	<b>14447501</b>

Table 9. 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	68	311	25	340	107	139	640	0	156	340	125	0	53	6	4	0	2314
Medium Office	308	2555	265	2282	744	248	2496	67	507	2438	1003	9	590	139	103	5	13759
Small Office	1007	9342	985	7935	2484	408	6767	358	1640	7735	3105	29	1479	337	248	10	43869
Stand-alone Retail	1108	9055	893	7161	2286	287	7638	255	837	8002	1890	22	1575	270	221	9	41509
Strip Mall	176	1047	166	956	607	138	1213	32	194	1156	339	3	234	48	33	1	6343
Primary School	319	2219	296	2307	1112	262	2791	135	424	2591	752	13	762	180	96	2	14261
Secondary School	633	4999	525	6092	2426	626	5587	303	826	6357	1567	33	1640	297	240	28	32179
Hospital	189	1451	187	1304	452	89	1561	68	180	1738	433	14	466	117	74	3	8326
Outpatient Healthcare	265	3201	333	2883	807	163	2922	131	441	3562	1051	22	1037	164	140	18	17140
Full Service Restaurant	381	3353	378	2562	846	152	2444	105	229	2617	701	9	396	81	52	4	14310
Quick Service Restaurant	292	3026	359	2722	894	99	2366	96	206	2619	811	6	475	86	30	0	14087
Large Hotel	199	849	121	771	373	117	911	24	153	733	242	5	179	54	33	0	4764
Small Hotel	134	1064	84	789	338	52	1041	36	92	843	342	6	313	74	63	3	5274
Non-Refrigerated Warehouse	1035	7956	1020	5207	2207	337	6412	188	1126	7380	2538	29	1830	294	261	18	37838
High-rise Apartment	545	482	49	310	284	218	3668	1	445	799	177	0	96	3	5	0	7082
Mid-rise Apartment	471	2886	350	2399	1789	769	9341	69	1455	4770	1321	17	1288	133	85	0	27143
<b>Sum by Zone</b>	<b>7130</b>	<b>53796</b>	<b>6036</b>	<b>46020</b>	<b>17756</b>	<b>4104</b>	<b>57798</b>	<b>1868</b>	<b>8911</b>	<b>53680</b>	<b>16397</b>	<b>217</b>	<b>12413</b>	<b>2283</b>	<b>1688</b>	<b>101</b>	<b>290198</b>

### 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 10, Table 11), CBECS PBA (Table 12,



Table 13) and CBECS PBAPlus (Table 14, Table 15). 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 10. 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)	129	0.03%	898	0.00%
Laundry (Service)	109	0.03%	765.5	0.00%
Beauty (Service)	187	0.05%	983.8	0.01%
Convenience Store	2036	0.50%	13752.4	0.07%
Court House	728	0.18%	42808	0.23%
Data Center	612	0.15%	114676.3	0.61%
Transit Terminal	2305	0.56%	110736.7	0.59%
Laboratory	1587	0.39%	119874.6	0.63%
Supermarket	4233	1.03%	157377.6	0.83%
Parking Garage	17298	4.22%	1879594	9.94%
Other <sup>1</sup>	90387	22.06%	2029405	10.73%
All	119611	29.19%	4470872	23.63%

Table 11. 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)	0	165	18.3	166.1	49	9.7	129.3	0	24.5	183.9	49.4	0	68.1	34.7	0	0	898
Laundry (Service)	9	299	6.4	117.8	31	7.4	135.6	0	0.7	105.9	45	0.2	6.5	0	1	0	765.5
Beauty (Service)	4	350.3	14.8	193.7	38.5	1.3	166.8	0	13.9	96.6	29.6	0	69.9	1.4	3	0	983.8
Convenience Store	159.5	2721.5	225.7	2508.3	767.7	81.3	2004.5	172	204.4	2745.1	813.5	0	836.6	258.9	253.4	0	13752.4
Court House	2185.2	5263.1	1609.3	7907	5056.6	640.8	9151.2	291.4	1000.2	5396.4	2217.7	6.5	1194.1	668.9	219.6	0	42808
Data Center	33.4	11290.9	4654.9	14537.2	3663.1	5602	32933.9	3810	2070.3	19517	15447.4	0	904.7	183.5	28	0	114676.3
Transit Terminal	5519.7	20149.6	1044.4	11480.1	11115.9	2960.7	21380	284.3	4159	14116.2	8676.2	57	7370.4	1122.3	1298.4	2.5	110736.7
Laboratory	1587	11288.8	2065.9	10508.4	8799.2	9227	28222.7	759.9	4546.6	33582.1	5230	11.3	3110	452.8	338.8	144.1	119874.6
Supermarket	4595.1	33294.2	1591.5	34092.5	4622	1845.7	31110.7	238.2	1763.3	30521.8	6595.3	90.3	5947.8	710.2	359	0	157377.6
Parking Garage	128696.6	349833.5	47114.8	245731.7	193558.8	78535.6	326160	3384.1	98521.4	245377.7	86274.3	1329.3	67193.9	3335.5	4544.9	2.2	1879594
Other	51917.9	321989.9	45224.5	355584.2	165288.5	35372.6	368143.3	13492.1	50962.6	381173.8	103089.2	2075.5	102241.3	15843.4	15142.2	1864.2	2029405
Sum by Zone	194707.4	756645.8	103570.5	682827	392990.3	134284.1	819538	22432	163266.9	732816.5	228467.6	3570.1	188943.3	22611.6	22188.3	2013	4470872

Table 12. 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	964	0.24%	81867	0.43%
Other	1223	0.30%	126954.2	0.67%
Laboratory	1587	0.39%	119874.6	0.63%
Food Sales	6269	1.53%	171130	0.90%
Religious Worship	12044	2.94%	179810.4	0.95%
Lodging (dormitory)	3858	0.94%	307820.2	1.63%
Public Order and Safety	14516	3.54%	348418.7	1.84%
Public Assembly	35044	8.55%	773619.4	4.09%
Service	44106	10.76%	2361378	12.48%
All	119611	29.19%	4470872	23.63%

<sup>1</sup> 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 13. 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	1481.3	15994.9	897.4	13540.1	4388.6	2740	13241.4	412.3	3808.9	17290.1	4354.6	0	3156.3	161.9	399.2	0	81867
Other	635.2	12965.3	4869	18021.3	4214.6	5603.7	36186.9	3899.4	2235.7	20800.6	15921.3	1.7	1016.9	423.9	132.7	26	126954.2
Laboratory	1587	11288.8	2065.9	10508.4	8799.2	9227	28222.7	759.9	4546.6	33582.1	5230	11.3	3110	452.8	338.8	144.1	119874.6
Food Sales	4754.6	36015.7	1817.2	36600.8	5389.7	1927	33115.2	410.2	1967.7	33266.9	7408.8	90.3	6784.4	969.1	612.4	0	171130
Religious Worship	3265	39151.5	3478.6	43246.7	7569	758	35579.6	806.8	3176.8	25840.8	9654.1	115.2	5481.9	1246.6	433.7	6.1	179810.4
Lodging (dormitory)	6644.9	37490.6	7934.4	57343.8	31579	7952.9	62770.7	1838.4	9652.4	54659.3	14964.1	269.5	10098	2159.1	2073	390.1	307820.2
Public Order and Safety	8377.2	48874.9	7862.8	66647.3	30652.8	4839.3	66719.3	4244.1	7802.8	57050.5	17567.9	642.1	19036.7	3960.4	3846.9	293.7	348418.7
Public Assembly	24728	120728.9	15843.8	123048.9	67689	12776	141781.9	4060.3	19916.9	148349.2	40410	510.9	40976.5	6645.4	5987	166.7	773619.4
Service	143234.2	434135.2	58801.4	313869.7	232708.4	88460.2	401920.3	6000.6	110159.1	341977	112956.8	1929.1	99282.6	6592.4	8364.6	986.3	2361378
Sum by Zone	194707.4	756645.8	103570.5	682827	392990.3	134284.1	819538	22432	163266.9	732816.5	228467.6	3570.1	188943.3	22611.6	22188.3	2013	4470872

Table 14. 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	100	0.02%	3473.1	0.02%
12: Convenience Store	2036	0.50%	13752.4	0.07%
52: Courthouse/probation office	728	0.18%	42808	0.23%
24: Recreation	3344	0.82%	44530.2	0.24%
48: Other service	5890	1.44%	108195.5	0.57%
23: Library	2709	0.66%	43305.1	0.23%
20: Refrigerated warehouse	964	0.24%	81867	0.43%
49: Other	1223	0.30%	126954.2	0.67%
26: Other public assembly	2305	0.56%	110736.7	0.59%
16: Fire station/police station	8650	2.11%	116846.8	0.62%
08: Laboratory	1587	0.39%	119874.6	0.63%
14: Grocery store/food market	4233	1.03%	157377.6	0.83%
17: Other public order and safety	5138	1.25%	188763.9	1.00%
25: Social/meeting	7808	1.91%	238859.3	1.26%
21: Religious worship	12044	2.94%	179810.4	0.95%
46: Vehicle service/repair shop	20818	5.08%	370115	1.96%
37: Dormitory/fraternity/sorority	3858	0.94%	307820.2	1.63%
22: Entertainment/culture	18878	4.61%	336188.1	1.78%
47: Vehicle storage/maintenance	17298	4.22%	1879594	9.94%
All	119611	29.19%	4470872	23.63%

Table 15. 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	20.8	561.2	31.4	932.1	138	0.3	320.8	9	8.8	711.1	26.2	0	713.4	0	0	0	3473.1
12: Convenience Store	159.5	2721.5	225.7	2508.3	767.7	81.3	2004.5	172	204.4	2745.1	813.5	0	836.6	258.9	253.4	0	13752.4
52: Courthouse/probation office	2185.2	5263.1	1609.3	7907	5056.6	640.8	9151.2	291.4	1000.2	5396.4	2217.7	6.5	1194.1	668.9	219.6	0	42808
24: Recreation	2806.3	10984.2	941.2	7264.3	1997.6	463.8	7155.1	239	1077.4	7062.8	2549.5	11.8	1316.6	336.7	312.4	11.5	44530.2
48: Other service	1738.4	12834.9	1429.3	15330.9	9765.8	5676.7	18826.5	551.5	1699.4	22870.3	5936.6	21.6	10093.3	903.7	450.8	65.8	108195.5
23: Library	934	5559.4	661.7	7252.9	3196.4	1137.6	9653.7	138	775	9680.9	1867.4	34.9	1611.5	507.8	274.5	19.4	43305.1
20: Refrigerated warehouse	1481.3	15994.9	897.4	13540.1	4388.6	2740	13241.4	412.3	3808.9	17290.1	4354.6	0	3156.3	161.9	399.2	0	81867
49: Other	635.2	12965.3	4869	18021.3	4214.6	5603.7	36186.9	3899.4	2235.7	20800.6	15921.3	1.7	1016.9	423.9	132.7	26	126954.2
26: Other public assembly	5519.7	20149.6	1044.4	11480.1	11115.9	2960.7	21380	284.3	4159	14116.2	8676.2	57	7370.4	1122.3	1298.4	2.5	110736.7
16: Fire station/police station	2846.9	19258.4	3014.1	18941.7	7473.2	1755.4	18805.3	920.7	3204.8	23452.1	6320.9	131.8	7664.2	1553.7	1465.5	38.1	116846.8
08: Laboratory	1587	11288.8	2065.9	10508.4	8799.2	9227	28222.7	759.9	4546.6	33582.1	5230	11.3	3110	452.8	338.8	144.1	119874.6
14: Grocery store/food market	4595.1	33294.2	1591.5	34092.5	4622	1845.7	31110.7	238.2	1763.3	30521.8	6595.3	90.3	5947.8	710.2	359	0	157377.6
17: Other public order and safety	3345.1	24353.4	3239.4	39798.6	18123	2443.1	38762.8	3032	3597.8	28202	9029.3	503.8	10178.4	1737.8	2161.8	255.6	188763.9
25: Social/meeting	5731.2	30723.9	6087.3	44339.7	20973.5	3504.2	41885.8	970.2	5033	53410.7	10382.2	153.3	12208.2	2104.3	1294.3	57.5	238859.3
21: Religious worship	3265	39151.5	3478.6	43246.7	7569	758	35579.6	806.8	3176.8	25840.8	9654.1	115.2	5481.9	1246.6	433.7	6.1	179810.4
46: Vehicle service/repair shop	12778.4	70905.6	10225.9	51875	29245.8	4247.6	56613	2056	9929.5	73017.9	20719.7	578.2	21282	2353.2	3368.9	918.3	370115
37: Dormitory/fraternity/sorority	6644.9	37490.6	7934.4	57343.8	31579	7952.9	62770.7	1838.4	9652.4	54659.3	14964.1	269.5	10098	2159.1	2073	390.1	307820.2

CBECS PBAPlus	1A	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8	Sum by Bldg Type
<b>22: Entertainment/culture</b>	9736.8	53311.8	7109.2	52711.9	30405.6	4709.7	61707.3	2428.8	8872.5	64078.6	16934.7	253.9	18469.8	2574.3	2807.4	75.8	336188.1
<b>47: Vehicle storage/maintenance</b>	128696.6	349833.5	47114.8	245731.7	193558.8	78535.6	326160	3384.1	98521.4	245377.7	86274.3	1329.3	67193.9	3335.5	4544.9	2.2	1879594
<b>Sum by Zone</b>	194707.4	756645.8	103570.5	682827	392990.3	134284.1	819538	22432	163266.9	732816.5	228467.6	3570.1	188943.3	22611.6	22188.3	2013	4470872

### 3.3 Changes in Weighting Factors from 2003-2018 to 2008-2022

The current work updated the previous weighting factors which were based on a 2003-2018 dataset, to the current weighting factors based on a 2008-2022 dataset. Table 16 shows that considering the updated data set, the percentage of new construction area represented by the prototypes has slightly increased from 75.0% to 76.4%. Figure 2 and Figure 3 show the change in construction area by building category and climate zone, respectively, between the two data sets. The 2008-2022 construction weights for non-refrigerated warehouses and mid-rise apartments substantially increased, while the construction weight for the stand-alone and strip mall retail buildings exhibited a marked decrease. Construction weights by climate zone showed only modest changes.

Table 16. Comparison of the overall construction weight between 2003-2018 and 2008-2022.

Source: PNNL conducted Dodge database analysis	2003-2018	2008-2022
% covered by the 16 prototypes	75.0% <sup>1</sup>	76.4%
Total construction area (thousands of ft <sup>2</sup> per year)	1,287,090	1,261,225

<sup>1</sup> This number was reported as 75.5% in the corresponding table of the previous report (Lei et al., 2020). It has been updated to reflect a refinement in rounding and aggregation procedures.

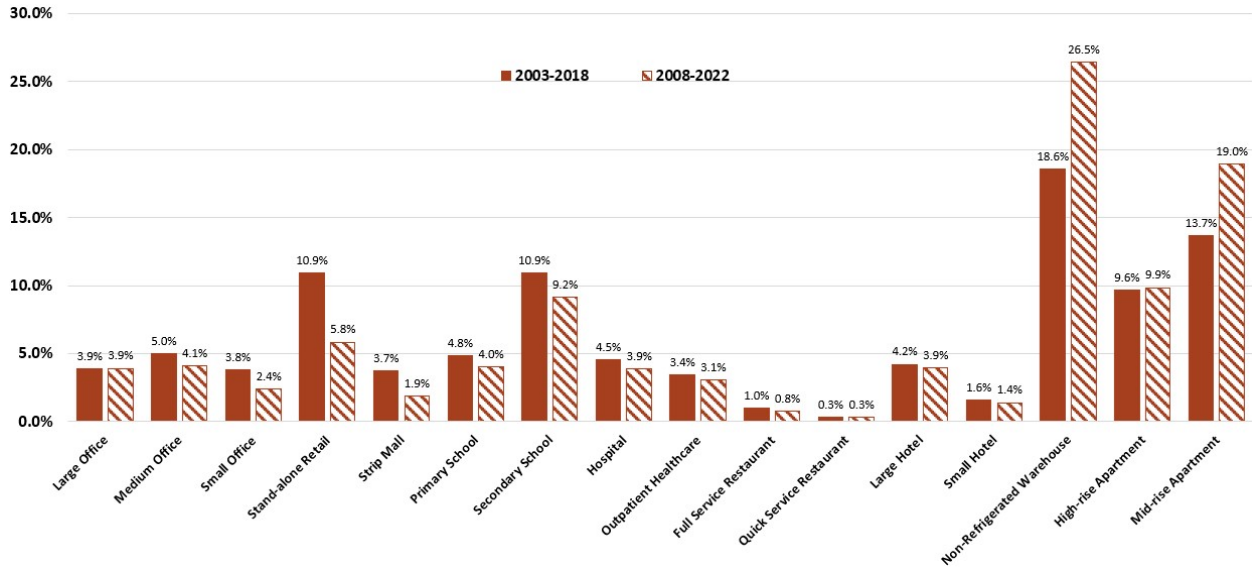


Figure 2. Comparison of the construction weight by square footage between 2003-2018 and 2008-2022 by prototype building category<sup>1</sup>.

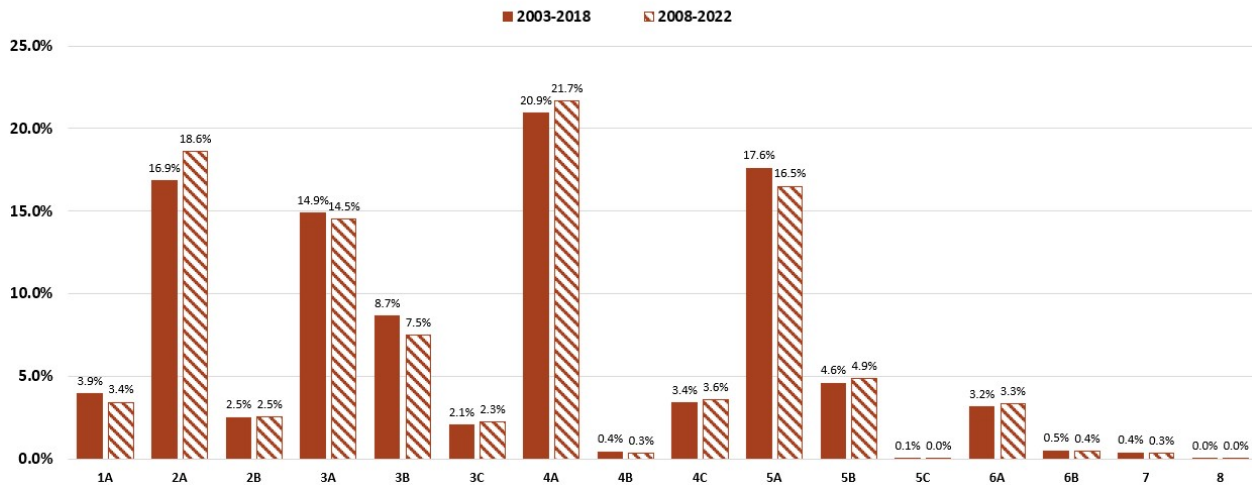


Figure 3. Comparison of the construction weight by square footage between 2003-2018 and 2008-2022 by climate zone<sup>2</sup>.

<sup>1</sup> There was a data mismatching issue for the 2003-2018 data labels in the 2020 report for the comparison figure (i.e., Figure 3 from Lei et al. (2020)). The data labels in this report are updated and has slightly different values, comparing to the 2020 report.

<sup>2</sup> There was a data mismatching issue for the 2003-2018 data labels in the 2020 report for the comparison figure (i.e., Figure 4 from Lei et al. (2020)). The data labels in this report are updated and has slightly different values, comparing to the 2020 report.

## 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. Using the established workflow and categorization logic developed by PNNL, this study updated the new construction weighting factors for the commercial building using the most recent 15-year Dodge dataset. The analysis highlights the robustness of this methodology for performing such tasks and suggests its applicability for future updates in the analysis of the weighting factors.

## 5.0 References

ATHALYE, R., HALVERSON, M., ROSENBERG, M., LIU, B., ZHANG, J., HART, R., MENDON, V., GOEL, S., CHEN, Y., XIE, Y. & ZHAO, M. 2016. Energy Savings Analysis: ANSI/ASHRAE/IES Standard 90.1-2016. Pacific Northwest National Laboratory, Richland, WA (United States).

CHEN, Y., LIU, B., ZHANG, J., ROSENBERG, M. I., EDELSON, J. & LYLES, M. 2019. Final Energy Savings Analysis of the Proposed NYStretch-Energy Code 2018. Pacific Northwest National Laboratory, Richland, WA (United States).

HART, R., & LIU, B. 2015. Methodology for Evaluating Cost-Effectiveness of Commercial Energy Code Changes. Pacific Northwest National Laboratory, Richland, WA (United States).

JARNAGIN, R. & BANDYOPADHYAY, G. 2010. Determination of Weighting Factors for the ASHRAE Commercial Building Prototypes for Standard 90.1-2010. Pacific Northwest National Laboratory, Richland, WA (United States).

LEI, X., BUTZBAUGH, J. B., CHEN, Y., ZHANG, J., & ROSENBERG, M. I. 2020. Development of National New Construction Weighting Factors for the Commercial Building Prototype Analyses (2003-2018) (No. PNNL-29787). Pacific Northwest National Laboratory, Richland, WA (United States).

THORNTON, B. A., ROSENBERG, M. I., RICHMAN, E. E., WANG, W., XIE, Y., ZHANG, J., CHO, H., MENDON, V. V., ATHALYE, R. A. & LIU, B. 2011. Achieving the 30% Goal: Energy and Cost Savings Analysis of ASHRAE Standard 90.1-2010. Pacific Northwest National Laboratory, Richland, WA (United States).

ZHANG, J., XIE, Y., ATHALYE, R. A., ZHUGE, J. W., ROSENBERG, M. I., HART, P. R. & LIU, B. 2015. Energy and Energy Cost Savings Analysis of the 2015 IECC for Commercial Buildings. Pacific Northwest National Laboratory, Richland, WA (United States).

## Appendix A Additional Tables and Figures for Data Processing<sup>1</sup>

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	<b>Mfg War: Other Transportation N.E.C.</b>

<sup>1</sup> Compared to the 2003-2018 analysis, new items in Table A1 and A2 are bolded.

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
<b>Hospitals and Other Health Treatment</b>	<b>Inpatient Health Care</b>	<b>35: Hospital/inpatient health</b>	<b>Hospital</b>	<b>Other</b>





State Code	Climate Zone	Large Office	Medium Office	Small Office	Stand-alone Retail	Strip Mall	Primary School	Secondary School	Hospital	Outpatient Healthcare	Full Service Restaurant	Quick Service Restaurant	Large Hotel	Small Hotel	Non-Refrigerated Warehouse	High-rise Apartment	Mid-rise Apartment	No Prototype	All Total
WY	5B	0	561.3	179.5	515.2	9.6	557.5	677.6	144.9	81.5	52.6	16.8	79.1	264.3	352.3	0	184	2099.3	5775.5
WY	6B	0	379.5	384.3	927.4	52.9	2148.3	4130.3	1210.4	770.4	83	82.1	583.9	609.8	753.7	0	190.8	4067.4	16374.2
WY	7	0	134.2	39.5	52.9	403.8	312.5	241.9	346.6	68.3	11.1	0	137.7	154.9	49.3	0	222.4	824.9	3000

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 Restaurant	Quick Service Restaurant	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	0.00	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	0.03	0.09
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	0.01	0.02
AL	2A	0.00	0.01	0.01	0.02	0.01	0.01	0.02	0.00	0.01	0.00	0.00	0.01	0.01	0.04	0.01	0.01	0.05	0.22
AL	3A	0.01	0.03	0.02	0.05	0.03	0.04	0.12	0.03	0.02	0.01	0.00	0.03	0.01	0.08	0.02	0.08	0.25	0.84
AR	3A	0.00	0.02	0.02	0.03	0.01	0.03	0.09	0.02	0.02	0.00	0.00	0.02	0.01	0.06	0.00	0.01	0.11	0.44
AR	4A	0.00	0.03	0.01	0.02	0.00	0.01	0.03	0.01	0.01	0.00	0.00	0.00	0.00	0.02	0.00	0.02	0.05	0.21
AZ	2B	0.04	0.08	0.05	0.08	0.04	0.05	0.08	0.07	0.05	0.01	0.01	0.07	0.02	0.78	0.09	0.33	0.53	2.38
AZ	3B	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	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	0.01	0.03
AZ	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	0.01	0.00	0.00	0.01	0.02	0.07
CA	2B	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	3B	0.14	0.16	0.06	0.21	0.15	0.12	0.33	0.13	0.08	0.03	0.01	0.20	0.04	1.68	0.37	0.97	1.69	6.36
CA	3C	0.22	0.13	0.02	0.05	0.04	0.03	0.11	0.07	0.03	0.01	0.00	0.07	0.01	0.18	0.25	0.51	0.71	2.43
CA	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	0.01	0.03
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	0.01
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	0.00	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	0.00
CO	5B	0.07	0.09	0.04	0.09	0.02	0.04	0.10	0.07	0.06	0.01	0.01	0.09	0.03	0.45	0.15	0.52	0.55	2.41
CO	6B	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.04
CO	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.01	0.05
CT	5A	0.01	0.02	0.01	0.04	0.02	0.03	0.07	0.02	0.03	0.01	0.00	0.01	0.00	0.14	0.06	0.14	0.19	0.78
DC	4A	0.11	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	0.27	0.14	0.18	0.82
DE	4A	0.00	0.01	0.00	0.01	0.01	0.01	0.02	0.02	0.01	0.00	0.00	0.01	0.00	0.08	0.01	0.03	0.05	0.27
FL	1A	0.06	0.05	0.02	0.10	0.05	0.04	0.06	0.06	0.03	0.02	0.00	0.12	0.02	0.45	0.87	0.29	0.86	3.11
FL	2A	0.05	0.15	0.11	0.30	0.10	0.15	0.25	0.18	0.16	0.04	0.02	0.24	0.06	1.14	0.25	1.09	1.20	5.48
GA	2A	0.00	0.01	0.01	0.02	0.01	0.03	0.06	0.01	0.00	0.00	0.00	0.02	0.01	0.19	0.00	0.02	0.09	0.46
GA	3A	0.10	0.08	0.06	0.14	0.06	0.12	0.30	0.09	0.06	0.02	0.01	0.10	0.03	0.87	0.17	0.45	0.74	3.39
HI	1A	0.00	0.01	0.01	0.01	0.02	0.01	0.01	0.00	0.01	0.00	0.00	0.02	0.00	0.01	0.07	0.02	0.13	0.33
IA	5A	0.01	0.04	0.04	0.06	0.01	0.05	0.10	0.03	0.03	0.01	0.00	0.03	0.01	0.18	0.01	0.12	0.27	1.01
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	0.02	0.05
ID	5B	0.01	0.02	0.02	0.02	0.00	0.01	0.03	0.01	0.01	0.00	0.00	0.01	0.00	0.08	0.01	0.05	0.08	0.37
ID	6B	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.01	0.02	0.09
IL	4A	0.00	0.01	0.00	0.01	0.00	0.01	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.08	0.00	0.01	0.03	0.20
IL	5A	0.10	0.04	0.04	0.14	0.03	0.07	0.16	0.10	0.08	0.02	0.01	0.06	0.01	0.74	0.40	0.26	0.57	2.83
IN	4A	0.00	0.03	0.03	0.05	0.00	0.02	0.05	0.05	0.03	0.01	0.00	0.02	0.01	0.45	0.02	0.10	0.21	1.10
IN	5A	0.01	0.03	0.04	0.06	0.01	0.02	0.09	0.04	0.04	0.01	0.00	0.02	0.02	0.33	0.01	0.08	0.22	1.03
KS	4A	0.02	0.03	0.03	0.06	0.01	0.05	0.09	0.03	0.03	0.01	0.00	0.02	0.02	0.30	0.00	0.11	0.21	1.03
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	0.05	0.03	0.07	0.02	0.05	0.09	0.04	0.04	0.01	0.00	0.03	0.02	0.40	0.01	0.08	0.27	1.22
LA	2A	0.00	0.03	0.05	0.07	0.02	0.05	0.09	0.05	0.03	0.01	0.00	0.03	0.02	0.12	0.02	0.06	0.23	0.89
LA	3A	0.00	0.00	0.01	0.01	0.00	0.00	0.03	0.00	0.01	0.00	0.00	0.00	0.01	0.03	0.00	0.00	0.04	0.16
MA	5A	0.14	0.06	0.02	0.07	0.03	0.06	0.17	0.04	0.03	0.01	0.00	0.06	0.01	0.19	0.17	0.51	0.62	2.21
MD	4A	0.09	0.09	0.03	0.07	0.04	0.06	0.13	0.06	0.03	0.01	0.00	0.05	0.01	0.38	0.15	0.46	0.47	2.13
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	0.02	0.00	0.01	0.02	0.01	0.01	0.00	0.00	0.01	0.01	0.02	0.00	0.03	0.07	0.22
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	0.00



State Code	Climate Zone	Large Office	Medium Office	Small Office	Stand-alone Retail	Strip Mall	Primary School	Secondary School	Hospital	Outpatient Healthcare	Full Service Restaurant	Quick Service Restaurant	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	0.00
WI	5A	0.03	0.05	0.03	0.08	0.01	0.03	0.08	0.05	0.04	0.01	0.00	0.03	0.01	0.24	0.06	0.22	0.31	1.27	
WI	6A	0.00	0.01	0.01	0.02	0.00	0.01	0.03	0.02	0.02	0.00	0.00	0.01	0.01	0.04	0.00	0.03	0.08	0.31	
WV	4A	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	0.03	0.00	0.00	0.03	0.12	
WV	5A	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	0.00	0.00	0.00	0.02	0.08	
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	0.01	0.03	
WY	6B	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.09	
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 Restaurant	Quick Service Restaurant	Large Hotel	Small Hotel	Non-Refrigerated Warehouse	High-rise Apartment	Mid-rise Apartment	No Prototype	All Total	
AK	5C	0	3	2	0	0	0	5	1	2	0	0	0	0	2	4	0	1	23	43
AK	6A	0	0	7	0	0	4	7	4	6	0	0	0	3	12	0	3	53	99	
AK	7	3	48	95	59	10	13	58	13	39	9	6	5	6	92	1	10	234	701	
AK	8	0	5	10	9	1	2	28	3	18	4	0	0	3	18	0	0	86	187	
AL	2A	0	56	347	153	33	53	131	30	71	69	58	10	37	224	7	32	490	1801	
AL	3A	18	156	647	455	76	188	594	83	183	212	254	54	63	260	17	130	1631	5021	
AR	3A	5	109	465	284	27	146	526	59	190	104	86	28	45	136	0	47	1105	3362	
AR	4A	7	74	154	155	11	44	124	25	63	47	37	6	5	65	2	35	334	1188	
AZ	2B	25	254	932	795	151	253	438	174	307	356	340	117	68	964	49	349	1948	7520	
AZ	3B	0	5	45	60	4	13	35	12	26	13	15	5	8	35	0	6	123	405	
AZ	4B	0	8	40	39	5	7	23	12	13	8	6	4	7	15	0	6	78	271	
AZ	5B	0	13	70	37	6	13	29	9	27	13	13	9	26	32	1	19	144	461	
CA	2B	0	0	9	17	5	6	12	5	3	4	2	2	1	4	0	0	26	96	
CA	3B	93	564	1658	1484	467	784	1828	238	451	522	538	277	201	1639	274	1644	5220	17882	
CA	3C	139	248	408	287	138	262	626	89	163	152	99	117	52	337	218	769	1955	6059	
CA	4B	0	2	80	43	3	16	24	9	17	3	6	3	3	32	0	12	113	366	
CA	4C	0	3	1	10	0	1	13	1	5	0	3	3	3	4	0	3	29	79	
CA	5B	0	7	20	24	3	4	10	3	8	1	3	1	3	13	0	7	69	176	
CA	6B	0	1	1	0	0	1	2	0	0	0	0	0	0	2	0	0	15	22	
CO	4B	0	0	3	6	0	4	13	1	3	1	0	0	1	2	0	1	23	58	
CO	5B	65	448	1357	834	181	216	535	188	418	339	424	132	150	1121	118	733	2917	10176	
CO	6B	0	14	57	26	11	12	22	11	7	4	3	5	11	15	1	21	83	303	
CO	7	0	13	25	28	3	8	20	14	3	12	3	11	13	27	2	26	140	348	
CT	5A	12	136	356	450	97	126	304	55	190	159	118	26	19	477	40	273	1279	4117	
DC	4A	71	31	36	74	30	38	48	11	11	19	5	34	3	15	208	309	500	1443	
DE	4A	3	39	110	132	38	53	93	29	31	39	37	11	18	131	7	58	355	1184	
FL	1A	63	227	608	799	117	165	289	152	155	246	196	172	92	760	499	422	2462	7424	
FL	2A	41	799	3252	3561	431	573	1238	594	1215	1102	1046	342	325	2927	169	1200	7679	26494	
GA	2A	2	31	157	161	17	78	189	45	46	77	66	34	29	137	1	40	588	1698	
GA	3A	60	319	1268	1378	196	332	962	228	446	536	517	148	131	1095	102	500	3555	11773	
HI	1A	4	52	133	72	33	77	142	12	33	34	22	14	16	133	45	38	511	1371	
IA	5A	11	232	717	585	107	284	640	152	281	157	163	60	75	661	14	279	1833	6251	
IA	6A	0	0	15	41	1	10	66	13	20	2	7	0	11	30	0	7	128	351	
ID	5B	15	136	523	208	15	91	171	35	139	81	88	17	19	353	9	88	647	2635	
ID	6B	2	24	69	56	6	34	44	16	33	18	23	12	6	45	0	26	219	633	
IL	4A	1	23	78	124	13	44	132	57	97	38	38	6	12	102	2	29	307	1103	
IL	5A	53	211	790	985	142	413	794	198	409	377	333	80	60	814	290	604	2735	9288	
IN	4A	8	159	541	613	45	118	335	95	251	166	266	35	63	891	15	192	1548	5341	
IN	5A	8	185	918	723	71	157	417	133	360	183	298	43	71	1149	9	162	1997	6884	
KS	4A	16	153	651	464	68	304	460	155	284	170	189	47	79	433	7	180	1356	5016	
KS	5A	0	1	7	4	0	7	8	5	4	1	0	0	7	3	0	2	28	77	
KY	4A	10	253	742	746	62	284	498	118	295	291	294	59	89	664	10	141	1989	6545	
LA	2A	5	280	1557	791	97	238	550	155	374	303	235	45	111	650	22	144	1914	7471	
LA	3A	1	25	144	182	14	45	181	42	78	42	52	7	27	83	1	19	500	1443	

State Code	Climate Zone	Large Office	Medium Office	Small Office	Stand-alone Retail		Primary School	Secondary School	Hospital	Outpatient Healthcare	Full Service Restaurant	Quick Service Restaurant	Large Hotel	Small Hotel	Non-Refrigerated Warehouse	High-rise Apartment	Mid-rise Apartment	No Prototype	All Total
					606	Strip Mall													
MA	5A	103	275	514	606	144	197	558	137	231	234	146	88	64	477	126	1085	2574	7559
MD	4A	66	239	553	606	117	269	382	101	175	210	143	76	47	494	100	546	1609	5733
MD	5A	0	0	6	11	0	0	8	3	0	2	3	1	2	3	0	1	25	65
ME	6A	5	62	129	164	11	42	111	38	87	43	43	13	38	169	4	93	525	1577
ME	7	0	2	5	6	0	1	3	0	5	2	1	0	1	5	0	0	16	47
MI	5A	24	256	850	841	138	325	721	197	464	377	428	92	89	645	60	340	2236	8083
MI	6A	0	21	96	121	9	56	118	41	61	24	39	10	22	196	0	21	428	1263
MI	7	0	2	25	12	0	5	8	5	6	4	0	3	4	5	0	3	39	121
MN	5A	0	2	6	6	2	3	11	0	7	0	4	0	1	6	0	5	37	90
MN	6A	38	171	397	502	121	337	603	142	377	171	229	71	61	637	82	813	2811	7563
MN	7	1	13	48	79	5	47	91	24	59	11	11	5	20	69	1	23	318	825
MO	3A	0	0	3	1	0	1	6	1	1	1	0	0	0	2	0	0	9	25
MO	4A	28	165	570	814	78	324	748	190	291	220	245	62	66	440	52	322	1986	6601
MO	5A	0	3	15	35	0	9	49	9	17	3	6	0	3	11	0	6	75	241
MS	2A	0	27	239	90	10	33	86	24	34	44	22	8	12	71	1	16	368	1085
MS	3A	2	47	252	190	29	117	349	69	107	75	66	20	48	139	1	36	806	2353
MT	6B	3	75	150	112	22	73	115	53	76	39	34	24	32	151	1	58	462	1480
NC	3A	98	556	1806	1400	201	346	838	236	514	428	438	140	114	955	79	643	3339	12131
NC	4A	1	35	235	119	16	36	85	25	48	43	39	21	18	72	6	47	327	1173
NC	5A	0	2	10	24	0	7	21	3	1	6	7	3	0	3	0	3	38	128
ND	6A	2	64	155	87	30	87	128	35	80	32	15	23	43	101	3	61	461	1407
ND	7	0	17	40	34	10	15	52	12	25	12	9	7	14	54	1	20	203	525
NE	5A	12	165	501	241	29	197	354	119	192	87	82	30	50	266	14	132	1060	3531
NH	5A	4	90	116	169	29	32	72	40	69	57	43	8	12	147	2	100	389	1379
NH	6A	1	19	24	62	2	11	30	14	34	10	11	7	12	51	0	26	174	488
NJ	4A	22	127	232	516	104	170	433	76	155	161	150	51	43	622	158	738	1633	5391
NJ	5A	9	49	129	210	29	66	154	23	61	56	49	21	11	179	17	250	608	1921
NM	3B	0	24	136	81	5	41	76	23	42	32	41	9	22	47	0	13	237	829
NM	4B	0	37	137	93	20	65	131	20	60	69	53	9	12	91	1	40	384	1222
NM	5B	0	24	119	54	13	56	93	16	56	24	27	3	16	43	0	33	357	934
NV	3B	9	70	219	232	42	105	70	51	69	97	91	31	15	214	9	79	634	2037
NV	4B	0	14	65	15	1	7	13	5	8	7	2	1	4	22	0	1	86	251
NV	5B	1	29	215	68	13	37	61	25	38	33	26	8	12	119	3	31	298	1017
NY	4A	257	342	306	772	234	250	463	146	231	136	71	217	296	551	2771	5137	1936	14116
NY	5A	14	183	601	745	126	131	595	174	304	253	174	86	118	655	91	499	2084	6833
NY	6A	0	33	84	205	12	34	138	51	68	23	29	17	41	123	0	35	522	1415
OH	4A	29	220	644	598	70	122	347	137	285	268	248	80	85	557	56	348	1681	5775
OH	5A	15	234	1228	1138	88	269	713	221	487	321	432	45	101	845	40	245	2647	9069
OK	3A	24	254	924	584	69	401	799	129	270	234	218	66	78	604	11	97	1928	6690
OK	4A	2	17	47	54	5	46	105	14	31	10	12	17	9	35	3	11	267	685
OK	4B	0	0	1	2	0	3	4	0	0	0	1	0	0	0	0	0	10	21
OR	4C	33	182	626	381	54	152	349	70	204	79	79	46	43	464	79	461	1192	4494
OR	5B	0	30	119	79	13	36	87	19	57	19	9	8	23	118	0	26	279	922
PA	4A	39	184	354	530	119	220	376	139	172	173	118	71	65	413	121	635	1297	5026
PA	5A	45	156	358	573	68	147	403	114	153	141	129	80	77	429	41	213	1392	4519
RI	5A	1	35	55	99	26	26	68	16	32	32	13	11	13	76	3	68	283	857
SC	2A	0	7	47	57	8	9	35	11	17	25	12	4	8	35	0	12	176	463
SC	3A	20	284	779	853	106	223	599	109	352	287	307	94	96	669	21	263	2246	7308
SD	5A	0	4	29	6	1	13	25	9	7	2	1	1	1	18	0	1	66	184
SD	6A	3	94	237	121	23	75	164	48	97	41	29	17	26	149	3	73	566	1766
TN	3A	52	216	713	721	123	167	398	133	287	270	313	125	91	664	57	326	2042	6698
TN	4A	2	112	446	504	58	126	304	73	247	166	222	33	52	373	3	76	1160	3957
TX	1A	1	29	266	237	26	77	202	25	77	101	74	13	26	142	1	11	432	1740
TX	2A	263	1355	3743	4242	451	1235	2770	592	1444	1733	1587	406	542	3912	282	1442	8879	34878
TX	2B	0	11	44	81	10	37	75	8	23	18	17	2	15	52	0	1	185	579
TX	3A	51	245	679	873	86	308	749	169	390	308	394	73	87	473	11	226	1965	7087
TX	3B	5	68	383	396	84	158	376	120	205	167	193	45	78	246	1	36	951	3512
TX	4B	0	6	32	57	3	33	95	21	30	17	28	7	9	26	0	9	155	528
UT	3B	0	13	43	33	5	11	41	8	14	15	16	6	14	26	0	11	93	349
UT	5B	43	233	464	414	74	187	371	83	209	140	185	41	51	449	39	306	1428	4717
UT	6B	1	12	17	27	5	16	27	7	12	8	6	5	8	24	1	17	113	306
VA	3A	9	71	255	240	29	33	91	46	65	65	77	16	9	127	10	112	608	1863
VA	4A	77	309	1029	701	135	266	559	140	222	259	210	79	80	510	147	530	2432	7685

State Code	Climate Zone	Large Office	Medium Office	Small Office	Stand-alone Retail	Strip Mall	Primary School	Secondary School	Hospital	Outpatient Healthcare	Full Service Restaurant	Quick Service Restaurant	Large Hotel	Small Hotel	Non-Refrigerated Warehouse	High-rise Apartment	Mid-rise Apartment	No Prototype	All Total	
VA	5A	0	0	0	1	0	0	0	3	0	0	0	1	0	1	0	0	0	5	12
VT	6A	0	47	85	94	9	14	57	19	44	18	19	9	23	135	2	77	383	1035	
WA	4C	123	322	1013	446	140	271	464	109	232	150	124	104	46	658	366	991	2397	7956	
WA	5B	1	69	185	152	20	97	197	45	94	41	29	22	34	264	7	75	636	1968	
WA	5C	0	6	27	22	3	13	28	13	20	9	6	5	4	25	0	16	135	332	
WA	6B	0	0	2	4	0	2	1	3	3	0	0	0	2	5	0	2	22	46	
WI	5A	26	207	513	506	52	150	384	116	281	155	179	49	61	507	50	497	1950	5683	
WI	6A	4	79	250	178	16	92	218	61	163	32	54	12	33	227	2	79	817	2317	
WV	4A	1	14	39	116	10	77	95	30	33	28	42	6	11	44	0	7	258	811	
WV	5A	3	12	16	44	7	32	55	14	12	14	10	9	7	8	2	5	123	373	
WY	5B	0	14	33	20	1	15	13	10	5	10	7	1	8	26	0	3	80	246	
WY	6B	0	13	41	45	4	42	86	27	33	12	20	8	15	52	0	9	217	624	
WY	7	0	8	10	3	5	7	8	6	3	2	0	2	5	9	0	3	52	123	

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 Restaurant	Quick Service Restaurant	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	0.01	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	0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.06	0.17
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	0.00	0.00	0.00	0.02	0.05
AL	2A	0.00	0.01	0.08	0.04	0.01	0.01	0.03	0.01	0.02	0.02	0.01	0.00	0.01	0.05	0.00	0.01	0.12	0.44
AL	3A	0.00	0.04	0.16	0.11	0.02	0.05	0.14	0.02	0.04	0.05	0.06	0.01	0.02	0.06	0.00	0.03	0.40	1.23
AR	3A	0.00	0.03	0.11	0.07	0.01	0.04	0.13	0.01	0.05	0.03	0.02	0.01	0.01	0.03	0.00	0.01	0.27	0.82
AR	4A	0.00	0.02	0.04	0.04	0.00	0.01	0.03	0.01	0.02	0.01	0.01	0.00	0.00	0.02	0.00	0.01	0.08	0.29
AZ	2B	0.01	0.06	0.23	0.19	0.04	0.06	0.11	0.04	0.07	0.09	0.08	0.03	0.02	0.24	0.01	0.09	0.48	1.84
AZ	3B	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	0.03	0.10
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	0.01	0.01	0.00	0.00	0.04	0.11
CA	2B	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	3B	0.02	0.14	0.40	0.36	0.11	0.19	0.45	0.06	0.11	0.13	0.13	0.07	0.05	0.40	0.07	0.40	1.27	4.36
CA	3C	0.03	0.06	0.10	0.07	0.03	0.06	0.15	0.02	0.04	0.04	0.02	0.03	0.01	0.08	0.05	0.19	0.48	1.48
CA	4B	0.00	0.00	0.02	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
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	0.00	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	0.02	0.04
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	0.01	0.01
CO	5B	0.02	0.11	0.33	0.20	0.04	0.05	0.13	0.05	0.10	0.08	0.10	0.03	0.04	0.27	0.03	0.18	0.71	2.48
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	0.00	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	0.03	0.09	0.11	0.02	0.03	0.07	0.01	0.05	0.04	0.03	0.01	0.00	0.12	0.01	0.07	0.31	1.00
DC	4A	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.05	0.08	0.12	0.35
DE	4A	0.00	0.01	0.03	0.03	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.03	0.00	0.01	0.09	0.29
FL	1A	0.02	0.06	0.15	0.19	0.03	0.04	0.07	0.04	0.04	0.06	0.05	0.04	0.02	0.19	0.12	0.10	0.60	1.81
FL	2A	0.01	0.19	0.79	0.87	0.11	0.14	0.30	0.14	0.30	0.27	0.26	0.08	0.08	0.71	0.04	0.29	1.87	6.46
GA	2A	0.00	0.01	0.04	0.04	0.00	0.02	0.05	0.01	0.01	0.02	0.02	0.01	0.01	0.03	0.00	0.01	0.14	0.41
GA	3A	0.01	0.08	0.31	0.34	0.05	0.08	0.23	0.06	0.11	0.13	0.13	0.04	0.03	0.27	0.02	0.12	0.87	2.87
HI	1A	0.00	0.01	0.03	0.02	0.01	0.02	0.03	0.00	0.01	0.01	0.01	0.00	0.00	0.03	0.01	0.01	0.12	0.33
IA	5A	0.00	0.06	0.17	0.14	0.03	0.07	0.16	0.04	0.07	0.04	0.04	0.01	0.02	0.16	0.00	0.07	0.45	1.53
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	0.09
ID	5B	0.00	0.03	0.13	0.05	0.00	0.02	0.04	0.01	0.03	0.02	0.02	0.00	0.00	0.09	0.00	0.02	0.16	0.64
ID	6B	0.00	0.01	0.02	0.01	0.00	0.01	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.01	0.05	0.15
IL	4A	0.00	0.01	0.02	0.03	0.00	0.01	0.03	0.01	0.02	0.01	0.01	0.00	0.00	0.02	0.00	0.01	0.07	0.27



State Code	Climate Zone	Large Office	Medium Office	Small Office	Stand-alone Retail	Strip Mall	Primary School	Secondary School	Hospital	Outpatient Healthcare	Full Service Restaurant	Quick Service Restaurant	Large Hotel	Small Hotel	Non-Refrigerated Warehouse	High-rise Apartment	Mid-rise Apartment	No Prototype	All Total
IL	5A	0.01	0.05	0.19	0.24	0.03	0.10	0.19	0.05	0.10	0.09	0.08	0.02	0.01	0.20	0.07	0.15	0.67	2.27
IN	4A	0.00	0.04	0.13	0.15	0.01	0.03	0.08	0.02	0.06	0.04	0.06	0.01	0.02	0.22	0.00	0.05	0.38	1.30
IN	5A	0.00	0.05	0.22	0.18	0.02	0.04	0.10	0.03	0.09	0.04	0.07	0.01	0.02	0.28	0.00	0.04	0.49	1.68
KS	4A	0.00	0.04	0.16	0.11	0.02	0.07	0.11	0.04	0.07	0.04	0.05	0.01	0.02	0.11	0.00	0.04	0.33	1.22
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	0.18	0.18	0.02	0.07	0.12	0.03	0.07	0.07	0.07	0.01	0.02	0.16	0.00	0.03	0.49	1.60
LA	2A	0.00	0.07	0.38	0.19	0.02	0.06	0.13	0.04	0.09	0.07	0.06	0.01	0.03	0.16	0.01	0.04	0.47	1.82
LA	3A	0.00	0.01	0.04	0.04	0.00	0.01	0.04	0.01	0.02	0.01	0.01	0.00	0.01	0.02	0.00	0.00	0.12	0.35
MA	5A	0.03	0.07	0.13	0.15	0.04	0.05	0.14	0.03	0.06	0.06	0.04	0.02	0.02	0.12	0.03	0.26	0.63	1.84
MD	4A	0.02	0.06	0.13	0.15	0.03	0.07	0.09	0.02	0.04	0.05	0.03	0.02	0.01	0.12	0.02	0.13	0.39	1.40
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	0.02
ME	6A	0.00	0.02	0.03	0.04	0.00	0.01	0.03	0.01	0.02	0.01	0.01	0.00	0.01	0.04	0.00	0.02	0.13	0.38
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	0.06	0.21	0.21	0.03	0.08	0.18	0.05	0.11	0.09	0.10	0.02	0.02	0.16	0.01	0.08	0.55	1.97
MI	6A	0.00	0.01	0.02	0.03	0.00	0.01	0.03	0.01	0.01	0.01	0.01	0.00	0.01	0.05	0.00	0.01	0.10	0.31
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	0.03
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	0.04	0.10	0.12	0.03	0.08	0.15	0.03	0.09	0.04	0.06	0.02	0.01	0.16	0.02	0.20	0.69	1.85
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	0.01	0.08	0.20
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	0.14	0.20	0.02	0.08	0.18	0.05	0.07	0.05	0.06	0.02	0.02	0.11	0.01	0.08	0.48	1.61
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	0.06
MS	2A	0.00	0.01	0.06	0.02	0.00	0.01	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.02	0.00	0.00	0.09	0.26
MS	3A	0.00	0.01	0.06	0.05	0.01	0.03	0.09	0.02	0.03	0.02	0.02	0.00	0.01	0.03	0.00	0.01	0.20	0.57
MT	6B	0.00	0.02	0.04	0.03	0.01	0.02	0.03	0.01	0.02	0.01	0.01	0.01	0.01	0.04	0.00	0.01	0.11	0.36
NC	3A	0.02	0.14	0.44	0.34	0.05	0.08	0.20	0.06	0.13	0.10	0.11	0.03	0.03	0.23	0.02	0.16	0.81	2.96
NC	4A	0.00	0.01	0.06	0.03	0.00	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.02	0.00	0.01	0.08	0.29
NC	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	0.01	0.03
ND	6A	0.00	0.02	0.04	0.02	0.01	0.02	0.03	0.01	0.02	0.01	0.00	0.01	0.01	0.02	0.00	0.01	0.11	0.34
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	0.05	0.13
NE	5A	0.00	0.04	0.12	0.06	0.01	0.05	0.09	0.03	0.05	0.02	0.02	0.01	0.01	0.06	0.00	0.03	0.26	0.86
NH	5A	0.00	0.02	0.03	0.04	0.01	0.01	0.02	0.01	0.02	0.01	0.01	0.00	0.00	0.04	0.00	0.02	0.09	0.34
NH	6A	0.00	0.00	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	0.01	0.04	0.12
NJ	4A	0.01	0.03	0.06	0.13	0.03	0.04	0.11	0.02	0.04	0.04	0.04	0.01	0.01	0.15	0.04	0.18	0.40	1.32
NJ	5A	0.00	0.01	0.03	0.05	0.01	0.02	0.04	0.01	0.01	0.01	0.01	0.01	0.00	0.04	0.00	0.06	0.15	0.47
NM	3B	0.00	0.01	0.03	0.02	0.00	0.01	0.02	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.06	0.20
NM	4B	0.00	0.01	0.03	0.02	0.00	0.02	0.03	0.00	0.01	0.02	0.01	0.00	0.00	0.02	0.00	0.01	0.09	0.30
NM	5B	0.00	0.01	0.03	0.01	0.00	0.01	0.02	0.00	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.09	0.23
NV	3B	0.00	0.02	0.05	0.06	0.01	0.03	0.02	0.01	0.02	0.02	0.02	0.01	0.00	0.05	0.00	0.02	0.15	0.50
NV	4B	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.06
NV	5B	0.00	0.01	0.05	0.02	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.03	0.00	0.01	0.07	0.25
NY	4A	0.06	0.08	0.07	0.19	0.06	0.06	0.11	0.04	0.06	0.03	0.02	0.05	0.07	0.13	0.68	1.25	0.47	3.44
NY	5A	0.00	0.04	0.15	0.18	0.03	0.03	0.15	0.04	0.07	0.06	0.04	0.02	0.03	0.16	0.02	0.12	0.51	1.67
NY	6A	0.00	0.01	0.02	0.05	0.00	0.01	0.03	0.01	0.02	0.01	0.01	0.00	0.01	0.03	0.00	0.01	0.13	0.35
OH	4A	0.01	0.05	0.16	0.15	0.02	0.03	0.08	0.03	0.07	0.07	0.06	0.02	0.02	0.14	0.01	0.08	0.41	1.41
OH	5A	0.00	0.06	0.30	0.28	0.02	0.07	0.17	0.05	0.12	0.08	0.11	0.01	0.02	0.21	0.01	0.06	0.65	2.21
OK	3A	0.01	0.06	0.23	0.14	0.02	0.10	0.19	0.03	0.07	0.06	0.05	0.02	0.02	0.15	0.00	0.02	0.47	1.63
OK	4A	0.00	0.00	0.01	0.01	0.00	0.01	0.03	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.07	0.17
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	0.01
OR	4C	0.01	0.04	0.15	0.09	0.01	0.04	0.09	0.02	0.05	0.02	0.02	0.01	0.01	0.11	0.02	0.11	0.29	1.10
OR	5B	0.00	0.01	0.03	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	0.07	0.22
PA	4A	0.01	0.04	0.09	0.13	0.03	0.05	0.09	0.03	0.04	0.04	0.03	0.02	0.02	0.10	0.03	0.15	0.32	1.23
PA	5A	0.01	0.04	0.09	0.14	0.02	0.04	0.10	0.03	0.04	0.03	0.03	0.02	0.02	0.10	0.01	0.05	0.34	1.10
RI	5A	0.00	0.01	0.01	0.02	0.01	0.01	0.02	0.00	0.01	0.01	0.00	0.00	0.00	0.02	0.00	0.02	0.07	0.21
SC	2A	0.00	0.00	0.01	0.01	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	0.11
SC	3A	0.00	0.07	0.19	0.21	0.03	0.05	0.15	0.03	0.09	0.07	0.07	0.02	0.02	0.16	0.01	0.06	0.55	1.78
SD	5A	0.00	0.00	0.01	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	0.02	0.06	0.03	0.01	0.02	0.04	0.01	0.02	0.01	0.01	0.00	0.01	0.04	0.00	0.02	0.14	0.43
TN	3A	0.01	0.05	0.17	0.18	0.03	0.04	0.10	0.03	0.07	0.07	0.08	0.03	0.02	0.16	0.01	0.08	0.50	1.63

State Code	Climate Zone	Large Office	Medium Office	Small Office	Stand-alone Retail	Strip Mall	Primary School	Secondary School	Hospital	Outpatient Healthcare	Full Service Restaurant	Quick Service Restaurant	Large Hotel	Small Hotel	Non-Refrigerated Warehouse	High-rise Apartment	Mid-rise Apartment	No Prototype	All Total	
TN	4A	0.00	0.03	0.11	0.12	0.01	0.03	0.07	0.02	0.06	0.04	0.05	0.01	0.01	0.09	0.00	0.02	0.02	0.28	0.97
TX	1A	0.00	0.01	0.06	0.06	0.01	0.02	0.05	0.01	0.02	0.02	0.02	0.00	0.01	0.03	0.00	0.00	0.11	0.42	0.42
TX	2A	0.06	0.33	0.91	1.04	0.11	0.30	0.68	0.14	0.35	0.42	0.39	0.10	0.13	0.95	0.07	0.35	2.17	8.51	8.51
TX	2B	0.00	0.00	0.01	0.02	0.00	0.01	0.02	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.05	0.14	0.14
TX	3A	0.01	0.06	0.17	0.21	0.02	0.08	0.18	0.04	0.10	0.08	0.10	0.02	0.02	0.12	0.00	0.06	0.48	1.73	1.73
TX	3B	0.00	0.02	0.09	0.10	0.02	0.04	0.09	0.03	0.05	0.04	0.05	0.01	0.02	0.06	0.00	0.01	0.23	0.86	0.86
TX	4B	0.00	0.00	0.01	0.01	0.00	0.01	0.02	0.01	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.04	0.13	0.13
UT	3B	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	0.02	0.09	0.09
UT	5B	0.01	0.06	0.11	0.10	0.02	0.05	0.09	0.02	0.05	0.03	0.05	0.01	0.01	0.11	0.01	0.07	0.35	1.15	1.15
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	0.07
VA	3A	0.00	0.02	0.06	0.06	0.01	0.01	0.02	0.01	0.02	0.02	0.02	0.00	0.00	0.03	0.00	0.03	0.15	0.45	0.45
VA	4A	0.02	0.08	0.25	0.17	0.03	0.06	0.14	0.03	0.05	0.06	0.05	0.02	0.02	0.12	0.04	0.13	0.59	1.88	1.88
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	0.00
VT	6A	0.00	0.01	0.02	0.02	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.01	0.03	0.00	0.02	0.09	0.25	0.25
WA	4C	0.03	0.08	0.25	0.11	0.03	0.07	0.11	0.03	0.06	0.04	0.03	0.03	0.01	0.16	0.09	0.24	0.58	1.94	1.94
WA	5B	0.00	0.02	0.05	0.04	0.00	0.02	0.05	0.01	0.02	0.01	0.01	0.01	0.01	0.06	0.00	0.02	0.16	0.48	0.48
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	0.08	0.08
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	0.01
WI	5A	0.01	0.05	0.13	0.12	0.01	0.04	0.09	0.03	0.07	0.04	0.04	0.01	0.01	0.12	0.01	0.12	0.48	1.39	1.39
WI	6A	0.00	0.02	0.06	0.04	0.00	0.02	0.05	0.01	0.04	0.01	0.01	0.00	0.01	0.06	0.00	0.02	0.20	0.57	0.57
WV	4A	0.00	0.00	0.01	0.03	0.00	0.02	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.06	0.20	0.20
WV	5A	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	0.00	0.00	0.00	0.03	0.09	0.09
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	0.01	0.00	0.00	0.02	0.06	0.06
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	0.00	0.01	0.00	0.00	0.05	0.15	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	0.03

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