

A Comparison of House Size and Foundation Type for U.S. Residential Homes

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This research analyses the residential construction practices associated with the types of foundations and finished floor area that are monitored and recorded by the US Census Bureau's Survey of Construction (SOC) of new single-family homes built throughout the United States. Using SOC microdata from 1999 to 2013 for all four US Census Bureau regions and all nine corresponding divisions, trends are identified by types of foundations used—including *slab*, *full or partial basement*, and *crawl space*—and variation of finished floor area within foundation type of newly constructed homes. The results indicated that home size, in terms of finished floor area, generally increased in most US Census Bureau Divisions for the time period studied. The South Atlantic Division experienced the largest increase in completed new homes and accounted for 28.3% of all residential construction over the past 15 years. For all divisions, homes with basement foundations were consistently larger than those constructed with either crawl space or slab-on-grade foundations. Since 1999, approximately 50.9% of new residential construction has been built on slab foundations, with an additional 32.3% constructed with basement foundations and the remaining 16.9% completed with crawl space foundations.

Keywords: residential foundation, residential floor area, US Census Bureau Survey of Construction, residential construction, home construction

Introduction

Monitoring and understanding trends in housing starts and home building are critical to many aspects of the US economy. One important tool for determining the state of residential construction both nationally and regionally is known as the Survey of Construction (SOC), which provides information on residential building activity in the US. (US Census Bureau, 2014d). The US Census Bureau maintains the SOC and conducts monthly interviews and assessments to gather data on ongoing residential construction activity. Approximately 900 public offices that issue building permits are sampled and about 70 land areas where building permits are not required are physically inspected (US Census Bureau, 2014c). The US Census Bureau analyzes and reports the results of the ever continuing SOC on both a monthly and annual basis. These reports are an important leading economic indicator as to the state of the US economy. The most recent annual report based on the SOC is the *2013 Characteristics of New Housing* (US Census Bureau, 2014a). In this annual report, results are presented collectively for the US and are also presented for each the four US Census Bureau Regions. Results by division, however, are not included in any US Census Bureau report that is based on the SOC. In this study, the results presented on house size and foundation type were analyzed and reported by US Census Bureau division and have not been previously published in any currently existing Census Bureau report. A similar study, conducted by Bradtmueller and Foley (2014), investigated the exterior wall materials used as cladding in new single-family residential construction and reported usage trends for each Census Bureau division.

Unfortunately, the SOC foundation categories used by the Census Bureau do not indicate the specific materials used and how the foundation types are insulated. The category *slab* for slab-on-grade also includes houses built with frost-protected shallow foundations, which are likely increasing in use because of the decreased material and construction costs. Crandell (2010) reported that rigid polystyrene foam has been used effectively for underground frost protection in many types of building foundations worldwide, and its use is specified in ASCE Standard 32-01—Design and Construction of Frost-Protected Shallow Foundations. In a study that included constructing small test homes, Biblis (2005) observed that the homes built on concrete slab floors, without perimeter insulation around the slab, consumed 12 to 25% more heating energy than did a control home built with a wood floor over a crawl space. Currently, some homes are being constructed with an insulated crawl space that, consequently, becomes part

of the conditioned building envelope. The interior crawl space walls are insulated with rigid foam to increase energy efficiency by keeping air ducts installed below the first floor in conditioned space. (Hales and Baylon, 2010) When the ground in the crawl space is not also insulated, Hales and Baylon (2010) state that this configuration is more beneficial in warmer climates than in cooler ones.

Analysis

For the purposes of this paper, the only SOC data analyzed was that associated with newly completed single-family residential homes where the completion of construction could be verified via the designated month and year completion code (variable COMP). The US Census Bureau conducts interviews every month of current and ongoing residential construction in its four main national regions of Northeast, Midwest, South, and West, and the information collected constitutes the SOC. These Census Bureau regions are further divided into nine divisions (variable DIV) with each one comprised of a designated group of states. The **Region**, **Division**, and State hierarchy are as follows:

- **Northeast:** *New England* (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut) and *Middle Atlantic* (New York, New Jersey, and Pennsylvania)
- **Midwest:** *East North Central* (Ohio, Indiana, Illinois, Michigan, and Wisconsin) and *West North Central* (Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, and Kansas)
- **South:** *South Atlantic* (Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, and Florida), *East South Central* (Kentucky, Tennessee, Alabama, and Mississippi), and *West South Central* (Arkansas, Louisiana, Oklahoma, and Texas)
- **West:** *Mountain* (Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, and Nevada) and *Pacific* (Washington, Oregon, California, Alaska, and Hawaii)

The US Census Bureau SOC microdata is made available to the public annually in June in the form of an Excel file containing all of the information from the individual surveys that were completed during the previous year (<https://www.census.gov/construction/chars/>). In this research, a portion of the SOC database was reconstructed for the time period from 1999 to 2013 and contains over 420,000 individual survey records that represent over 20.5 million newly constructed single-family homes. Each month, a sample of residential building permits is selected from each of the sampled building permit offices. Building permits for one-to-four-unit residential buildings are sampled at an overall rate of 1 in 50. The variable WEIGHT accounts for this sampling such that each record—containing data from a home that is physically surveyed—has a weighting value that indicates the number of housing units statistically represented by this sample case. For each division (variable DIV) within each US Census Bureau region, this reconstructed database was used to determine descriptive statistics on the home foundation type (variables BASE and WEIGHT) and finished floor area (variables SQFS and WEIGHT) of each house record. By definition, the *finished floor area* consists of all completely finished floor space, including space in basements and attics with finished walls, floors, and ceilings. No garage area is included or any unfinished attic, utility room, or basement areas.

Study Objectives

The objectives of this study include the following:

1. Identify the historical trends of finished floor area in new single-family homes built between 1973 and 2013 based on published results from the US Census Bureau's Survey of Construction.
2. Using the reconstructed SOC database for 1999 to 2013, investigate the three main foundation types (variable BASE; *slab*, *full or partial basement*, and *crawl space*) for residential construction and determine where they are used and at what frequency on both a US Census Bureau region and division level. As a SOC housing characteristic, foundation type has been included in the survey since at least 1971 (US Bureau of the Census, 1976).
3. Using the reconstructed SOC database for 1999 to 2013, determine the weighted mean annual floor area for each foundation type within each Census Bureau Division. As a SOC housing characteristic, finished floor area also has been included in the survey since at least 1971 (US Bureau of the Census, 1976).

Results

US Census Bureau SOC Finished Floor Area Trends and Foundation Categories

The 2013 *Characteristics of New Housing* report (US Census Bureau, 2014a) contains mean annual finished floor areas from 1973 to 2013 for both the US and the US Census Bureau Regions. For these locations, Table 1 provides the minimum and maximum mean annual floor areas for new residential construction and includes the year that each occurred, the physical increase in floor area and the corresponding percentage increase. For the 31-year time period under consideration, Table 1 indicates that the mean annual size of new homes in the US was smallest in 1975 at 1645 ft² and peaked most recently in 2013 at 2598 ft², which represents a 953 ft² (57.9%) increase in finished floor area. All of the regions experienced their mean floor area low in 1975 except for the South Region where its low of 1670 ft² occurred in 1973 and was also very close to the 1975 mean of 1705 ft². Similarly, the peak mean floor area of all regions occurred in 2013 except for that of the Northeast Region at 2651 ft² in 2008. In this case, the mean in 2013 was 2636 ft² and was very close to the 2008 peak. As Table 1 indicates, regional mean floor areas have increased by 51.8, 54.4, 61.0, and 68.3% and these increases correspond to the Midwest, West, South, and Northeast Regions, respectfully. In general for the US and for each of these regions, there was a decrease in the mean size of homes built after 2007 or 2008 that corresponds to the severe downturn in the housing market and economy at that time. Within a few subsequent years, however, mean home size growth continued again. As the means in Table 1 show, the US is constructing larger homes with more finished floor space than has been done before in its recent history.

Table 1.

Historical range of mean finished floor area of new single-family homes built between 1973 and 2013 based on results from the US Census Bureau's Survey of Construction. ¹

SOC Annual Means	US and US Census Bureau Regions				
	US [ft ² (year)]	Northeast [ft ² (year)]	Midwest [ft ² (year)]	South [ft ² (year)]	West [ft ² (year)]
Lowest Mean	1645 (1975)	1575 (1975)	1580 (1975)	1670 (1973)	1635 (1975)
Highest Mean	2598 (2013)	2651 (2008)	2398 (2013)	2689 (2013)	2524 (2013)
Area Increase (ft²)	953	1,076	818	1,019	889
Area Increase (%)	57.9	68.3	51.8	61.0	54.4

¹ 2013 *Characteristics of New Housing* report (US Census Bureau, 2014a)

Since 1971, US homes built with basements or crawl spaces have been generally on the decline, whereas homes with slab-on-grade foundations have been generally increasing (US Census Bureau, 2014a). The US Census Bureau Survey of Construction classifies residential foundations as either *full or partial basement*, *crawl space*, *slab*, or *other*, in which *other* includes raised supports, earthen, and any other foundation types. For annual reporting purposes, the 2013 *Characteristics of New Housing* report (US Census Bureau, 2014a) contains mean results of these categories from 1973 to 2013 by US Census Bureau region and combines the *slab* and *other* categories into one. Below, however, are the foundation trends by US Census Bureau division, where Figure 1 presents the trending from 1999 to 2013 for each foundation type within the divisions of each region.

1999 to 2013 Trends in Residential Foundation Types by US Census Bureau Division

Northeast Region: New England and Middle Atlantic Divisions (Figure 1a). New homes in the New England Division were predominately constructed with full/partial basement foundations where the mean was 89.3%. Historically, there was a slight downward trend in which the peak of 96.5% occurred in 2000 and the low of 80.1% happened in 2012. Similarly, the housing starts in the Middle Atlantic Division have been primarily constructed with basement foundations as shown by the mean of 73.6%. A sharper downward trend was observed here where the high of 86.6% occurred in 2002 and then subsequently reached a low of 61.4% in 2012. In this same division, slab-on-grade averaged 15.7% and was the next most common foundation type, where Figure 1a shows a generally positive trend from 8.1% in 2002 up to 23.1% in 2012. The use of crawl spaces in this division was next, where an upward shift peaked in both 2006 and 2012 at 14.1% and the mean and minimum were 8.8 and 3.4% (2004), respectively. In the New England Division, home construction with crawl spaces and slabs did not exceed 6.9 and 9.2%, respectively.

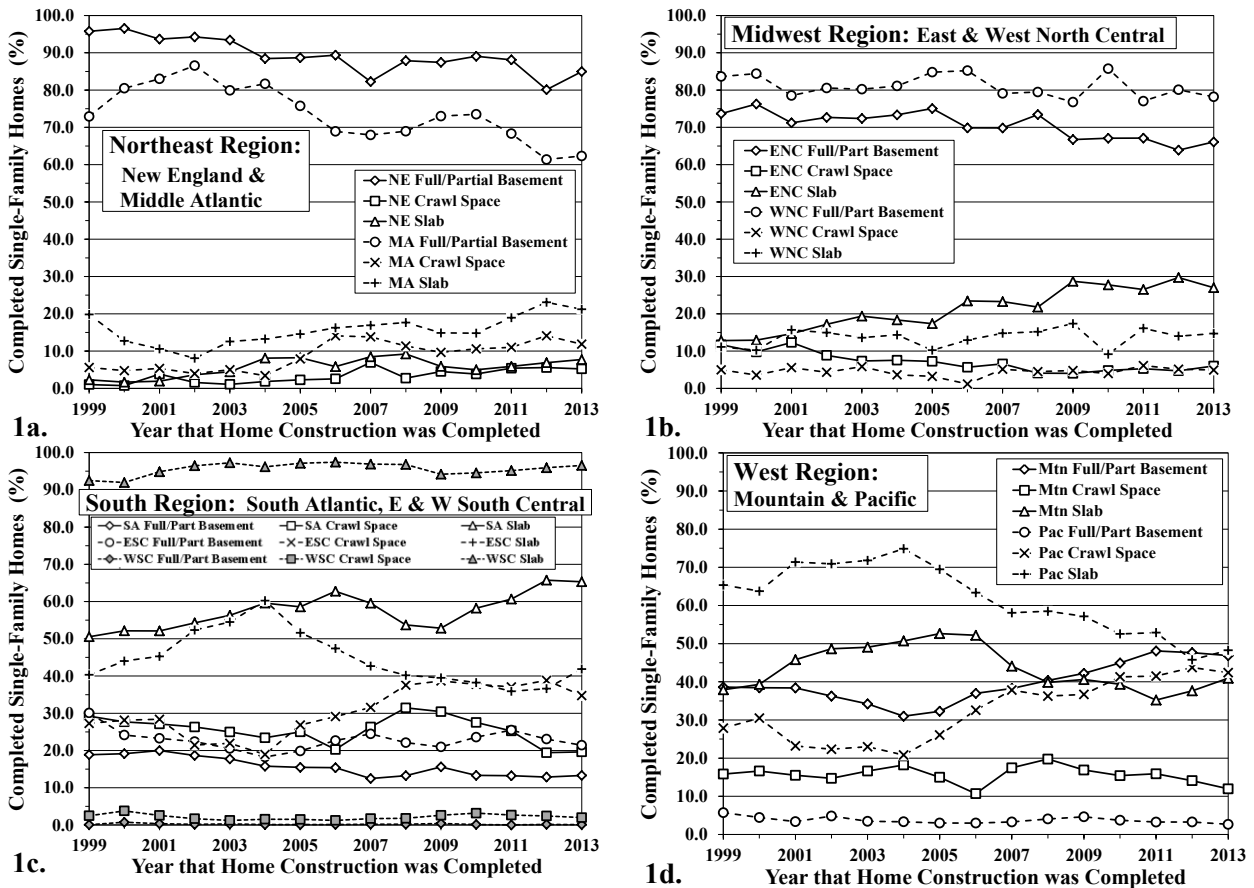


Figure 1. Distribution of foundation types used in single-family residential construction for each US Census Bureau region and division: (a) Northeast, (b) Midwest, (c) South, and (d) West.

Midwest Region: East and West North Central Divisions (Figure 1b). From 1999 to 2013 in both the East North Central and West North Central Divisions, new homes were mainly constructed with basement foundations, where the West North Central Division ranged from 76.8 to 85.7% with a mean of 81.0% and the East North Central Division ranged from 63.9 to 76.3% with a mean of 70.6%. There was a slight downward trend observed in the construction of basement foundations for both divisions. Slab foundations were the next most common, with the East North Central Division having a mean of 21.4% and showing a consistent upward trend from a low of 12.8% in 1999 to a high of 29.7% in 2012. Slab use in the West North Central Division was relatively flat with a high of 17.4% (2009) to a low of 9.2% (2010) and a mean of 13.6%. Mean crawl space usage in the East North Central Division was 7.1% and the trend dropped from a high of 12.3% in 2001 to 4.0% in 2009; it is currently at 6.0% in 2013. In the West North Central Division, the usage of crawl space foundations was very flat with a low of 1.2% (2006), a high of 6.1% (2011), and a mean of 4.5%.

South Region: South Atlantic and East and West South Central Divisions (Figure 1c). The types of foundations constructed for new homes in the West South Central Division are very consistent over the entire 1999 to 2013 time period, with the mean values of 95.6, 2.2, and 0.2% representing slab, crawl space, and basement foundations, respectively. The frequency of slab foundations in the South Atlantic Division steadily increased from 50.6% in 1999 to 65.8% in 2012. Crawl space usage in this division showed a recent drop from a high of 31.5% in 2008 to a low of 19.4% in 2012. New home construction incorporating full or partial basements in the South Atlantic Division decreased slightly with a mean of 15.7% and a range from 20.0% (2001) to 12.5% (2007). In the East South Central Division, slab and crawl space usage were almost mirror images of each other. For example, homes with crawl spaces increased from a low in 2004 of 18.9% to a high in 2012 of 38.8%. In contrast, homes built on slab foundations decreased from a high of 60.3% in 2004 to a low of 35.9% in 2011. New homes built with

basements in the East South Central Division showed a slight decrease over time with a mean of 22.8% and a range from 30.1% (1999) to 18.3% (2004).

West Region: Mountain and Pacific Divisions (Figure 1d). From 1999 to 2013 in the Pacific Division, basement foundations were consistently uncommon in new construction as evidenced by the mean of 3.7% with a tight range of 5.7% (1999) to 2.7% (2013). In this division, the historical trend of homes with slab foundations is a direct mirror image of that for homes built with crawl spaces. For example, the use of slabs generally increased to a high of 74.9% in 2004 and subsequently decreased to a low of 45.8% in 2012. Inversely, the historical trend of crawl space use decreased to a low of 20.8% in 2004 and subsequently rose 43.7% in 2012. For the Mountain Division, slab foundation usage increased to a high of 52.6% in 2005 and then fell to a low of 35.2% in 2011; the overall mean was 43.6%. In contrast, new homes in the Mountain Division that were constructed with basement foundations decreased to a low of 31.0% in 2004 and then increased to a high of 48.1% in 2011; the corresponding mean was 39.6%. Crawl space construction in the Mountain Division was relatively consistent with a mean, low and high of 15.6%, 10.7% (2006), and 19.8% (2008) respectively.

1999 to 2013 Trends in Residential Home Size by Foundation Type and US Census Bureau Division

Northeast Region: New England and Middle Atlantic Divisions (Figure 2a). For the New England Division, new homes with basement foundations had the largest year-to-year mean finished floor area, which averaged 2421 ft² representing 451,800 homes. The largest single-year mean size was 2611 ft² (2006) and the smallest mean was 2159 ft² (2010); as a general trend, the size of new homes with basements do not appear to be increasing or decreasing. By comparison, the size of homes with slab foundations averaged 1715 ft² (28,000 homes) over the entire time period, and the floor area appears to be increasing over time—despite a low of 1352 ft² in 2011—with a high of 2202 ft² in 2013. Finished floor size for homes with crawl space foundations was not included in Figure 2a because the number of actual home surveyed was under 20 for most years, but the overall mean was 2381 ft² representing 15,200 homes. In the case of the Middle Atlantic Division, mean floor area for the 15-year span was largest for homes with basements at 2512 ft² (911,200 homes), followed by those built on crawl spaces at 2391 ft² (97,800 homes) and then homes built on slabs at 2012 ft² (178,100 homes). The annual mean size of homes with basements peaked in 2006 at 2699 ft² and that was followed by a low in 2011 of 2279 ft². Based on Figure 2a, the overall trend in the size of homes with basements appears to be cyclic but level. In contrast, the size of homes with crawl space foundations saw an annual mean low of 1809 ft² in 2003, followed by a mean high of 2965 ft² in 2008, and a current mean floor area of 2801 ft² in 2013. In the Middle Atlantic Division, the floor area of homes built on crawl spaces is generally increasing over time. Likewise, the size of homes constructed on slabs mostly increased over time, where mean floor area was lowest at 1627 ft² in 1999, then increased steadily to its high of 2354 ft² in 2010, and subsequently rebounded to 2039 ft² in 2013.

Midwest Region: East and West North Central Divisions (Figure 2b.) In the East North Central Division, new homes built on basement foundations have steadily increased in size since the low annual mean of 2305 ft² in 1999 to the current highest annual mean of 2757 ft² in 2013. For this entire period, mean floor area was 2485 ft² and this represented over 1,729,000 homes. Similarly, homes constructed on crawl spaces have also shown a trend of increasing in size, where the lowest mean of 1540 ft² occurred in 1999 and later rose to the highest mean of 2010 ft² in 2013. Over this time period, the mean floor area of 1767 ft² was representative of 187,600 homes. By comparison, the same 15-year mean floor area of homes built on slabs was essentially identical at 1762 ft² and this mean symbolized 463,500 newly constructed homes. During this time period, the annual mean floor area of homes built on slabs remained relatively consistent, where the lowest, highest, and most current means were 1687 ft² (1999), 1864 ft² (2008), and 1714 ft² (2013), respectively. For the West North Central Division, homes with basements showed a steady increase in mean floor area from the low of 2062 ft² in 2000 to the high of 2358 ft² in 2013. Considering all new homes in this division from 1999 to 2013, mean floor area was 2197 ft², which accounted for 1,246,000 homes. By comparison for this same time period, homes build on crawl spaces averaged 1610 ft² (65,200 homes) and those built on slabs had a mean floor area of 1483 ft² (203,700 homes). Homes with crawl space foundations peaked in mean size at 1904 ft² in 2006 and subsequently trended downward in size dropping to their lowest mean floor area of 1328 ft² in 2011. In the West North Central Division, the sizes of homes constructed on slab foundations had cyclically changed over this 15-year time frame time but it remained relatively consistent with an overall mean of 1483 ft² and high, low, and current annual means of 1670 ft² (2010), 1336 ft² (2011), and 1346 ft² (2013), respectively.

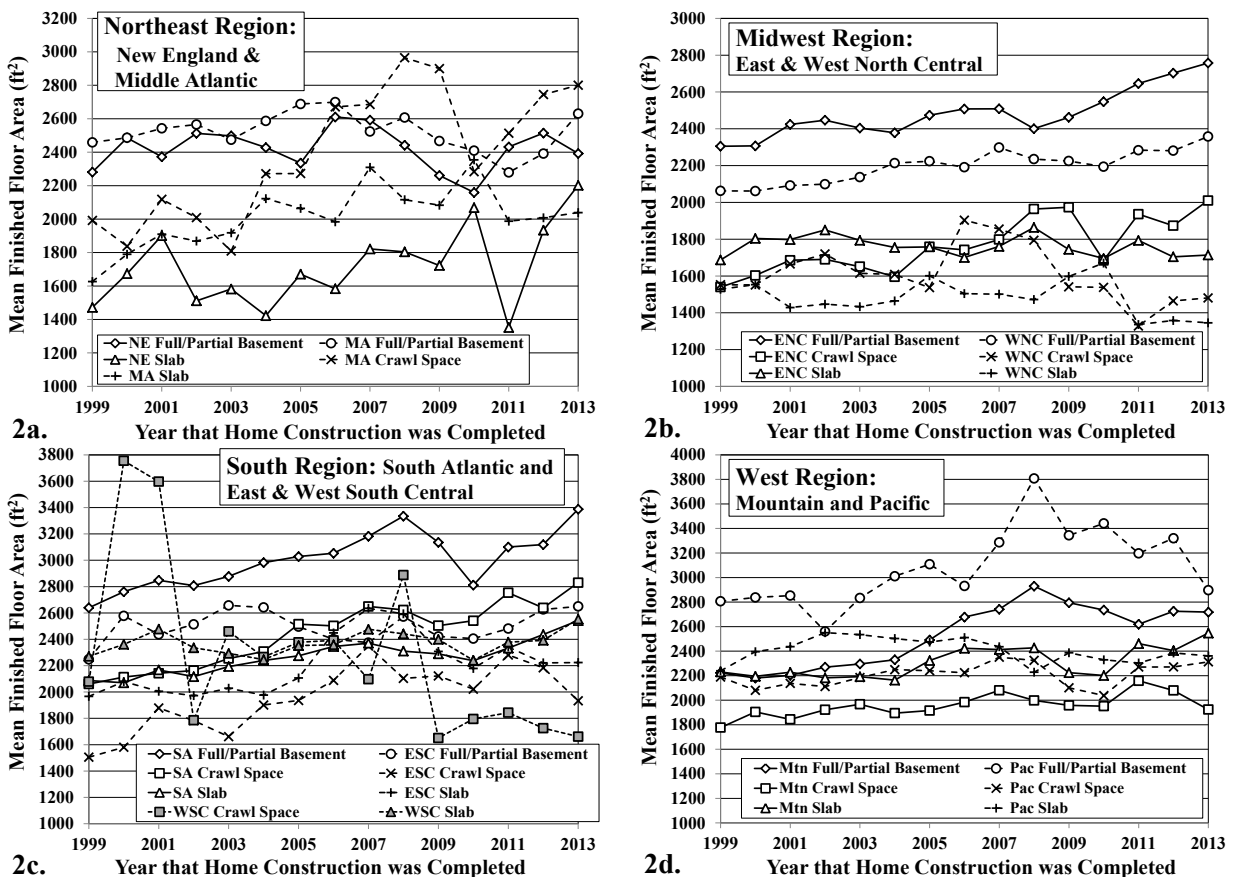


Figure 2. Mean floor area by foundation type in single-family residential construction for each US Census Bureau region and division: (a) Northeast, (b) Midwest, (c) South, and (d) West.

South Region: South Atlantic and East and West South Central Divisions (Figure 2c). Figure 2c shows the home size trends that have been occurring in the three divisions of the South Region, which also contained more new homes built during this time frame than all of the other three regions. In the South Atlantic Division, all three foundation types exhibited a general increase in home size from 1999 to 2013. For homes with basements, mean floor area increased from 2639 ft² (1999) to 3387 ft² (2013), or 28.3%. Likewise for homes with crawl spaces, mean floor area increased 37.3% from 2061 ft² (1999) to 2830 ft² (2013) and homes built on slabs increased 21.8% in mean size from 2070 ft² (1999) to 2542 ft² (2013). For comparison over the entire 15-year time period, mean floor areas were 3004 ft² (941,000 homes), 2440 ft² (1,479,000 homes), and 2267 ft² (3,322,000 homes), corresponding to homes constructed with basement, crawl space, and slab foundations, respectively. The South Atlantic Division saw more growth in new residential construction than did any other division, where its approximately 5,742,000 homes represented 28.4% of all those built in the US from 1999 to 2013. For the East South Central Division, homes built with basements started at a mean low floor area of 2248 ft² in 1999 and had peaks of 2657 and 2650 ft² in 2003 and 2013, respectively. For this division, change in mean floor area has been cyclical, but relatively flat with a 15-year mean of 2500 ft² (300,500 homes). This overall mean can be compared to 1955 ft² (380,000 homes) and 2205 ft² (605,800 homes) for the homes supported by crawl space and slab-on-grade foundations, respectively. For this time period, changes in mean floor area for these latter two types of foundations showed similar trends. The home sizes generally increased from the lowest annual means in 1999 of 1505 ft² (crawl space) and 1967 ft² (slab) to their highest means in 2007 of 2349 ft² (crawl space) and 2635 ft² (slab). Subsequently, the means floor areas generally decreased to their current levels in 2013 of 1933 ft² (crawl space) and 2223 ft² (slab). In the West South Central Division, only 113 homes constructed with basements were physically included in the SOC from 1999 to 2013, so these results are not included in Figure 2c. The mean floor area results for homes built over crawl spaces showed a lot of disparity, with the 15-year mean of 2291 ft² (58,900 homes), a mean annual high of 3755 ft² in 2000 and mean

lows of 1651 and 1661 ft² in 2009 and 2013, respectively. Like in the other divisions in the South Region, the vast majority of homes constructed in the West South Central Division were built on slab foundations, where the overall mean floor area was 2372 ft² (2,758,000 homes) and minimum and maximum mean values of 2240 and 2554 ft² correspond with 2010 and 2013, respectively.

West Region: Mountain and Pacific Divisions (Figure 2d). In the Mountain Division, the mean floor area of homes with basements was at a low of 2181 ft² in 2000, it then generally increased to a high of 2930 ft² in 2008, and subsequently decreased to the 2013 mean of 2718 ft². For the full 15-year period, the mean was 2529 ft² and represented 822,000 new homes. The overall mean floor area of homes built with crawl spaces was 1957 ft² (342,700 homes), with an annual mean low, high, current value of 1777, 2158, and 1924 ft² in 1999, 2011, and 2013, respectively. Floor size in this case gradually increased over most of the time period. From 1999 to 2013, slab foundations were used in approximately 1,001,000 homes with a mean finished floor size of 2308 ft²; home size generally increased over this period. The corresponding mean low of 2164 ft² happened in 2004, whereas the mean high of 2547 ft² occurred in 2013. For the Pacific Division, approximately 98,800 homes were built with basements and these had an overall mean size of 3082 ft². These homes generally increased in size from the lowest mean area of 2561 ft² in 2002 to the largest mean of 3808 ft² in 2008, and afterwards fell to the most recent mean low of 2897 ft² in 2013. Compared to basement foundations, homes built over crawl spaces were more prevalent and had an overall mean area of 2206 ft² based on approximately 789,000 homes built since 1999. The size of these homes appears to be relatively constant over time, where there was a mean high of 2350 ft² in 2007, a mean low of 2038 ft² in 2010, and a current mean of 2313 ft² in 2013. Approximately 1,739,000 homes built in the Pacific Division were constructed using slab-on-grade foundations, and these had a 15-year mean floor area of 2405 ft². The size of these homes appeared to be relatively stable, where mean lows of 2239 and 2228 ft² occurred in 1999 and 2008, respectively, the mean high of 2551 ft² occurred in 2002, and the most recent 2013 mean was 2361 ft².

Conclusions

In the Northeast Region, the percentage of new homes constructed with basements has generally declined although it was still the most common type of residential foundation. In 2013, basements accounted for 85.3% of the foundations in the New England Division (15-year means: 89.3%; 2421 ft²; and 451,800 homes) and 62.3% of those in the Middle Atlantic Division (15-year means: 86.0%; 2521 ft²; and 911,211 homes). Similarly in the Midwest Region, new homes with full or partial basements are the most common, but their year-to-year percentage was relatively flat for West North Central Division (15-year means: 81.0%; 2192 ft²; and 1,246,000 homes),+ whereas the East North Central Division (15-year means: 70.6%; 2485 ft²; and 1,729,000 homes) trended slightly downward over time. In both of these regions, basement foundations can add additional finished floor area to a home at a marginal increase in excavation cost because the bottom of the foundation wall footing is required to be at or below the frost line. If, however, frost-protected shallow foundations are increasing in usage, the cost savings could be substantial enough for new home owners to forgo the inclusion of the traditional basement.

In the South Region, 65.3% of the foundations in 2013 within the South Atlantic Division were slabs (15-year means: 57.5%; 2267 ft²; and 3,322,000 homes) and they also showed an increasing trend. For 2013, foundations in the East South Central Division consisted of 41.9% slabs (15-year means: 44.7%; 2205 ft²; and 605,800 homes) with a decreasing trend and 34.8% crawl spaces (15-year means: 30.6%; 1955 ft²; and 380,000 homes) with an increasing trend. In 2013, the West South Central Division consisted of 96.6% slabs (15-year means: 95.6%; 2372 ft²; and 2,758,000 homes), which has remained very consistent over time. In the South Region, a high water table can make a slab-on-grade the most logical foundation choice. Additionally, a shallower frost line requirement in the warmer climates can also make a slab foundation the most cost-effective option. In 2013 in the West Region, foundations in the Mountain Division were comprised of 46.9% basements (15-year means: 39.6%; 2529 ft²; and 822,000 homes) with an increasing trend and 40.9% slabs (15-year means: 43.6%; 2308 ft²; and 1,001,000 homes) with a decreasing trend. Similarly for the Pacific Division in 2013, home foundations were comprised of 48.3% slabs (15-year means: 61.6%; 2405 ft²; and 1,739,000 homes) that showed a decreasing trend and 42.4% crawlspaces (15-year means: 32.4%; 2206 ft²; and 789,000 homes) with an increasing trend. The Western Region consists of a wide array of disparate climatic and geographic combinations in the western US as well as Hawaii and Alaska, but slab foundations are currently the most common type of foundation.

In the New England, Middle Atlantic, East and West North Central, and South Atlantic Divisions, the 15-year mean floor area of homes can be ranked largest to smallest by basement, crawl space, and slab foundations, respectively. For the East and West South Central, Mountain and Pacific Divisions, overall mean floor area is similarly ordered by homes constructed with basement, slab, and crawl space foundations, respectively. These trends seem logical because a basement offers the potential of an additional floor of finished space, but homes with basements are the least common in type of foundations in the divisions of the Southern Region and the Pacific Division. For the same 1999 to 2013 time period, the four highest frequencies of basement homes were built in the East North Central (1,729,000), West North Central (1,246,000), South Atlantic (941,000), and Middle Atlantic (911,200) Divisions. Similarly, homes constructed with crawl spaces were most prevalent in the South Atlantic (1,479,000), Pacific (789,000), East South Central (379,900) and Mountain (342,800) Divisions. Finally, the greatest number of homes built on slab foundations occurred in the South Atlantic (3,322,000), West South Central (2,758,000), Pacific (1,739,000) and Mountain (1,001,000) Divisions. In total, the data analyzed in this study for the time period of 1999 to 2013 represented 10.30 million (50.9%) new homes with slab foundations, 6.507 million (32.2%) homes built with basements, and 3.415 million (16.9%) homes constructed over crawl space foundations.

References

- Biblis, E.J. (2005). Experimental determination of the energy requirements for cooling and heating different single-story residential structures. *Forest Products Journal*, 55 (3), 81-85.
- Bradtmueller, J.P. & Foley, S.P. (2014). Trends of exterior wall materials used in us residential construction. Associated Schools of Construction International Proceedings of the 50th Annual Conference, Washington, D.C. April 2014.
- Crandell, J. H. (2010). Below-ground performance of rigid polystyrene foam insulation: review of effective thermal resistivity values used in ASCE Standard 32-01—Design and Construction of Frost-Protected Shallow Foundations. *Journal of Cold Regions Engineering*, 24 (2), 35-53.
- Hales, D. & Baylon, D. (2010). Moving ducts into conditioned space: getting to code in the Pacific Northwest. *ASHRAE Transactions*, 116 (1), 507-511. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
- US Bureau of the Census. (1976). Construction Report Series C25-75-13 Characteristics of New Housing: 1975. US Department of Commerce, Washington, DC. [WWW document] URL <http://www.census.gov/prod/1/constr/c25/c25-7513.pdf>
- US Census Bureau. (2014a). 2013 Characteristics of New Housing. [WWW document] URL <https://www.census.gov/construction/chars/pdf/c25ann2013.pdf>
- US Census Bureau. (2014b). Characteristics of New Housing – Microdata – Download Files. [WWW document] URL <https://www.census.gov/construction/chars/microdata.html>.
- US Census Bureau. (2014c). New Residential Construction, How the Data are Collected (Survey of Construction). [WWW document]. URL https://www.census.gov/construction/nrc/how_the_data_are_collected/soc.html
- US Census Bureau. (2014d). Survey of Construction Microdata Files. [WWW document]. URL https://www.census.gov/construction/chars/pdf/socmicro_info.pdf