



Home Innovation
RESEARCH LABS™

DRAFT

RADON-RESISTANT CONSTRUCTION PRACTICES IN NEW U.S. HOMES

2018

EXCERPTS for ICC Code Development 2021

Prepared for

U.S. Environmental Protection Agency
Indoor Environments Division
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Prepared by

Home Innovation Research Labs
Annual Builder Practices Survey
MR1032

December 2019

TABLE OF CONTENTS

INTRODUCTION	1
GEOGRAPHIC SAMPLING	2
METHODOLOGY	3
STATISTICAL ESTIMATES	4
DETAILED DATA TABULATIONS	5
REPORT DATA TABLES	6
Weighting Procedures for Tabulations	7
DEMOGRAPHIC SAMPLING	8
BUILDERS AND THEIR HOMES	9
Average Units Per Builder In 2018	9
Distribution of Single-Family Detached Homes by Price-Point In 2018	9
CHARACTERISTICS OF NEW SINGLE-FAMILY DETACHED HOMES	10
Average Size of New Homes	10
Average Price of New Homes	11
HOUSING DESIGNS	12
Single-Family Detached Housing Designs	12
Multifamily Housing Designs	13
FOUNDATION TYPES	14
OVERVIEW OF THE RESULTS	16
Sample Composition by Size of Builders	17
Zone 1: Percent of Builders in Sample by Size of Builder	18
Zone 1: Homes with Radon-Reducing Features by Annual Starts	18
Radon-Reducing Features in Single-Family Detached Housing	19
Radon-Reducing Features in Multifamily Housing	21
Subslab Preparation in Single-Family Detached Homes	21
Subslab Membranes in Single-Family Detached Homes	23
Slab Sealing with Caulking in Single-Family Detached Homes	25
Costs of Installing Passive or Active Subslab or Sub-Membrane Ventilation	25

Multifamily Housing Designs

In this study, a multifamily unit is defined as a townhouse, duplex, or apartment (or condo). Multifamily units are generally less costly to construct than single-family detached (SFD) houses due to their much smaller average size and sharing of foundations and roof structures. They further conserve building materials with shared walls between units and are typically built at higher densities (more units per acre of land) to conserve land cost. The average multifamily unit is also smaller than an average SFD house. In 2018, the average multifamily dwelling had 1,276 square feet of finished space with an average selling price of \$229,260.

Due to the relationship between radon level and proximity of the living unit to the ground, apartments data are presented separately by a percentage of living units located on the first, second, and third floors. To calculate the number of living units on the first, second, and third floors, the assumption is made that half of the units of a two-story multifamily building are on the first floor, and half are on the second floor. In calculations for a three-story multifamily building, one-third of the units is allocated to each level.

Likewise, tabulations for townhouses and duplexes take into account the number of stories they have. In 2018, one-story townhouses accounted for 30.1 percent. Two- and three-story townhouses were 45.4 and 23.2 percent of the total, respectively. Four-story townhouses represented only 1.4 percent.

OVERVIEW OF THE FINDINGS

In 2018, 750,625 single-family detached (SFD) and 498,708 multifamily homes were built in the United States. This is up from 740,800 SFD homes and 467,117 multifamily homes in 2017. This change reflects the continued rebound in the SFD home market, which tumbled beginning in 2006. It also signals that the rebound in multifamily construction, which preceded the SFD rebound by several years, has likely peaked and may flatten in the coming years.

Overall use of radon-resistant construction practices has been on the increase in new homes for decades. For this study, a house must have either a passive stack ventilation pipe or an active system (fan-driven) to qualify as having radon-reducing features. In 2018, shares of new SFD homes with radon-reducing features decreased slightly while there was a significant increase in multifamily homes with these features, resulting in an overall upward percentage of new U.S. homes with radon-reducing features.

In 2018, 20.2 percent of all new SFD homes – excluding those on piers – included a radon-reduction system. This is down from 21.7 percent reported in 2017 and but still higher than 18.7 percent in 2016 and consistent with the long-term trend of increased usage of radon-resistant construction practices.

Installation of radon-reducing features in multifamily buildings in 2018 was 33.8 percent, higher than the 26.6 percent in 2017 and 19.0 percent reported in 2016. This increase of radon-resistant construction practices reported for multifamily homes, while consistent with the long-term upward trend in this sector, could be influenced by the relatively small number of builders in the sample (246) and sampling error.

shares of SFD homes with radon-reducing features in Zones 1, 2, and 3 were 44.9, 26.0, and 9.2 percent, respectively.

Radon-Reducing Features in Multifamily Housing

The overall inclusion rates of radon-reducing features in multifamily living units and townhouses (excluding those on pier foundations) was 33.8 percent in 2018, 26.6 percent in 2017, and 19.0 percent in 2016. In 2018, the share of units with radon-reducing features in Zone 1 was 112.9K (92.5 percent); 41.5K (27.2 percent) in Zone 2; and 89.9K (44.8 percent) in Zone 3. This represents an increase in Zones 1 and 3 and a decrease in Zone 2 from 2017, where the share of units in Zones 1, 2, and 3 were 77.9, 76.3, and 1.2 percent, respectively.

Subslab Preparation in Single-Family Detached Homes

Reducing radon levels in a house generally requires providing a permeable layer under the basement or first floor slab that can be vented or depressurized in order to remove the radon gas that originates in the surrounding soil. A ventilation system draws radon gas from the subslab area and exhausts it to the home's exterior to prevent it from accumulating in the home. For basement and slab foundations, the permeable layer is typically created by spreading four inches or more of gravel or crushed stone before the concrete slab floor is poured. Four or more inches of gravel or stone base is standard construction practice for drainage purposes in many areas of the country, making the incremental cost of a full radon-resistant system significantly lower.

Cost of Active Sub-Slab Ventilation in Single-Family Detached Homes

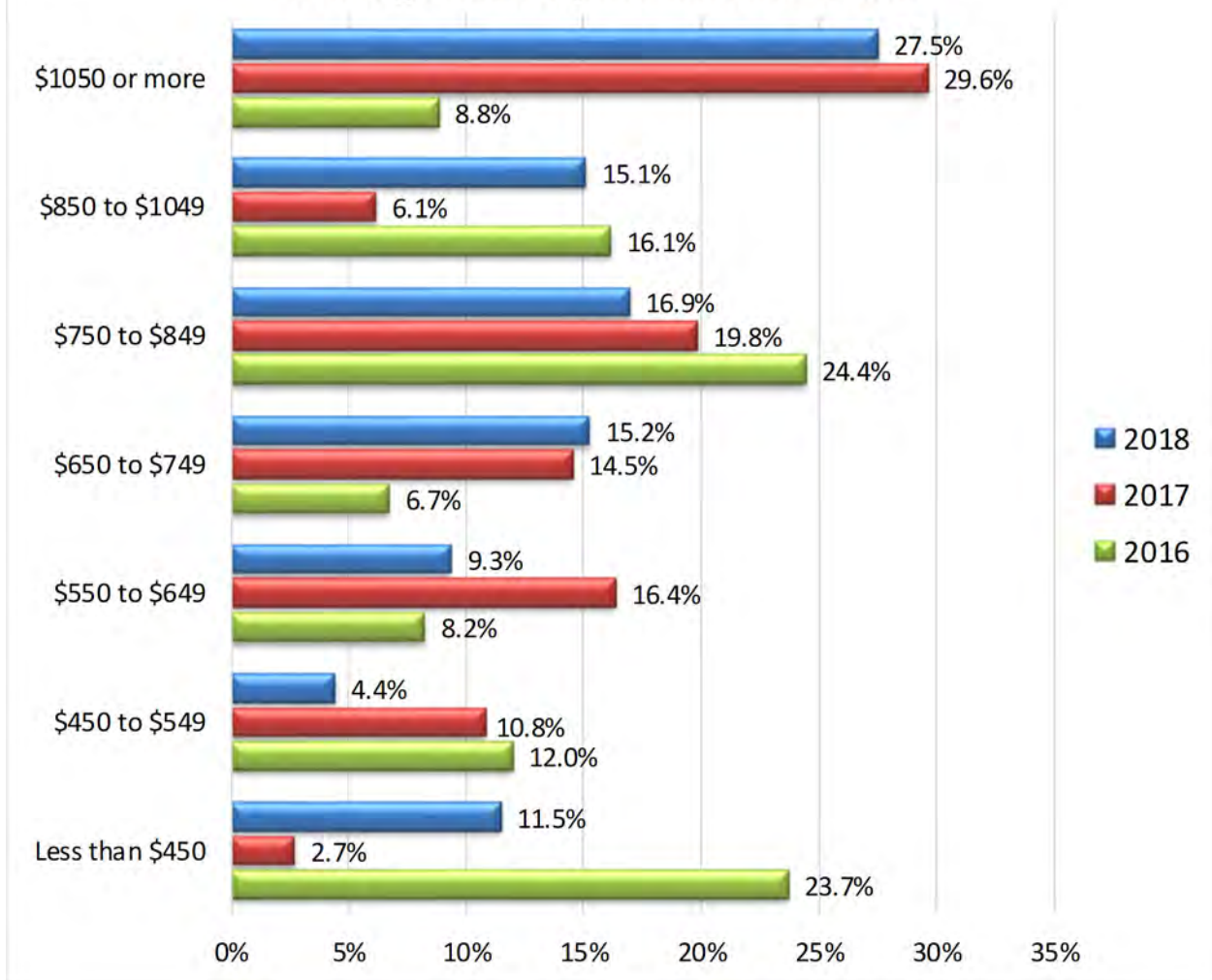


Figure 14. Cost of Passive Sub-Slab Ventilation in Single-Family Detached Homes, 2016 to 2018

The average cost of an active (fan-driven) radon-reduction system in new SFD homes in 2018 was \$812, higher than the \$808 reported for 2017 and \$697 for 2016.

In 2018, the average reported installation cost for a passive system in a multifamily dwelling was approximately \$393, down from the \$461 in 2017 and \$417 in 2016. The average cost of an active radon-reduction system reported in new multifamily dwellings in 2018 was \$845, lower than \$865 in 2017, but higher than \$757 in 2016. Prior to 2017, only costs given by multifamily builders who stated they specifically implemented either passive or active systems were used in calculating the average. However, due to the small sample sizes for the multifamily calculations, the research team changed the methodology to use all multifamily respondent answers, whether or not they claimed to have installed the system. This rests on the assumption that builders who reported costs were aware of them, likely from comparing costs of radon-reduction systems before choosing to install, or not install them in the homes they built. The result of this change was lower variations in costs between years.