August 19, 2020

Michael J. Pfeiffer, Senior Vice President of Technical Services
International Code Council
Central Regional Office
mpfeiffer@iccsafe.org

Mr. Pfeiffer,

This letter is in response to the notice of appeal that was posted by ICC on July 30, 2020. As a named appellant, Leading Builders of America (LBA) respectfully requests that William Koffel, Amanda Hickman, and Ken Gear be permitted to participate in and present information at the Scope and Intent ICC Appeals Board Hearing on September 3, 2020.

LBA has prepared the enclosed written response statement and supporting information for the consideration of the International Code Council Appeals Board. This response addresses two specific code changes that LBA discussed in its appeal: RE147-19 and CE217-19. Approval of these code change proposals was in violation of Section 1.3 of Council Policy 28 because they would expand the current scope of the International Energy Conservation Code (IECC). This written statement also addresses the negative consequences that will result, if the actions taken during the Online Governmental Consensus Vote on RE147-19 and CE217-19 are not set aside.

Thank you for your consideration.

Sincerely,

Ken Gear
Chief Executive Officer
Leading Builders of America
1455 Pennsylvania Ave NW, Suite 400
Washington, DC 20004
(202) 621-1815

Attachments: LBA Fact Sheet: 2019, HIRL Energy Savings and Cost Benefit Analysis of 2021 IECC Changes for Electric Readiness

CC: Dominick Sims

Scope and Intent Appeal Response Statement Submitted by LBA

RE147-19 Electric Readiness
CE217-19 Electric Vehicle Ready Space

ICC Council Policy 28 very clearly states that the ICC Board of Directors (ICC Board) shall determine the title and the general purpose and scope of each Code published by the ICC. Code change proposal RE147-19 would mandate electric circuits for potential future electric appliances where gas water heaters, dryers, and conventional cooking equipment are installed. CE217 would require a dedicated 40-amp, 240-volt receptacle outlet for an Electric Vehicle (EV) charger be installed in the building. The proponents of these proposals did not make it a request of their proposals to expand the IECC scope. Both of these future electrification proposals are clearly out of the current scope and intent of the IECC. If these code changes are incorporated into the 2021 edition of the IECC, it would constitute an expansion of the scope and intent of the IECC without the required approval of the ICC Board of Directors which is a violation of CP#28.

> *R101.3 Intent. This code shall regulate the design and construction of buildings for the* ***effective use and conservation of energy over the useful life of each building****. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.*

A requirement for an outlet in the garage of a dwelling, especially one that the Proponent admits is energy neutral, does not belong in the Part IV of the IRC. Chapter 39 already provides the requirements for receptacle outlets in dwellings. An electrical contractor working on a dwelling unit will not know to check Part IV of the IRC for an outlet requirement to make the home "electric-ready" should the homeowner, or a future homeowner, want to convert from gas or propane.

While the I-codes refer generically to the responsibilities of the *code official*, it is understood that in many jurisdictions the primary responsibility for enforcement of a particular I-code rests with building official, fire official, mechanical official, electrical inspector, etc. Who is responsible for making sure that the requirement for an electrical receptable, located in the IECC, has been met?

These comments were identified by the committee in their Committee statement. Despite the guidance from the Committee and a Committee statement that it is outside of their scope, the proponent failed to submit a Public Comment to locate the requirement in the proper section of the IRC. It should be noted that this was not the result of items being on the Group A and Group B agenda, since the IRC, in its totality, is on the Group B agenda. Public Comment 1, submitted by the Proponent of RE147-19, addressed some of the technical issues identified by the Committee but did not address the Scope issue.

There is precedent for handling proposals that overreach and expand past the scope and intent of the code. In the case of CE175-16, the Board of Directors ultimately ruled that proposal, which was approved through the consensus process, was in fact out of scope and set aside the approval action.

Scope and Intent Appeal Response Statement Submitted by LBA

During the 2016 Group B cycle, CE175-16 (low-flow shower heads) was permitted by the ICC Board to go through the consensus process with the following note attached to the proposal:

> *This code change proposal addresses the scope and application of the International Energy Conservation Code and the International Plumbing Code. The action taken by the Residential (Commercial) Energy Conservation Code Committee on this proposal, coupled with the final action taken at the 2016 Public Comment Hearings and subsequent Online Governmental Consensus Vote, will be limited to an advisory recommendation to the ICC Board of Directors who will determine the final disposition on this proposed change in accordance with Section 1.3 of CP28, which stipulates that the ICC Board of Directors determines the scope of the I-Codes.*

CE175 Part I was approved through the consensus process but the ICC Board ultimately rejected the proposal's approval and sited in part, their decision to "set aside the action taken CE175 Part I as it would modify the scope of the IECC…"

http://media.iccsafe.org/news/icc-enews/2017v14n22/jump-board.html

The scope of the IECC only applies to the BUILDING. In the case of CE217-19, the requirement for a dedicated 40-amp, 240-volt receptacle outlet for an Electric Vehicle (EV) charger would only make it more convenient to charge a VEHICLE at home. This requirement will NEVER result in energy savings for the BUILDING. In fact, turning a home into an EV charging station is likely to INCREASE future energy consumption of the building.

Home Innovation Research Labs (HIRL) conducted an energy savings and cost-benefit analysis of CE217-19 Part II and RE147-19 at the request of LBA. The reporting of energy use and energy savings is used in the analysis was in accordance with the U.S. Department of Energy (DOE) protocols for new construction.[1]

HIRL found that both code changes increased the cost of construction without any associated energy savings. RE147-19 would cost the consumer in excess of $1,700 with no energy savings payback. CE217-19 Part II would cost the consumer in excess of $680 with no energy savings payback. The full report is attached.

Requiring theoretical technologies that may not even ever be installed or used in the future, is completely antithetical to a minimum national model code. Technology is constantly evolving. The requirements contained in these proposals may be completely antiquated by the time the code is even adopted. These proposals stand to set a dangerous precedent for the Code, if they are not rescinded. And they will come at a very steep price with no associated energy savings benefit to the homebuyer.

[1] Home Innovations Research Labs, Energy Savings and Cost Benefit Analysis of 2021 IECC Changes for Electric Readiness

FACT SHEET: 2019

★ Leading Builders of America (LBA) was founded in 2009 to provide the largest homebuilders in the United States with a direct voice in the policymaking process in Washington, combining their reach and expertise to address the key issues impacting the health of the industry. Membership includes both public and privately-owned companies. The LBA Board of Directors is comprised of the CEOs of its member companies.

★ LBA's 21 member companies are: Ashton Woods Homes; Beazer Homes; Brookfield Residential; David Weekley Homes; D.R. Horton; Hovnanian Enterprises; KBHome; Lennar Corporation; LGI Homes; MDC Holdings (Richmond American); Meritage Homes; M/I Homes; Perry Homes; PulteGroup; Shea Homes; Taylor Morrison; The Drees Companies; Toll Brothers; TRI Pointe Group; William Lyon Homes; Woodside Homes.

★ LBA members build in 34 states and the District of Columbia: Alabama, Arizona, California, Colorado, Delaware, District of Columbia, Florida, Georgia, Hawaii, Idaho, Illinois, Indiana, Iowa, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Nevada, New Jersey, New Mexico, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Virginia, Washington, West Virginia, and Utah.

★ LBA members produce a wide range of home types including traditional single-family homes, townhomes, condominiums, apartments, retirement and second homes.

★ Many LBA member companies own affiliated businesses that provide mortgage lending and title services.

★ In 2018, LBA members sold over 216,000 new homes. Approximately 35% of all new homes sold in the United States were built by an LBA member.

★LBA members produced over 650,000 jobs in 2018 through direct employment and the engagement of subcontractors.

★ In 2016, LBA member companies generated over $87 billion in revenue for the national economy.

★ LBA emphasizes support for policies and programs that promote a healthy and sustainable housing market by working to create a legislative and regulatory atmosphere that promotes high-quality, energy efficient new homes for well-qualified homebuyers. LBA places special

emphasis on policies and regulations impacting the housing finance and tax provisions important to homebuyers, as well as energy efficiency issues, labor availability and workplace safety.

★ LBA takes an active role in the development of residential energy policy at the legislative, regulatory and model code levels. Member companies are leaders in energy efficient building programs including Energy STAR and the DOE Builder's challenge. LBA members have been active in identifying ways to remove obstacles that prevent builders from building more efficient homes. We crafted the SAVE Act, federal legislation instructing housing agencies to recognize energy efficiency in the home financing process. When enacted, it will unlock significant new opportunities to increase the efficiency of new homes and to include additional energy efficient products and features in new homes. We've engaged the energy code development process to move away from proscriptive code requirements in favor of performance-based provisions that promote innovation and savings.

★ LBA is an official sponsor of the Pacific Coast Building Conference (PCBC), held each June in California. LBA CEO's and senior executives are active participants in education programs, and national and regional purchasing executives participate in the trade show through the Key Buyers' Club.

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Home Innovation
RESEARCH LABS™

ENERGY SAVINGS AND COST-BENEFIT ANALYSIS OF 2021 IECC CHANGES FOR ELECTRIC READINESS

Prepared For

Leading Builders of America

National Quality Council

August 2020

Report No. CR1312-1-1-1_08042020

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TABLE OF CONTENTS

ACRONYMS, ABBREVIATIONS, AND DEFINITIONS

AFCI	Arc-Fault Circuit Interrupter
EA	Each
GFCI	Ground-Fault Circuit Interrupter
IECC	International Energy Conservation Code
IRC	International Residential Code
LBA NQC	Leading Builders of America, National Quality Council
LF	Linear feet
NAHB	National Association of Home Builders
NEC	National Electric Code
O&P	Overhead and profit
SF	Square feet

BACKGROUND

The Leading Builders of America (LBA) National Quality Council (NQC) requested Home Innovation Research Labs (Home Innovation) to evaluate the energy savings and cost-benefit impact of two proposed 2021 IECC code changes for residential buildings: RE147 Electric Readiness and CE217 Part 2 Electric Vehicle Ready Space. RE147 mandates electric circuits for future electric appliances where gas water heaters, dryers, and conventional cooking equipment are installed. CE217 Part 2 requires a dedicated 40-amp, 240-volt receptacle outlet for an Electric Vehicle (EV) charger. To evaluate the proposed changes, Home Innovation determined the incremental installed cost and annual energy cost for a standard Reference House in three locations as described in the Methodology section below. The results of the cost/energy savings impact analysis are summarized in the Results section below.

METHODOLOGY

Metrics for the Reference House were defined for a representative single-family home constructed to the 2018 IRC/IECC: 2,600 sq. ft. above grade, 2-story, 4-bedroom, attached 2-car garage, with natural gas furnace, water heater, range, and dryer. The selected locations for analysis are Houston TX (Climate Zone 2), Baltimore MD (CZ 4), and Minneapolis MN (CZ 6). The Reference House construction and locations are based on results that were initially defined in a report titled "Estimated Costs of the 2015 Code Changes" prepared by Home Innovation for the National Association of Home Builders (NAHB). Additional details and basis for selection of building criteria are provided in Appendix C.

The incremental installed costs in this analysis were developed using RSMeans[1] 2020 Residential Cost Data and distributor web sites. The costs for individual code changes are shown in Appendix A. Costs are reported at the national level and can be modified for a region using builders' known bid prices or by applying a location adjustment factor shown in Appendix B. Appendix A costs are reported as both total to the builder and total to consumer. The total cost to builder includes overhead and profit (designated in the tables as "w/O&P") applied to individual component costs (i.e., materials and labor) to represent the cost charged by the sub-contractor. The total cost to consumer is based on the builder's gross margin, reported as 18.9% of construction cost in the 2016 Cost of Doing Business. The cost summary table shown in the Results section below shows the total cost to consumer with the location adjustment factor applied.

The reporting of energy use and energy savings is in accordance with the U.S. Department of Energy (DOE) protocols for new construction[2] including cash flow analysis and economic assumptions for mortgage cost: 30 year amortization period at an annual interest rate of 4.16%[3]. The annual energy costs in this analysis were developed using REM/Rate[4] v16.0.1 software and average annual energy prices from the U.S. Energy Information Agency[5] by location.

[1] RSMeans, https://www.rsmeans.com/

[2] DOE 2014 Building America House Simulation Protocols: https://www.energy.gov/sites/prod/files/2014/03/f13/house_simulation_protocols_2014.pdf

[3] Three-year average rate for 30-year mortgage, 2017-2019: http://www.freddiemac.com/pmms/pmms30.html

[4] REM/Rate: http://www.remrate.com/

[5] Energy Information Agency: https://www.eia.gov/

RESULTS

The estimated incremental installed costs, annual energy costs, and economic analysis are summarized in the table below for the Reference House in the three selected locations. The incremental installed costs are reported as costs to consumers and adjusted by location. See Appendix A for installed cost details and costs to builders.

Both proposed code changes (RE147 and CE217 Part 2) will increase the cost of construction without any associated energy savings. In all cases, there is zero energy measure value and zero energy cost savings and therefore no payback. The increased mortgage costs shown are based on the associated incremental cost of construction amortized over 30 years at a rate of 4.16% as outlined in the methodology section.

Note: Based on an electrical load calculation for this reference house, with full conditioned basement, all electric appliances (electric heat pump with 15 kW auxiliary heater, water heater, range, and dryer), and a standard 40-amp EV charger, a standard 200-amp electric service and panel would be sufficient. However, a larger home or higher capacity/additional EV charger may require an electrical service upgrade and associated additional installed cost.

Summary of Cost and Energy Savings Impact Analysis on the Reference House

Cost Impact	CZ2 Houston	CZ4 Baltimore	CZ6 Minneapolis
RE147: Electric Readiness cost, $	1,764	1,818	1,782
CE217p2: EV Charger Ready cost, $	681	702	688
Total incremental installed cost, $	2,445	2,520	2,470
Baseline energy cost, $/yr	1,832	2,042	2,037
Proposed energy cost, $/yr	1,832	2,042	2,037
Energy measure value, $/yr	0	0	0
Energy cost savings, %	0	0	0
Simple payback, years	NA	NA	NA
Mortgage cost increase, $/yr	157	162	159

APPENDIX A: INCREMENTAL COST FOR EACH CODE CHANGE

RE147-19

Reference Code Section

2018 IECC R404.2 (IRC N1104.2) (New), R404.2.1 (IRC N1104.2.1) (New), R404.2.2 (IRC N1104.2.2) (New), R404.2.3 (IRC N1104.2.3) (New).

Summary of the Code Change:

The proposed code change is a new requirement that mandates electric circuits for future electric appliances where gas water heaters, dryers, and conventional cooking equipment are installed. (Note that for a gas furnace, a circuit for a future electric heat pump air handler is not required.) The change calls for a 20-amp receptacle connected to the electric panel with a 3 conductor #10 AWG wire and a single pole circuit breaker space adjacent to each circuit breaker for the branch circuit. The change also calls for an indoor space that is at least 3 feet by 3 feet by 7 feet high within 3 feet of the water heater.

Cost Implication of the Code Change:

This change will increase the cost of construction for houses with natural gas appliances. The analysis is based on three complete electric circuits installed at the Reference House, including GFCI protected circuit breakers, as shown in the table below. The water heater space is not considered applicable to the Reference House.

Associated Costs of Electric Readiness for the Reference House with Natural Gas Appliances

Component	Unit	Material	Labor	Total	w/O&P	Quantity	Cost
30-amp Water Heater circuit: breaker, disconnect, 20' #10/2 NM	EA	29.00	66.50	95.50	141.00	1	141.00
Wire, #10/2 NM, add 40' for Water Heater	LF	0.45	1.67	2.12	3.20	40	128.00
GFCI 30-amp 2-pole breaker for Water Heater	EA	124.99		124.99	137.49	1	137.49
Standard 30-amp 2-pole breaker	EA	10.24		10.24	11.26	(1)	(11.26)
50-amp Range circuit: outlet, 30' #8/3 NM	EA	82.50	79.00	161.50	220.00	1	220.00
Wire, #8/3, add 30' for Range	LF	1.17	2.57	3.74	5.45	30	163.50
Breaker, 50-amp for Range circuit	EA	30.50	60.50	91.00	133.00	1	133.00
GFCI 50-amp 2-pole breaker for Range	EA	149.99		149.99	164.99	1	164.99
Standard 50-amp 2-pole breaker	EA	30.50		30.50	33.55	(1)	(33.55)
30-amp Dryer circuit: outlet, breaker, 20' #10/3 NM	EA	54.50	52.00	106.50	145.00	1	145.00
Wire, #10/3, add 40' for Dryer	LF	0.66	2.38	3.04	4.61	40	184.40
GFCI 30-amp 2-pole breaker	EA	124.99		124.99	137.49	1	137.49
Standard 30-amp 2-pole breaker	EA	10.24		10.24	11.26	(1)	(11.26)
Total to Builder							**1,499**
Total to Consumer							**1,782**
Total to Consumer with location adjustment factor applied						**Factor**	
Houston						0.99	**1,764**
Baltimore						1.02	**1,818**
Minneapolis						1.00	**1,782**

CE217-19 Part 2

Reference Code Section

2018 IECC R202 (IRC N1101.6), R404.2 (IRC N1104.2) (New), R404.2.1 (IRC N1104.2.1) (New), R404.2.2 (IRC N1104.2.2) (New), Table R404.2.2 (IRC N1104.2.2) (New), R404.2.3 (IRC N1104.2.3) (New)

Summary of the Code Change:

The code change is a new requirement for at least one EV ready space with a 40-amp, 240-volt dedicated branch circuit for an EV charger.

Cost Implication of the Code Change:

This code change will increase the cost of construction for all houses. The analysis is based on installing one EV charger circuit (for a "Level 2" plug-in charger, by others) at the Reference House as shown in the table below.

Associated Costs of Electric Vehicle Readiness for the Reference House

Component	Unit	Material	Labor	Total	w/O&P	Quantity	Cost
40-amp circuit, breaker, disconnect, 40' #8/2	EA	144.00	95.50	239.50	315.00	1	315.00
GFCI 40-amp 2-pole breaker	EA	124.99		124.99	137.49	1	137.49
Standard 40-amp 2-pole breaker	EA	10.87		10.87	11.96	(1)	(11.96)
Receptacle, NEMA 6-50	EA	13.34		13.34	14.67	1	14.67
Weatherproof while-in-use cover	EA	12.98		12.98	14.28	1	14.28
Wire, #8/2, add 20'	LF	1.17	2.57	3.74	5.45	20	109.00
Total to Builder							**578**
Total to Consumer							**688**
Total to Consumer with location adjustment factor applied						**Factor**	
Houston						0.99	**681**
Baltimore						1.02	**702**
Minneapolis						1.00	**688**

APPENDIX B: LOCATION ADJUSTMENT FACTORS

State	City	Cost Adjustment Factor	State	City	Cost Adjustment Factor
Alabama	Birmingham	0.96	Montana	Billings	1.01
Alabama	Mobile	0.94	Nebraska	Omaha	0.99
Alaska	Fairbanks	1.29	Nevada	Las Vegas	1.00
Arizona	Phoenix	0.99	New Hampshire	Portsmouth	0.93
Arizona	Tucson	0.96	New Jersey	Jersey City	0.95
Arkansas	Little Rock	0.96	New Mexico	Albuquerque	1.00
California	Alhambra	1.00	New York	Long Island City	1.02
California	Los Angeles	0.99	New York	Syracuse	0.99
California	Riverside	0.98	North Carolina	Charlotte	0.97
California	Stockton	1.00	North Carolina	Greensboro	0.96
Colorado	Boulder	1.04	North Carolina	Raleigh	0.96
Colorado	Colorado Springs	1.00	North Dakota	Fargo	0.99
Colorado	Denver	1.05	Ohio	Columbus	0.99
Connecticut	New Haven	1.01	Oklahoma	Oklahoma City	0.97
Delaware	Dover	0.97	Oklahoma	Tulsa	0.98
District of Columbia	Washington, D.C.	0.99	Oregon	Bend	1.03
Florida	Fort Meyers	0.92	Pennsylvania	Norristown	0.90
Florida	Miami	0.96	Pennsylvania	State College	0.92
Florida	Orlando	0.97	Rhode Island	Providence	0.99
Florida	Tampa	0.95	South Carolina	Greenville	0.93
Georgia	Atlanta	0.98	South Dakota	Sioux Falls	0.99
Hawaii	Honolulu	1.19	Tennessee	Memphis	0.99
Idaho	Boise	0.98	Texas	Austin	0.95
Illinois	Chicago	1.00	Texas	Dallas	0.98
Indiana	Indianapolis	1.00	Texas	Houston	0.99
Iowa	Des Moines	0.96	Texas	San Antonio	0.98
Kansas	Wichita	0.98	Utah	Ogden	0.95
Kentucky	Louisville	0.94	Utah	Provo	0.97
Louisiana	Baton Rouge	0.99	Utah	Salt Lake City	0.98
Maine	Portland	0.99	Vermont	Burlington	1.01
Maryland	Baltimore	1.02	Virginia	Fairfax	0.94
Massachusetts	Boston	1.02	Virginia	Winchester	0.94
Michigan	Ann Arbor	0.96	Washington	Tacoma	1.02
Minnesota	Minneapolis	1.00	West Virginia	Charleston	0.96
Mississippi	Biloxi	0.98	Wisconsin	La Crosse	0.93
Missouri	Springfield	0.95	Wyoming	Casper	1.00

*Source: RSMeans *Residential Cost Data 2020*. Sample cities are listed in this table; check RSMeans for additional locations.

APPENDIX C: REFERENCE HOUSES

Reference House Characteristics

The features of the Reference House for this analysis are summarized in the table below.

Reference House Features	Value
Conditioned floor area, above grade, SF	2,600
Number of stories above grade	2
Bedrooms, qty.	4
1st floor area: 40' wide x 38' deep - (20'x22' garage)	1,080
2nd floor area: 40' wide x 38' deep	1,520
Ceiling height, first floor, ft.	9
Ceiling height, second floor, ft.	8
Walls, gross area, includes 1' rim for 2nd floor	2,808
Window area, SF (13.8% of CFA; 90 SF per side)	360
Foundation: CZ2 slab; CZ4&6 basement	slab or basement
Attic	Vented

Reference House Characteristics – Previous Studies

For earlier studies, baseline metrics were defined for four representative single-family houses, built to the IRC, to determine the cost impact of any code changes. The Reference Houses and their site locations were initially defined in a report titled "Estimated Costs of the 2015 Code Changes" prepared by Home Innovation for NAHB. These single-family houses were selected for their similarity to new home offerings in the six metropolitan areas selected as site locations – Miami, Dallas, Los Angeles, Seattle, New York, and Chicago, and their size proximity to a national average of 2,607 SF. Features of the Reference Houses are summarized in the next section.

The four residential building designs are based on the data contained in the Census Bureau report, *Characteristics of New Single-Family Construction Completed*[6]. The report provides information about building foundation type and number of stories for new single-family detached construction over the previous nine-year period.

New Construction Foundation Types

Slab	54%
Crawlspace	17%
Basement	30%

New Construction Number of Stories

One-story	53%
Two-story	43%
Three-story	3%

[6] www.census.gov/construction/chars/completed.html

The Census data supports defining the four reference houses as follows to encompass approximately 85% of the last decade's new single-family construction:

- One-story on slab foundation
- Two-story on slab foundation
- One-story on basement foundation
- Two-story on basement foundation

The table below covers the locations where each type of reference house foundation would be pragmatically constructed. All these selected cities, except Chicago, lie within the top ten states for construction starts in 2013.[7] Chicago was selected to represent a Climate Zone 5 house.

Sites for Reference Houses

Reference House	Climate Zone	1	2	3	4
Foundation		Slab	Slab	Basement	Basement
Miami	1	X	X		
Los Angeles	3	X	X		X*
Dallas	3	X	X		X*
Seattle	4	X	X	X	X
New York	4	X	X	X	X
Chicago	5			X	X
Fairbanks	8			X	X

Based on the data compiled by Home Innovation from the *2013 Builder Practices Survey* (BPS)[8], a nationwide annual survey, the typical Heating, Ventilation, and Cooling (HVAC) systems used in new houses are summarized in the table below. According to the BPS, 44% of new homes are cooled with a central air conditioner. These results influenced the selection of a gas furnace with central (electric) air conditioner as the HVAC system in each of the reference houses.

Typical HVAC Systems Supplied with New Houses

Feature	% of Stock
Furnace or Boiler, natural gas or propane	48%
Central Air Conditioner, electric	44%
Standard Heat Pump with Backup Heat	41%
Geothermal Heat Pump	4%
Electric furnace, baseboard, or radiant	4%
Furnace or Boiler, oil	2%

[7] www.census.gov/construction/bps/pdf/2013statepiechart.pdf
[8] www.homeinnovation.com/trends_and_reports/data/new_construction

The statistics presented in the foregoing tables support defining the features of the Reference Houses as detailed in the table below.

Features of the Reference Houses

Reference House	1	2	3	4
Square Feet	2,607	2,607	2,607	2,607
Foundation	Slab	Slab	Basement	Basement
Number of Stories	1	2	1	2
Number of Bedrooms	3	4	3	4
Number of Bathrooms	2	2.5	2	3
Garage, attached	2-car	2-car	2-car	2-car
Heat, Gas Furnace	Yes	Yes	Yes	Yes
Cooling, (Electric) central air	Yes	Yes	Yes	Yes
Hot Water, Gas 50-gallon tank	Yes	Yes	Yes	Yes
9 ft. Ceilings, 1st	Yes	Yes	Yes	Yes
8 ft. Ceilings, 2nd	n/a	n/a	Yes	Yes
Energy Star appliances	Yes	Yes	Yes	Yes
Laundry Room/Closet	Yes	Yes	Yes	Yes
Walls, 2x4 (Climate Zones 1 & 2)	Yes	Yes	n/a	n/a
Walls, 2x6 (Climate Zones 3 thru 8)	n/a	n/a	Yes	Yes
Bsmt., Conditioned, Unfinished	n/a	n/a	Yes	Yes
Furnace Location	Attic	Attic	Basement	Basement
Water Heater Location	Interior	Garage	Basement	Basement
Window SF/% gross wall	360/18%	315/12%	360/18%	330/12%
Cladding	Brick, 4 sides	Brick, 4 sides	Brick, 4 sides	Stucco
Roof Pitch	12/12	6/12	9/12	4/12

The furnace location has been designated as a platform in the attic for both slab reference houses, a common practice in mild climates; furnace would be located within conditioned space for cold climates.

Reference House 1: One-Story House with Slab Foundation

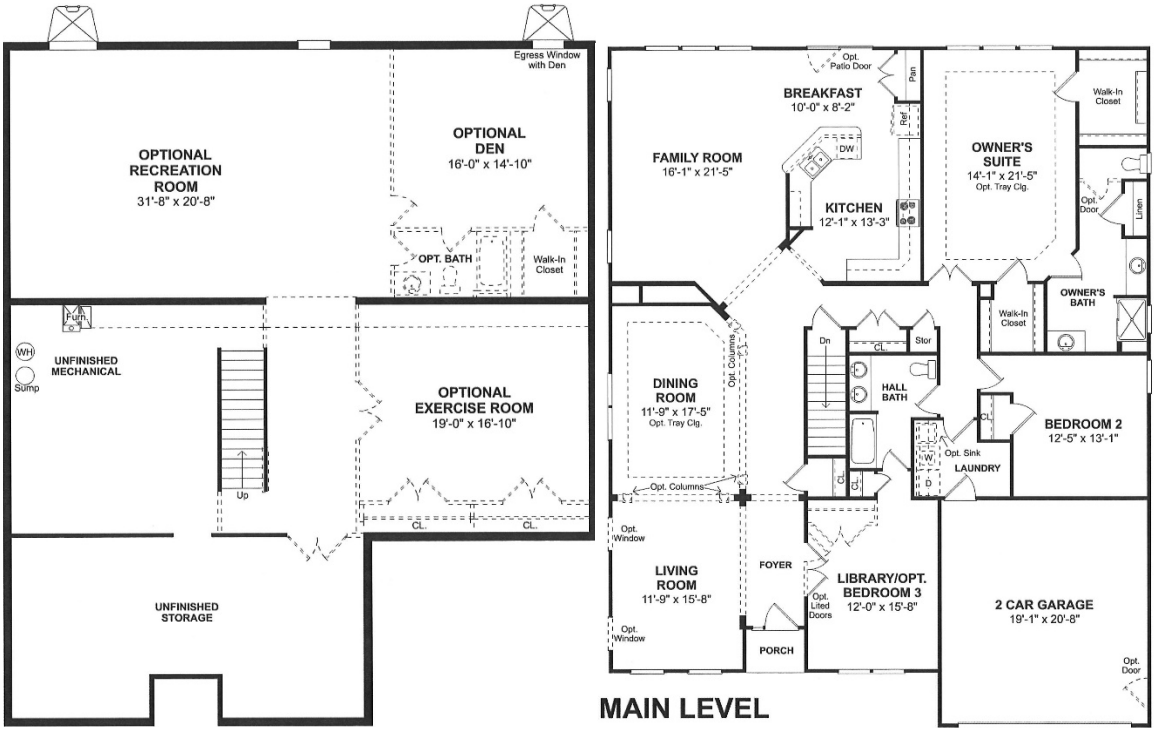
Courtesy: LionsGate Homes at The Creekside

Reference House 2: Two-Story House with Slab Foundation

Courtesy: Meritage Homes at Riverstone

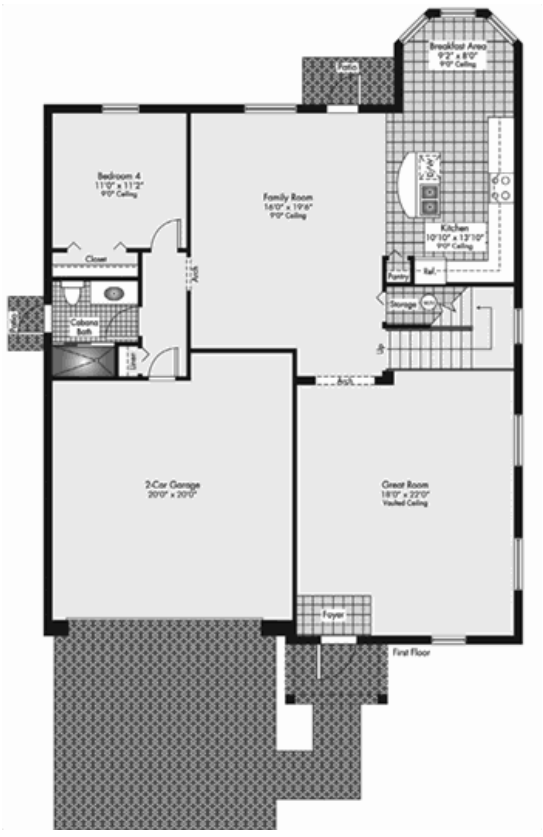
Reference House 3: One-Story House with Basement Foundation

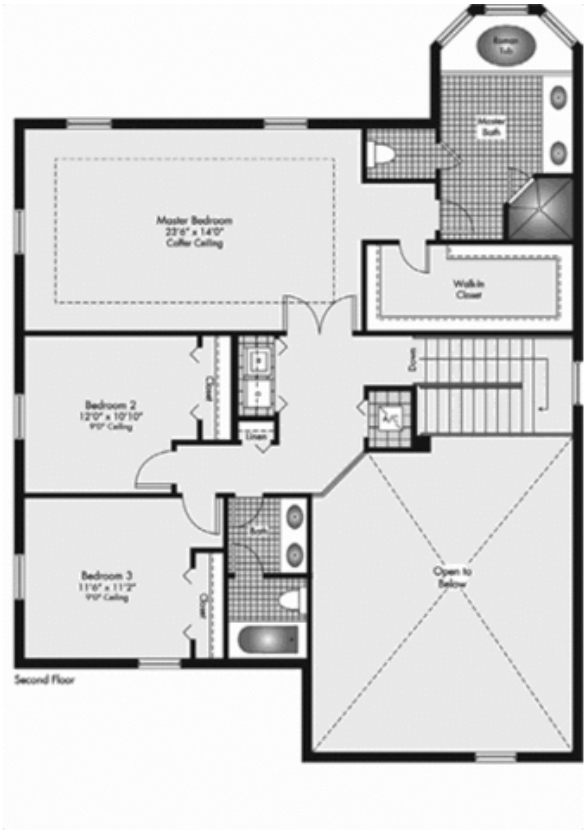
Courtesy: K Hovnanian Four Seasons at New Kent Vineyards



Reference House 4: Two-Story House with Basement Foundation

Courtesy: Lennar at Sorento Estates



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