Home Innovation
RESEARCH LABS™

ESTIMATED COSTS OF THE 2024 IRC CODE CHANGES

Prepared For

National Association of Home Builders

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ACRONYMS, ABBREVIATIONS, AND DEFINITIONS

ASTM	American Society for Testing and Materials
CY	Cubic yard
EA	Each
FT	Feet
HR	Hour
HVAC	Heating, ventilation, and air conditioning
ICC	International Code Council
IECC	International Energy Conservation Code
IN	Inch
IRC	International Residential Code
LB	Pound
LF	Linear feet
PSF	Pounds per square foot
SF	Square feet

BACKGROUND

The 2024 International Residential Code (IRC) includes several changes which impact construction costs for residential construction.[1] The objective of this analysis was to quantify the incremental construction cost associated with constructing a house compliant with the 2024 IRC relative to a 2021 IRC baseline. Home Innovation Research Labs (Home Innovation) estimated the expected cost impacts of selected code changes provided by the National Association of Home Builders (NAHB) using four single-family, detached reference houses. Cost estimates are aggregated in ranges of high to low based on various methods or components that might be used to comply with the code. Results are relative to the reference house characteristics and configurations; costs may vary substantially for other house designs.

This report does not address any code changes associated with energy efficiency. The energy efficiency requirements in the IRC (Chapter 11) are the same as the residential provisions in the International Energy Conservation Code (IECC). These 2024 IRC Chapter 11 code changes will be assessed separately in an upcoming report by Home Innovation.

METHODOLOGY

The characteristics of the reference houses used for this analysis are summarized below in Table 1. The reference houses and their site locations were initially defined in a report titled *Estimated Costs of the 2015 IRC Code Changes.*[2] The houses were selected for their similarity to new home offerings in the six metropolitan areas selected as site locations – Miami, FL, Dallas, TX, Los Angeles, CA, Seattle, WA, New York, NY, and Chicago, IL – and their size proximity to a national average of 2,607 SF. Subsequent reports added three site locations for assessing energy use: Helena, MT, Duluth, MN, and Fairbanks, AK. Additional information on the basis for the reference house configurations is provided in Appendix C. Elevations and floor plans for these reference houses are provided in Appendices D through G. These reference houses provided the basis to estimate the incremental costs or savings of the code changes for the 2024 IRC relative to the 2021 IRC.

For this study, construction costs were developed primarily based on RSMeans 2024 Residential Cost Data, using national average costs for labor and materials.[3] For specific locations, the national average costs could be modified by applying the appropriate adjustment factor from RSMeans; selected location adjustment factors from RSMeans are provided in Appendix B. In some cases, costs were sourced from material suppliers, online distributor websites, or other relevant sources as applicable to the specific measure. Costs associated with testing or fees provided by an energy rater, engineer, or other third party were estimated based on an internet search of associated web sites. Cost details for individual code changes are provided in Appendix A.

Costs in the results section are reported as cost to consumer. The cost to consumer is calculated by applying a markup to the builder cost to account for builder overhead and profit. For this analysis, the cost to consumer is calculated by applying a markup of 1.182 to the builder cost.[4]

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[1] International Code Council, www.iccsafe.org/Pages/default.aspx

[2] Estimated Costs of the 2015 Code Changes, Home Innovation Research Labs, www.homeinnovation.com/trends_and_reports/featured_reports/estimated_costs_of_the_2015_irc_code_changes

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

[4] Average Builder gross margin of 18.2% in 2020 as reported by NAHB in The Cost of Doing Business Study, 2022 Edition

The cost to builder represents the cost charged by the subcontractor. RSMeans provides a unit cost which includes materials, labor, installation equipment (if needed to install materials, i.e., not permanently installed equipment), subcontractor overhead (overhead burden is applied to labor cost as a markup of approximately 1.5 although this markup varies by trade) and subcontractor profit (using a 10% markup applied to all costs). For this study, where materials are sourced from national distributor websites (not RSMeans), a 10% subcontractor profit is added for consistency.

The cost details for individual code changes provided in Appendix A are reported as both cost to builder and cost to consumer.

Table 1. Features of the Reference Houses

	Reference House			
Feature	**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	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
Basement, 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%
Roof Pitch	12/12	6/12	9/12	4/12

RESULTS

The estimated incremental construction costs of the selected code changes attributed to the reference houses are summarized in Table 2. The costs are aggregated by location and house configuration. The results are reported in ranges of "High" and "Low" based on the code changes that would typically be applicable to the reference houses in those locations. Note that where a code change results in a cost savings, the smallest savings is shown as "high" cost, and the largest savings is shown as "low" cost.

Table 3 summarizes the estimated construction costs of selected code changes that are not attributed to the reference houses and are not included in the aggregated summary. These code changes typically apply only in specific locations (e.g., hurricane-prone areas or flood zones), to items that would be an optional feature for most homes (e.g., decks), or to alternative methods of compliance. Those costs can be added to or subtracted from the aggregated costs in Table 2 as applicable to a particular location or a specific building.

The overwhelming majority of changes in the 2024 IRC not related to energy efficiency or existing buildings, identified by NAHB as significant, and provided to Home Innovation for analysis were deemed to be additional options for compliance with the code, only applicable in specific locations or cases (e.g., if a deck is constructed), or only triggered if a product or system requires the use of alternate means and methods code provisions or a registered design professional. Three significant changes were deemed applicable to most dwellings constructed under the IRC and are shown in Table 2.

Table 3 includes one code change for existing buildings. Other changes for existing buildings will be addressed in an addendum to this report.

This report does not address any code changes associated with energy efficiency. The energy efficiency requirements in the IRC (Chapter 11) are the same as the residential provisions in the International Energy Conservation Code (IECC). These 2024 IRC Chapter 11 code changes will be assessed separately in an upcoming report by Home Innovation.

Cost details for individual code changes are provided in Appendix A.

Table 2. Estimated Incremental Cost of Selected 2024 IRC Changes attributed to the Reference Houses

		Selected Cities	Miami, Dallas		LA, Seattle, New York		Chicago, Helena		Duluth, Fairbanks	
		Climate Zone	1 & 2		3 & 4		5 & 6		7 & 8	
		Reference House	1 & 2		1, 2, 3, & 4		3 & 4		3 & 4	
			Cost Range							
Ref #	Description of Change	2024 IRC Section	High	Low	High	Low	High	Low	High	Low
R-10 (RB173)	Adds requirements for framing at an open floor edge to support a guard assembly & resist rotation.	R502.11	$459	$0	$459	$0	$156	$0	$156	$0
R-11 (RB175)	Allows a 6-mil polyethylene vapor retarder under a slab-on-ground floors instead of a 10-mil vapor retarder conforming to ASTM E1745 Class A reqs.	R506.3.3	($472)	($951)	($472)	($957)	($472)	($957)	($472)	($957)
R-20 (S241.2)	Modifies the water-resistive barrier requirements for stucco in dry climates	R703.7.3	$0	($1,203)	$0	($1,270)	$0	($1,270)	$0	($1,270)
Total			**($13)**	**($2,154)**	**($13)**	**($2,227)**	**($316)**	**($2,227)**	**($316)**	**($2,227)**

Table 3. Estimated Incremental Cost of Selected 2024 IRC Changes not attributed to the Reference Houses

		Selected Cities	Miami, Dallas		LA, Seattle, New York		Chicago, Helena		Duluth, Fairbanks	
		Climate Zone	1 & 2		3 & 4		5 & 6		7 & 8	
		Reference House	1 & 2		1, 2, 3, & 4		3 & 4		3 & 4	
			Cost Range							
Ref #	Description of Change	2024 IRC Section	High	Low	High	Low	High	Low	High	Low
R-1 (ADM 13.2)	Reorganizes and expands the duties and powers of the Building Official.	R104	$597	$74	$597	$74	$597	$74	$597	$74
R-2 (RB7)	Reorganizes and updates the appendix for existing buildings; a few items are substantive.	Appendix BO	$1,304	($1,332)	$1,304	($1,720)	$875	($1,720)	$875	($1,720)
R-3 (RB44)	Modifies the table for allowable deflection under live load to exclude guards & handrails.	Table R301.7	$0	($402)	$0	($402)	$0	($402)	$0	($402)
R-4 (RB45)	Requires splices in floor, ceiling, or roof framing members not occurring over a bearing point to be designed by a registered design professional.	R502.3, R802.4.1, R802.5	$804	$0	$891	$0	$891	$0	$891	$0

R-5 (RB108)	Provides an exception that exterior stairways to grade with three or fewer risers may have a 36" wide landing provided the stairway is not serving the required egress door.	R318.7.6	$0	($798)	$0	($798)	$0	($798)	$0	($798)
R-6 (RB149)	Requires markings where BIPV systems create hidden electrical hazards.	R329.6.4	$246	$190	$246	$190	$246	$190	$246	$190
R-9 (RB165)	Adds a new column with the USDA Textural Soil Classification and indicates which soil types are unsuitable for backfill.	R401.4.1	$0	($946)	$0	($946)	$0	($946)	$0	($946)
R-12 (RB190)	Adds prescriptive requirements for deck ledger flashing and requires the water-resistive barrier to run behind the ledger.	R507.2.4, R507.9, R703.2, R703.4	$36	$28	$36	$28	$36	$28	$36	$28
R-13 (RB226)	Provides an additional method to support masonry veneer at a roof-wall intersection.	R703.8.2.2	$0	($328)	$0	($328)	$0	$0	$0	$0
R-15 (RM13)	Adds a compliance option for location of exhaust openings above windows and doors.	M1504.3	$0	($262)	$0	($262)	$0	($262)	$0	($262)
R-16 (RM18)	Allows taking return air for HVAC systems from bathrooms	M1602.2	$435	$198	$435	$198	$435	$198	$435	$198
R-17 (RM19)	Allows taking return air for HVAC systems from closets	M1602.2	$1,843	$0	$1,843	$0	$1,843	$0	$1,843	$0
R-18 (RM20)	Allows taking return air for HVAC systems from mechanical rooms.	M1602.2	$0	$0	$244	$0	$244	$0	$244	$0
R-19 (S240.2)	Modifies the water-resistive barrier requirements for stucco to apply to all exterior sheathing.	R703.7.3	$684	$369	$750	$369	$750	$394	$750	$394

APPENDIX A: COST DETAILS OF INDIVIDUAL CODE CHANGES

R-1: Proposal ADM13.2

IRC R104 Duties and Powers of the Building Official

Summary of Code Change:

The code change replaces the existing Section R104 with a reorganized and expanded set of duties and powers of the building official, especially regarding the alternative materials and methods provisions. While it's difficult to assess the full cost impact, two items stand out: (1) R104.2.1 allows the building official to compel the builder to provide them with a copy of the standard governing a listed product; (2) R104.2.2.6.2 allows the building official to require a signed and sealed engineering report or engineered design for an alternative product where an ICC-ES or other evaluation report is not provided.

Cost Implication of Code Change:

This code change may increase the cost of construction where applicable. Analysis is based on the cost to purchase two example standards and an estimated fee for a structural engineer to provide a report or engineered design. Costs could be higher where additional standards or engineering time are required.

Applicability of Code Change:

This code change is applicable where the building official requires a copy of a standard or an engineering report previously not required.

Table A1-1. Estimated Cost Impact of ADM 13.2: example low cost

			Quantity, by Reference House				Cost, by Reference House			
Component	**Unit**	**Unit Cost**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
ASTM E1886-19*	EA	63.00	1	1	1	1	63	63	63	63
Total to builder							**63**	**63**	**63**	**63**
Total to consumer							**74**	**74**	**74**	**74**

*ASTM E1886-19 Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems

Table A1-2. Estimated Cost Impact of ADM 13.2: example high cost

			Quantity, by Reference House				Cost, by Reference House			
Component	**Unit**	**Unit Cost**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
UL 723*	EA	505.00	1	1	1	1	505	505	505	505
Total to builder							**505**	**505**	**505**	**505**
Total to consumer							**597**	**597**	**597**	**597**

*UL 723 Test for surface burning characteristics of building materials

Table A1-3. Estimated Cost Impact of ADM 13.2: example engineer's fee

			Quantity, by Reference House				Cost, by Reference House			
Component	**Unit**	**Unit Cost**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Structural Engineer, fee	HR	170.00	2	2	2	2	340	340	340	340
Total to builder							**340**	**340**	**340**	**340**
Total to consumer							**402**	**402**	**402**	**402**

R-2: Proposal RB7

IRC Appendix BO Existing buildings and structures

Summary of Code Change:

This code change reorganizes and updates the appendix for existing buildings. Many portions of the code change update terminology and delete provisions and pointers to requirements that are already found in the body of the code.

Cost Implication of Code Change:

The code change may increase or decrease the cost of construction. A few items in the code change are substantive. Analysis is based on the cost impact of the following items: (1) Adding a requirement to provide CO alarms where required by IRC R315.2.2; (2) Removing the requirement for a preliminary meeting with the building official and permit applicant; (3) Removing the provision allowing a building official to require an evaluation by a registered design professional for a house undergoing reconstruction; (4) Adding requirements to provide stairway illumination as well as code-compliant handrails and guards when stairs are altered; (5) Adding a requirement for a wall-mounted switch controlling lighting outlets when a room is altered; (6) Removing the requirement for wall and ceiling finishes in areas being reconstructed to comply with the flame spread and smoke development requirements of R302.9 and for area separation walls between attached dwelling units to meet R302.

Applicability of Code Change:

Individual items within this code change may be applicable for existing buildings. The total cost would only apply if all aspects of the work are required as part of the project, but in the more likely scenario where all items don't apply, the total provides a range of costs for this code change.

Table A2-1. Estimated Cost Impact of RB7

			Quantity, by Reference House				Cost, by Reference House			
Component, by item #	**Unit**	**Unit Cost**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
1. Carbon monoxide detector, hardwired	EA	167.00	3	2	2	2	501	334	334	334
2. Builder/Carpenter*	HR	66.40	(1)	(1)	(1)	(1)	(66)	(66)	(66)	(66)
3. Structural Engineer fee	HR	170.00	(4)	(4)	(4)	(4)	(680)	(680)	(680)	(680)
4. Stairway lighting, handrail, guards (see details in Table A2-2 below)	EA	2,155.16	0	1	0	1	0	2,155	0	2,155
5. Switch assembly for outlet	EA	86.00	1	1	1	1	86	86	86	86
6. Cover existing interior wall paneling with 1/2" drywall (see details in Table A2-3)	SF	2.24	(432)	(324)	(504)	(486)	(968)	(726)	(1,129)	(1,089)
Total to builder							**(1,127)**	**1,103**	**(1,455)**	**740**
Total to consumer							**(1,332)**	**1,304**	**(1,720)**	**875**
***Note that a jurisdiction may charge a fee for consultation.**										

Table A2-2. Estimated Cost Impact of RB7 item 4

Component	Unit	Unit Cost	Quantity	Cost
Lighting electrical circuit, 3-way switch	EA	104.50	2	209
Lighting outlet	EA	50.00	1	50
Lighting fixture	EA	85.50	1	86
Demo existing stair railing, 2 laborer crew, est.	HR	52.83	2	106
Wood stair railing*	LF	34.90	14	489
Wood stair newels	EA	239.00	2	478
Wood stair balusters	EA	28.40	26	738
Total to builder				**2,155**

***Based on the top of the guard is the handrail; costs could be higher if installing a handrail as a separate component.

Table A2-3. Estimated Unit Cost of RB7 item 6

Component	Unit	Unit Cost
1/2 gypsum	SF	1.69
Paint, 2 coats	SF	0.55
Total to Builder		**2.24**

Table A2-4. Estimated area of interior wood wall for item 6, using a Family Room, Study, Library, or Flex Room, by Reference House

Area	Unit	1	2	3	4
Wall area with interior wood paneling	SF	432	324	504	486

R-3: Proposal RB44

IRC Table R301.7 Allowable deflection of structural members

Summary of Code Change:

This code change modifies the table for allowable deflection of any structural member under live load to exclude guards and handrails.

Cost Implication of Code Change:

This code change may decrease the cost of construction where applicable. Analysis is based on a builder no longer needing to hire an engineer to calculate the deflection of wood guards for an outdoor deck and second-story guards for balconies overlooking the first floor for two-story house designs. The high cost is assumed to be zero.

Applicability of Code Change:

This code change may be applicable for houses with an outdoor deck or second-story balcony.

Table A3. Estimated Cost Impact of RB44

			Quantity by Reference House				Cost by Reference House			
Component	**Unit**	**Unit Cost**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Structural Engineer fee	HR	170.00	(2)	(2)	(2)	(2)	(340)	(340)	(340)	(340)
Total to builder							**(340)**	**(340)**	**(340)**	**(340)**
Total to consumer							**(402)**	**(402)**	**(402)**	**(402)**

R-4: Proposal RB45

IRC R502.3 Allowable joist spans, R802.4.1 Rafter size, and R802.5 Ceiling joists

Summary of Code Change:

This proposal requires splices in floor, ceiling, or roof framing members not occurring over a vertical support (bearing point) to be designed by a registered design professional.

Cost Implication of the Code Change:

This proposal may increase the cost of construction where applicable, e.g., because a framer cut one set of joists or rafters too short and field-framed a splice, for which the builder ends up needing to hire an engineer to run numbers and sketch a repair detail. Analysis is based on the estimated fee for a structural engineer to provide an engineered design and detail, plus an additional estimated cost to install a floor joist "sister". The "low" cost is assumed to be zero.

Applicability of Code Change:

This code change is applicable where there are splices in floor, ceiling, or roof framing that do not occur over vertical supports.

Table A4. Estimated Cost Impact of RB45

			Quantity, by Reference House				Cost, by Reference House			
Component	**Unit**	**Unit Cost**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Structural Engineer, fee	HR	170.00	4	4	4	4	680	680	680	680
2x10 blocking, joist sister	LF	5.89	0	6	6	6	0	35	35	35
Bolt, w/nut, washer, 3/4 dia, 4" long	EA	4.84	0	8	8	8	0	39	39	39
Total to builder							**680**	**754**	**754**	**754**
Total to consumer							**804**	**891**	**891**	**891**

R-5: Proposal RB108

IRC R318.7.6 Landings for stairways

Summary of Code Change:

This code change provides an exception that exterior stairways to grade with three or fewer risers serving a deck, porch, or patio shall have a bottom landing of not less than 36 inches, provided that the stairway is not the required access to grade serving the required egress door, i.e., instead of a landing width for the entire stair

Cost Implication of the Code Change:

This code change could decrease the cost of construction where applicable. This change may save the cost to provide concrete, pavers, or other hardscapes across the entire width of the deck, porch, or patio where it steps down to grade. Analysis is based on a 20'x14' deck with steps along one 14' side; the cost savings are estimated using a 3'x3' concrete landing instead of a 14'x3' concrete landing.

Applicability of Code Change:

This code change is applicable to exterior stairways to grade, serving deck, porch or patio, with a maximum of three risers and not serving the required egress door.

Table A5. Estimated Cost Impact of RB108

			Quantity by Reference House				Cost by Reference House			
Component	**Unit**	**Unit Cost**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Excavate, by hand, heavy soil	CY	99.50	(1.2)	(1.2)	(1.2)	(1.2)	(122)	(122)	(122)	(122)
Forms, slab on grade	LF	5.55	(22)	(22)	(22)	(22)	(122)	(122)	(122)	(122)
Concrete, stair landing, cast on ground	SF	13.07	(33)	(33)	(33)	(33)	(431)	(431)	(431)	(431)
Total to builder							**(675)**	**(675)**	**(675)**	**(675)**
Total to consumer							**(798)**	**(798)**	**(798)**	**(798)**

R-6: Proposal RB149

IRC R329.6.4 Building-integrated photovoltaic (BIPV) systems

Summary of Code Change:

This code change requires that markings be provided where BIPV systems (PV systems that also function as a roof covering) are installed in a manner creating areas with electrical hazards that are hidden from view. The markings must identify hazardous areas to avoid ladder placement. The markings must be visible from grade beneath the eaves. There is an exception for BIPV systems listed in accordance with UL 3741 where the removal or cutting away of portions of the BIPV system during firefighting operations have been determined to not expose a firefighter to electrical shock hazards.

Cost Implication of the Code Change:

This code change will increase the cost of construction where applicable. Analysis is based on the cost to install BIPV warning labels every 10 feet along roof eaves and rakes.

Applicability of Code Change:

This code change is applicable where BIPV systems are installed.

Table A6. Estimated Cost Impact of RB149

			Quantity, by Reference House				Cost, by Reference House			
Component	**Unit**	**Unit Cost**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
"Caution Solar Circuit" reflective label	EA	1.40	30	20	30	20	42	28	42	28
Labor to install labels	HR	66.40	2.5	2	2.5	2	166	133	166	133
Total to builder							**208**	**161**	**208**	**161**
Total to consumer							**246**	**190**	**246**	**190**

R-9: Proposal RB165

IRC R401.4.1 Geotechnical Evaluation

Summary of Code Change:

This code change relocates Table R405.1 to R401.4.1(2), adds a new column with the USDA Textural Soil Classification, and indicates which soil types are unsuitable for backfill.

Cost Implication of the Code Change:

The code change may decrease the cost of construction. This change enables the use of USDA data and textural descriptions to ensure builders select a proper soil classification where geotechnical investigation is not done, so it may save the cost of a soil test report since the USDA information is available at no cost. Analysis is based on the estimated cost savings of not needing a soil test report.

Applicability of Code Change:

This change is applicable where a soil test is no longer required.

Table A9. Estimated Cost Impact of RB165

			Quantity, by Reference House				Cost, by Reference House			
Component	**Unit**	**Unit Cost**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Soil test report	EA	800	(1)	(1)	(1)	(1)	(800)	(800)	(800)	(800)
Total to builder							(800)	(800)	(800)	(800)
Total to consumer							(946)	(946)	(946)	(946)

R-10: Proposal RB173

IRC R502.11 Floor framing supporting guards

Summary of Code Change:

This code change adds requirements for framing at an open floor edge to support a guard assembly and resist rotation where guards are required.

Cost Implication of the Code Change:

This code change may increase the cost of construction where applicable. Analysis is based on installing one additional 2x10 at the floor edge of second floor interior openings that overlook the first floor for the reference houses, additional 2x10 blocking at guard post locations, and additional nailing of the floor sheathing. Quantities are estimates based on a review of the floors plans of the reference houses. The "low" cost will be zero for the one-story reference houses.

Applicability of Code Change:

This code change is applicable where a guard assembly is required to protect an interior opening overlooking the floor below.

Table A10-1. Estimated Cost Impact of RB173: additional 2x10, blocking, and nailing

			Quantity, by Reference House				Cost, by Reference House			
Component	**Unit**	**Unit Cost**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Edge framing, additional 2x10	LF	3.95	0	24	0	6	0	95	0	24
Blocking, 2x10, 6' per post (posts 4' o.c.)	LF	5.27	0	48	0	18	0	253	0	95
Additional nailing of sheathing at roll brace (see details in Table A10-2)	EA	3.54	0	8		3	0	28	0	11
Total to builder							**0**	**376**	**0**	**129**
Total to consumer							**0**	**445**	**0**	**153**

Table A10-2. Estimated additional nailing of sheathing per roll brace

Component	Unit	Unit Cost	Quantity	Cost
Additional nails, 10d common bright (12 per roll brace, plus 12 at edge, approx. 58 nails/pound)	LB	5.00	0.5	2.50
Additional labor, 3/4 OSB sheathing	SF	0.52	2.0	1.04
Total to builder				**3.54**

Table A10-3. Estimated Cost Impact of RB173: double 2x10 vs single composite rim joist for I-joist system

			Quantity, by Ref House				Cost, by Reference House			
Component	**Unit**	**Unit Cost**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Double 2x10 joist	LF	7.90	0	24	0	6	0	190	0	47
Composite rim joist, 1.25 x 9.5	LF	3.43		(24)		(6)		(82)		(21)
Blocking, 2x10, 6' per post (posts 4' o.c.)	LF	5.27	0	48	0	18	0	253	0	95
Additional nailing of sheathing at roll brace (see details in Table A10-2)	EA	3.54	0	8		3	0	28	0	11
Total to builder							**0**	**389**	**0**	**132**
Total to consumer							**0**	**459**	**0**	**156**

R-11: Proposal RB175

IRC R506.2.3 Vapor Retarder

Summary of Code Change:

This code change requires a minimum 6-mil polyethylene vapor retarder to be placed under slab-on-ground floors. This change reverses the change from last cycle that required a 10-mil vapor retarder conforming to ASTM E1745 Class A requirements.

Cost Implication of the Code Change:

This code change will decrease the cost of construction for all reference houses. Analysis is based on the cost savings for the reference houses including basements and garages. Note that the vapor barrier is not required for garages, but garages are included as conventional practice.

Applicability of Code Change:

This code change is applicable for all reference houses.

Table A11-1. Estimated Cost Impact of RB175

			Quantity, by Reference House				Cost, by Reference House			
Component	**Unit**	**Unit Cost**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
6-mil polyethylene sheeting	SF	0.06	2,980	1,480	3,000	1,480	179	89	180	89
10-mil, ASTM E1745 Class A	SF	0.33	(2,980)	(1,480)	(3,000)	(1,480)	(983)	(488)	(990)	(488)
Total to builder							(805)	(400)	(810)	(400)
Total to consumer							(951)	(472)	(957)	(472)

Table A11-2. Slab-on-ground floor area by Reference House

Area	**Unit**	**1**	**2**	**3**	**4**
First floor	SF	2,600	1,080		
Garage	SF	380	400	400	400
Basement	SF			2,600	1,080
Total	SF	2,980	1,480	3,000	1,480

R-12: Proposal RB190

IRC R507.9.1.5 Ledger Flashing, R507.9.1.6 Water-resistive barrier; R703.2 Water-resistive barrier

Summary of Code Change:

This code change adds prescriptive requirements for deck ledger flashing (R507) and requires the water-resistive barrier to run behind the ledger (R507 and R703). For a deck addition, the code change may require portions of the existing siding to be removed.

Cost Implication of the Code Change:

The code change may increase the cost of construction where decks are installed. Analysis is based on the associated cost of providing a seam in the WRB just above the level of the deck ledger that will allow lapping the upper layer of the WRB over the vertical leg of the ledger flashing; the lower layer of the WRB needs to extend up far enough past the ledger to create the proper lap between upper and lower layers of the WRB. The added cost is estimated for the 20-foot long ledger of a 20' x 14' deck. A second cost is developed for an exception that permits the ledger flashing to be place against the face of the WRB where a self-adhering membrane counterflashing is installed not less than 2 inches over the vertical leg of the flashing and not less than 2 inches onto the WRB. The costs do not address where there is a need to remove and reinstall all types of wall cladding.

Applicability of Code Change:

This code change is applicable to houses with decks.

Table A12-1. Estimated Cost Impact of RB190

			Quantity by Reference House				Cost by Reference House			
Component	**Unit**	**Unit Cost**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Additional house wrap	SF	0.32	42	42	42	42	13	13	13	13
Additional labor, est.	HR	66.40	0.25	0.25	0.25	0.25	17	17	17	17
Total to builder							**30**	**30**	**30**	**30**
Total to consumer							**36**	**36**	**36**	**36**

Table A12-2. Estimated Cost Impact of RB190: counterflashing exception

			Quantity by Reference House				Cost by Reference House			
Component	**Unit**	**Unit Cost**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Counter flashing, 6" self-adhered, 25-mil HDPE	LF	1.12	21	21	21	21	24	24	24	24
Total to builder							**24**	**24**	**24**	**24**
Total to consumer							**28**	**28**	**28**	**28**

R-13: Proposal RB226

IRC R703.8.2.2, Figure R703.8.2.2, Figure R703.8.2.2(2) (New)

Summary of Code Change:

This code change provides an additional method to support exterior masonry veneer at a roof-wall intersection. The change allows a ledger consisting of not fewer than three 2” x 6” sawn lumber members to be installed above the roof sheathing to support the steel angle and brick (formerly the only option was to install the wood ledger below the roof sheathing). This option allows using one continuous piece of flashing installed over the steel angle and ledger instead of multiple pieces of step flashing over the brick that follow the slope of the roof.

Cost Implication of the Code Change:

The code change may decrease the cost of construction where applicable. Analysis is based on the cost savings of installing continuous flashing relative to step flashing, plus some additional savings for the amount of brick veneer displaced by the wood ledger that is now above the roof deck (the size of the wood ledger is the same for either option).

Applicability of Code Change:

This code change is applicable for house designs with masonry brick veneer and any roof-wall intersections.

Table A13. Estimated Cost Impact of RB226

			Quantity by Reference House				Cost by Reference House			
Component	**Unit**	**Unit Cost**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Flashing, 0.019" aluminum	SF	11.29		47			0	531	0	0
Step Flashing, 0.019" aluminum	SF	14.46		(47)			0	(680)	0	0
Brick veneer, standard	SF	17.95		(16)			0	(281)	0	0
Ledger, 2x6, below roof deck	LF	3.24		47			0	152	0	0
Total to builder							**0**	**(278)**	**0**	**0**
Total to consumer							**0**	**(328)**	**0**	**0**

R-15: Proposal RM13

IRC M1504.3

Summary of Code Change:

This code change adds a compliance option for location of exhaust openings above windows and doors. The exhaust opening must be located at least 1 foot above a gravity air intake, operable window, and door (formerly the minimum separation was 3 feet).

Cost Implication of the Code Change:

The code change could decrease construction costs in some cases by reducing exhaust duct length and number of duct bends. Analysis is based on an estimated reduction in the length of kitchen and bathroom exhaust ducts. The high cost is assumed to be zero.

Applicability of Code Change:

This code change is applicable for house designs where exhaust openings no longer need to be located away from windows and doors.

Table A15. Estimated Cost Impact of RM13

			Quantity by Reference House				Cost by Reference House			
Component	**Unit**	**Unit Cost**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Bathroom exhaust duct, 6" flexible insulated; save 4 LF per bathroom	LF	9.28	(8)	(8)	(8)	(8)	(74)	(74)	(74)	(74)
Kitchen exhaust duct, 3.25" x 10" metal, 22 ga, 3.3 lbs/ft, save 6 LF	LB	7.45	(20)	(20)	(20)	(20)	(148)	(148)	(148)	(148)
Total to builder							**(222)**	**(222)**	**(222)**	**(222)**
Total to consumer							**(262)**	**(262)**	**(262)**	**(262)**

R-16: Proposal RM18

IRC M1602.2 Return Air Openings

Summary of Code Change:

This code change allows taking return air for HVAC systems from bathrooms (formerly prohibited).

Cost Implication of the Code Change:

This code change would increase construction costs where this option is implemented. Analysis is based on installing a ducted return in each of two bathrooms to represent the high cost. The low cost is based on installing a transfer grille in each bathroom.

Applicability of Code Change:

This code change is applicable, as an option, to all reference houses.

Table A16-1. Estimated Cost Impact of RM18: High Cost

			Quantity by Reference House				Cost by Reference House			
Component	**Unit**	**Unit Cost**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Return branch duct, 5" flexible insulated, 15 LF per bathroom (2 bathrooms)	LF	8.77	30	30	30	30	263	263	263	263
Return grille, 10x6	EA	52.50	2	2	2	2	105	105	105	105
Total to builder							**368**	**368**	**368**	**368**
Total to consumer							**435**	**435**	**435**	**435**

Table A16-2. Estimated Cost Impact of RM18: Low Cost

			Quantity by Reference House				Cost by Reference House			
Component	**Unit**	**Unit Cost**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Transfer Grille, 12"x4" Return Air Pathway	EA	83.93	2	2	2	2	168	168	168	168
Total to builder							**168**	**168**	**168**	**168**
Total to consumer							**198**	**198**	**198**	**198**

R-17: Proposal RM19

IRC M1602.2 Return Air Openings

Summary of Code Change:

This code change allows taking return air for HVAC systems from closets (formerly prohibited).

Cost Implication of the Code Change:

This code change would increase construction costs where this option is implemented. Analysis is based on installing a ducted return and a transfer grille for each closet, 5 closets per reference house.

Applicability of Code Change:

This code change is applicable, as an option, to all reference houses.

Table A17. Estimated Cost Impact of RM19

			Quantity by Reference House				Cost by Reference House			
Component	**Unit**	**Unit Cost**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Return branch duct, 5" flexible insulated, 20 LF per closet (5 closets)	LF	8.77	100	100	100	100	877	877	877	877
Return grille, 10x6	EA	52.50	5	5	5	5	263	263	263	263
Transfer Grille, 12"x4" Return Air Pathway	EA	83.93	5	5	5	5	420	420	420	420
Total to builder							**1,559**	**1,559**	**1,559**	**1,559**
Total to consumer							**1,843**	**1,843**	**1,843**	**1,843**

R-18: Proposal RM20

IRC M1602.3 Return Air Openings

Summary of Code Change:

This code change allows taking return air for HVAC systems from mechanical rooms (formerly prohibited).

Cost Implication of the Code Change:

This code change could increase construction costs if this option is implemented. Analysis is based on the cost to install a ducted return and a transfer grille for a mechanical room or closet, for reference houses 3 and 4 (the air handler for reference houses 1 and 2 is defined as being located in the vented attic).

Applicability of Code Change:

This code change is applicable, as an option, to houses with mechanical rooms or closets in conditioned space.

Table A18. Estimated Cost Impact of RM20

			Quantity by Reference House				Cost by Reference House			
Component	**Unit**	**Unit Cost**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Return branch duct, 5" flexible insulated	LF	8.77			8	8			70	70
Return grille, 10x6	EA	52.50			1	1			53	53
Transfer Grille, 12"x4" Return Air Pathway	EA	83.93			1	1			84	84
Total to builder									**207**	**207**
Total to consumer									**244**	**244**

R-19: Proposal S240.2

IRC R703.7.3 Exterior plaster (stucco)

Summary of Code Change:

This proposal modifies the water-resistive barrier requirements for stucco to apply to all exterior sheathing for stucco (formerly limited to wood-based sheathing for stucco).

Cost Implication of the Code Change:

The code change may increase the cost of construction where applicable. Analysis is based on an example case for a dwelling on a tight lot where a fire-rated wall with gypsum board sheathing is required along one side of the house. The cost is based on one additional WRB layer using drainable housewrap in dry climates (B) and a drainable layer using a drainage mat (rainscreen) in moist climates (A and C).

Applicability of Code Change:

The code change is applicable for dwellings with stucco assemblies containing non-wood-based exterior sheathing.

Table A19-1. Estimated Cost Impact of S240.2 in Dry Climates (B)

			Quantity by Reference House				Cost by Reference House			
Component	**Unit**	**Unit Cost**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Housewrap, drainable	SF	0.46	675	684	750	722	312	316	346	334
Total to builder							**312**	**316**	**346**	**334**
Total to consumer							**369**	**374**	**410**	**394**

Table A19-2. Estimated Cost Impact of S240.2 in Moist Climates (A and C)

			Quantity by Reference House				Cost by Reference House			
Component	**Unit**	**Unit Cost**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Drainage Mat (Rainscreen), 3/16"	SF	0.85	675	684	750	722	571	579	635	611
Total to builder							**571**	**579**	**635**	**611**
Total to consumer							**675**	**684**	**750**	**722**

R-20: Proposal S241.2

IRC R703.7.3 Water-resistive barriers (Stucco), R703.7.3.1 Dry climates

Summary of Code Change:

This code change modifies the second option for water-resistive barriers for stucco in dry climates. The second option now specifically allows a means of drainage complying with Section R703.7.3.2 Moist or marine climates.

Cost Implication of the Code Change:

The code change may decrease construction costs in some cases. Analysis is based on the case where the water-resistive barrier is separated from the stucco using a drainable house wrap product with a drainage efficiency of not less than 90% (in accordance with R703.7.3.2 option 2) instead of a designed drainage space using ¾" vertical furring.

Applicability of Code Change:

This code change is applicable for houses in dry climates with stucco exterior wall cladding.

Table A20. Estimated Cost Impact of S240.2 in Dry Climates (B)

			Quantity by Reference House				Cost by Reference House			
Component	**Unit**	**Unit Cost**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
WRB, second layer, >90% drainage efficiency (e.g., Tyvek StuccoWrap)	SF	0.44	2,070	2,808	2,300	2,964	911	1,236	1,012	1,304
Furring, wood 1" x 2"	SF	0.80	(2,070)	(2,808)	(2,300)	(2,964)	(1,661)	(2,253)	(1,846)	(2,379)
Total to builder							**(750)**	**(1,018)**	**(834)**	**(1,074)**
Total to consumer							**(887)**	**(1,203)**	**(985)**	**(1,270)**

APPENDIX B: LOCATION ADJUSTMENT FACTORS

Table B1. Cost Adjustment Factor by Location*

State	City	Factor	State	City	Factor
Alabama	Birmingham	0.892	Montana	Billings	0.919
Alabama	Mobile	0.871	Nebraska	Omaha	0.922
Alaska	Fairbanks	1.163	Nevada	Las Vegas	1.067
Arizona	Phoenix	0.908	New Hampshire	Portsmouth	0.947
Arizona	Tucson	0.883	New Jersey	Jersey City	1.110
Arkansas	Little Rock	0.846	New Mexico	Albuquerque	0.898
California	San Diego	1.096	New York	Long Island City	1.279
California	Los Angeles	1.125	New York	Syracuse	0.993
California	Riverside	1.101	North Carolina	Charlotte	0.886
California	San Francisco	1.260	North Carolina	Hickory	0.853
Colorado	Boulder	0.873	North Carolina	Raleigh	0.850
Colorado	Colorado Springs	0.876	North Dakota	Fargo	0.896
Colorado	Denver	0.918	Ohio	Columbus	0.931
Connecticut	New Haven	1.062	Oklahoma	Oklahoma City	0.881
Delaware	Dover	1.051	Oklahoma	Tulsa	0.852
District of Columbia	Washington, D.C.	0.980	Oregon	Bend	0.984
Florida	Fort Meyers	0.866	Pennsylvania	Norristown	1.038
Florida	Miami	0.887	Pennsylvania	State College	0.959
Florida	Orlando	0.888	Rhode Island	Providence	1.058
Florida	Tampa	0.880	South Carolina	Greenville	0.878
Georgia	Atlanta	0.912	South Dakota	Sioux Falls	0.925
Hawaii	Honolulu	1.220	Tennessee	Memphis	0.896
Idaho	Boise	0.935	Texas	Austin	0.863
Illinois	Chicago	1.172	Texas	Dallas	0.852
Indiana	Indianapolis	0.920	Texas	Houston	0.866
Iowa	Des Moines	0.960	Texas	San Antonio	0.854
Kansas	Wichita	0.874	Utah	Ogden	0.886
Kentucky	Louisville	0.913	Utah	Provo	0.899
Louisiana	Baton Rouge	0.879	Utah	Salt Lake City	0.914
Maine	Portland	0.971	Vermont	Burlington	0.947
Maryland	Baltimore	0.959	Virginia	Fairfax	0.926
Massachusetts	Boston	1.124	Virginia	Winchester	0.883
Michigan	Ann Arbor	0.971	Washington	Tacoma	1.040
Minnesota	Minneapolis	1.067	West Virginia	Charleston	0.949
Mississippi	Biloxi	0.848	Wisconsin	La Crosse	0.950
Missouri	Springfield	0.895	Wyoming	Casper	0.905

*Source: RSMeans *Residential Cost Data 2024*. Sample cities are listed in this table; check RSMeans for additional locations.

APPENDIX C: REFERENCE HOUSES

The reference houses used for this analysis and their site locations were initially defined in a report titled *Estimated Costs of the 2015 IRC Code Changes*.[5] The houses were selected for their similarity to new home offerings in the six metropolitan areas selected as site locations – Miami, FL, Dallas, TX, Los Angeles, CA, Seattle, WA, New York, NY, and Chicago, IL – and their size proximity to a national average of 2,607 SF. Subsequent reports added three site locations for assessing energy use: Helena, MT, Duluth, MN, and Fairbanks, AK. Additional information on the basis for the reference house configurations is provided below. Elevations and floor plans are provided in Appendices D through G.

Estimated Costs of the 2015 IRC Code Changes

Reference House Configurations

The four Reference House designs used in this analysis 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 (Table C1) and number of stories for new single-family detached construction over the previous nine-year period. (Table).

Table C1. New Construction Foundation Types

Slab	54%
Crawlspace	17%
Basement	30%

Table C2. New Construction Number of Stories

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

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

Table C3 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.

[5] Estimated Costs of the 2015 Code Changes, Home Innovation Research Labs, www.homeinnovation.com/trends_and_reports/featured_reports/estimated_costs_of_the_2015_irc_code_changes

[6] Characteristics of New Housing, U.S. Census Bureau, www.census.gov/construction/chars/completed.html

[7] Housing Construction Starts, www.census.gov/construction/bps/pdf/2013statepiechart.pdf

Table C3. Sites for Reference Houses

Reference House	Climate Zone	1	2	3	4
Foundation		Slab	Slab	Basement	Basement
Miami	1	X	X		
Dallas	2	X	X		
Lose Angeles	3	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 data from Home Innovation's *2013 Annual Builder Practices Survey*[8]*(ABPS)*, the typical Heating, Ventilation, and Air Conditioning (HVAC) systems used in new houses are summarized in Table C4. According to the ABPS, 44% of new homes are cooled with a central air conditioner. These results influenced the selection of a gas furnace with a central (electric) air conditioner as the HVAC system in each of the reference houses.

Table C4. 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%

The furnace location has been designated as a platform in the attic for both slab reference houses, a practice that is common in Florida and Texas, where the weather is temperate year-round, and thus, the location is practical. A house built on a slab foundation in a cold climate zone would have the HVAC and water heating equipment located within conditioned space.

Reference House Features

The statistics presented in the foregoing tables support Reference House features that are detailed in Table C5.

Table C5. Features of the Reference Houses

	Reference House			
Feature	**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

[8] Annual Builder Practices Survey, www.homeinnovation.com/trends_and_reports/data/new_construction

Laundry Room	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
Basement, 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 [removed for 2024 study]	Brick, 4 sides	Brick, 4 sides	Brick, 4 sides	Stucco
Roof Pitch	12/12	6/12	9/12	4/12

APPENDIX D REFERENCE HOUSE 1: ONE-STORY SLAB FOUNDATION

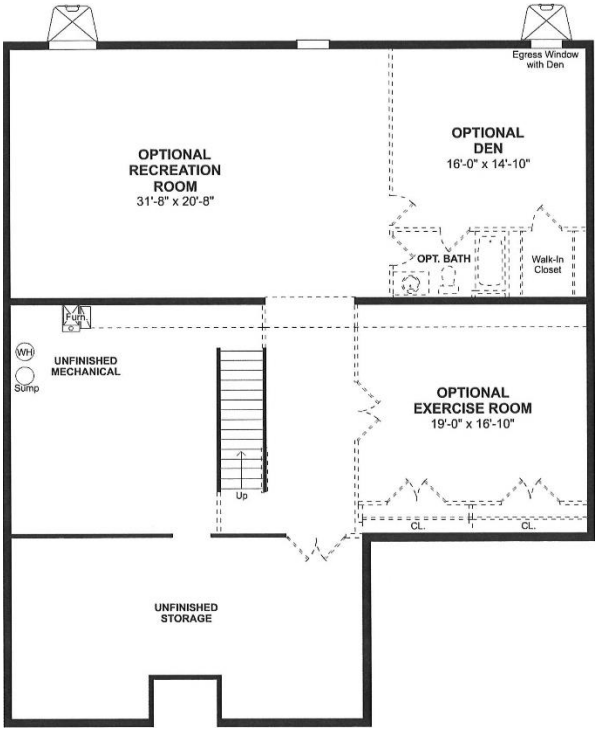
Courtesy: LionsGate Homes at The Creekside

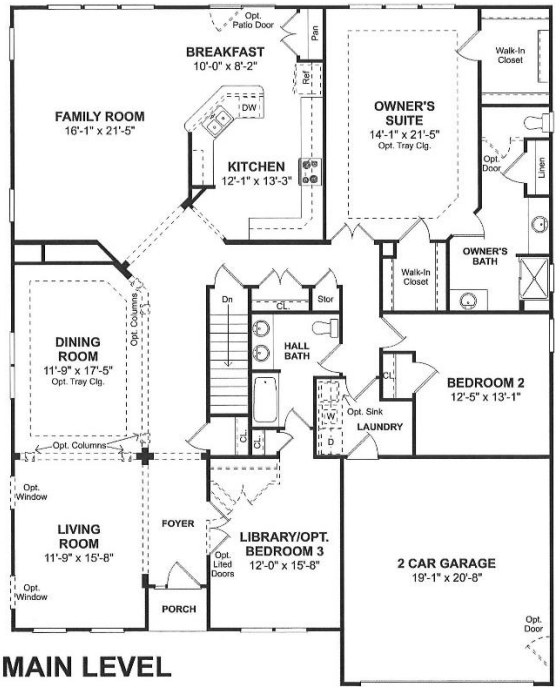
APPENDIX E REFERENCE HOUSE 2: TWO-STORY SLAB FOUNDATION

Courtesy: Meritage Homes at Riverstone

APPENDIX F REFERENCE HOUSE 3: ONE-STORY BASEMENT FOUNDATION

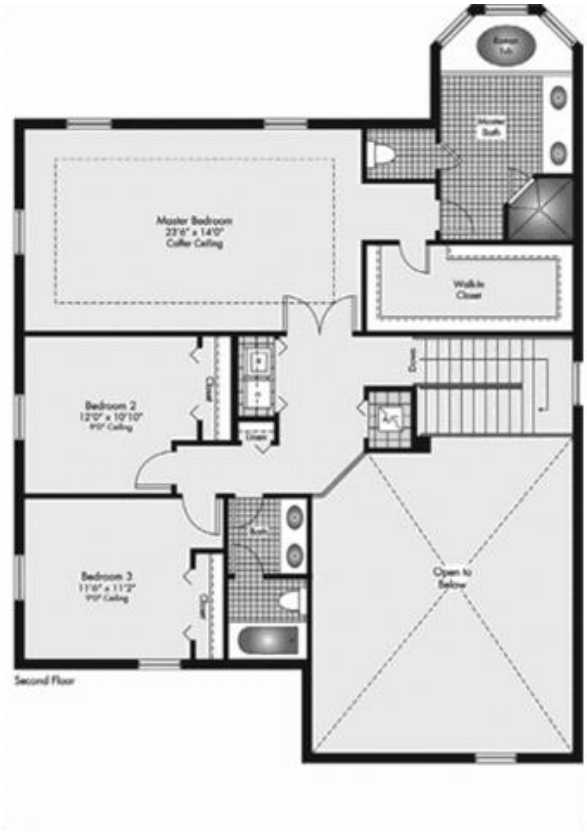
Courtesy: K Hovnanian Four Seasons at New Kent Vineyards





APPENDIX G REFERENCE HOUSE 4: TWO-STORY BASEMENT FOUNDATION

Courtesy: Lennar at Sorento Estates

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