Appendix C

Thermal Characteristics of Homes Built in 1974, 1973, and 1961

by the National Association of Home Builders
Research Foundation, Inc., July 1977

INTRODUCTION

This report contains information in thermal characteristics of homes built in 1973 and in 1974, and thermal insulation data for 1961 homes. In addition, comments from 83 builders regarding levels of insulation being installed in 1976-77 are included.

Scope and Method

In 1974, the Research Foundation conducted a national survey of builder practices for the National Association of Home Builders (NAHB). The study covered a wide range of home builder practices for homes built in 1973. Results represented a composite of about 84,000 homes built by over 1,600 builders selected at random from NAHB membership rolls. Data were summarized for four **(4)** census regions.

In 1975, a survey of over 120,000 single family dwellings was completed for homes built in 1974. This survey was taken from the entire membership of NAHB and was summarized by nine (9) census regions. Housing characteristic data were collected in sufficient detail for thermal characteristics to be analyzed.

In 1961, F. W. Dodge Corporation conducted a detailed material inventory of 1,000 randomly selected dwellings. Data from this inventory are included in this report.

Another extensive survey is being conducted by the Research Foundation for homes built in 1975 and 1976. Data from this survey are not yet available but a review of several thousand questionnaires revealed many builders are installing more insulation than the average and some builders are installing less insulation than the average. Eighty-three of these untypical builders were surveyed in an attempt to discover what causes builders to make changes related to energy conservation. Results of that survey are included.

1974 HOUSING CHARACTERISTICS

This section contains characteristics of **about 120,000 single family detached homes** built in 1974, summarized by nine census **regions. Following are the regions and the percentage of the total number of homes with in each region.**

Region	Percent of homes
New England (N. E.) ...	3
Middle Atlantic (M.A.). ...	10
East North Central (E. N. C.)	15
West North Central (W.N.C.).	7
South Atlantic (S. A.)	20
East South Central (E.S.C.), .,	6
West South Central (W. S. C,) .,	15
Mountain (M) ...	9
Pacific (P .)	15

1a. Finished Floor Area - Percent by Region

Square Footage	N.E.	M.A.	E.N.C.	W.N.C.	S.A.	E.S.C.	W.S.C.	M.	P.	Total U.S.
Under 800	7	4	3	5	1	3	*	2	1	2
800 - 999	8	9	5	7	2	2	*	5	1	3
1000 - 1199	24	23	18	23	14	19	8	16	12	16
1200 - 1399	16	16	16	27	24	18	9	21	17	18
1400 - 1599	8	7	14	13	17	17	23	22	26	18
1600 - 1799	8	6	12	5	11	12	26	11	16	14
1800 - 1999	7	10	8	7	12	10	12	5	10	10
2000 - 2199	4	8	10	5	10	8	7	10	8	8
2200 - 2399	9	6	5	3	4	4	6	3	5	5
2400 - 2799	6	8	6	3	3	4	6	3	3	4
Over 2800	3	3	3	2	2	3	3	2	1	2
Total	100	100	100	100	100	100	100	100	100	100
Average SF	1,518	1,570	1,507	1,429	1,584	1,610	1,746	1,535	1,604	1,585

1b. Finished First Floor Area - Percent by Region (Estimated)

Percent on 1st Floor	72.3	67.5	76.0	79.9	89.2	86.5	94.4	87.7	83.3	84.2
Sq. Footage	1,098	1,060	1,145	1,141	1,413	1,393	1,648	1,346	1,336	1,334

1c. Wood Frame vs. Concrete Slab 1st Floor, by Region

Wood Frame %	96	88	87	99	47	54	3	49	44	52
Wood Frame SF	1,054	933	996	1,130	664	752	49	660	588	694
Slab %	4	12	13	1	53	46	97	51	56	48
Slab SF	44	127	149	11	749	641	1,599	686	748	640

* Less than 1%

2. Number of Stories - Percent by Region

Type House	N.E.	M.A.	E.N.C.	W.N.C.	S.A.	E.S.C.	W.S.C.	M.	P.	Total U.S.
One Story	36	35	48	53	77	69	87	73	65	65
Two Story	31	33	24	12	13	11	12	6	24	18
Bi-Level	26	25	12	20	4	12	1	10	5	10
Split Level	7	7	16	15	6	8	1	11	6	7
Total	100	100	100	100	100	100	100	100	100	100
Average Stories/House*	1.4	1.4	1,4	1.3	1.2	1.2	1.1	1.2	1.3	1.3

3. Square Footage of Exterior Wall - by Region

Opaque Wall	1,190	1,221	1,188	1,087	1,134	1,201	1,193	1,091	1,194	1,162
Windows & Doors	287	296	282	282	297	294	324	297	298	295
Total SF	1,477	1,517	1,470	1,369	1,431	1,495	1,517	1,388	1,1192	1,457

* Bi-level considered one story, split level two story

4. Heating and Cooling Equipment - Percent by Type

Heating Equipment	N.E.	M.A.	E.N.C.	W.N.C.	S.A.	E.S.C.	W.S.C.	M.	P.	Total U.S.
Warm air furnace	28.2	52.2	85.7	91.8	61.0	69.0	96.9	81.2	76.2	75.0
Hot water system	37.9	20.0	1.3	2.0	0	0	1.4	1.2	6.0	4.6
Heat pump	0	3.4	7.0	2.6	10.4	22.2	0.7	11.6	1.8	6.4
Electric baseboard	33.9	21.7	4.9	1.6	16.8	3.9	0.9	4.2	9.7	9.7
Electric radiant ceiling	0	2.4	1.1	2.0	8.9	4.3	0	1.6	4.7	3.4
None	0	0.3	0	0	2.8	0.6	0.1	0.2	1.6	0.9
Heating Fuel										
Gas	39.3	42.4	74.7	76.5	22.8	34.2	41.4	55.7	72.7	50.8
Electric	38.5	30.4	22.4	22.4	69.9	65.2	58.5	42.9	22.6	43.4
Oil	22.2	27.2	2.9	1.1	4.5	0	0	1.2	3.1	5.4
Cooling Equipment										
None	81.8	49.4	43.8	19.0	7.5	6.0	0.7	33.3	54.4	28.5
Combination heating & cooling (cooling part of heating system)	14.2	36.8	40.3	61.3	59.5	51.3	75.8	36.5	34.5	63.2
Individual room	2.1	4.6	3.1	14.2	3.7	5.9	3.4	0.8	2.1	4.1
Split system (cooling separate from heating)	1.9	5.7	5.6	2.8	19.0	14.2	18.7	9.1	7.2	11.1
Heat pump	0	3.5	7.0	2.7	10.3	22.6	0.6	11.6	1.8	6.6
Other	0	0	0.2	0	0	0	0.8	8.7	0	0.9
Cooling Fuel										
Gas	0	2.9	4.1	5.2	1.9	2.2	2.7	3.5	1.7	2.5
Electric	18.2	47.7	52.1	75.8	90.6	91.8	96.6	63.2	43.9	68.8

5. Thermal Resistance (R) Values of Insulation - Percent

Exterior Walls	N.E.	M.A.	E.N.C.	W.N.C.	S.A.	E.S.C.	w.s.c.	M.	P.	Total U.S.
R-Values										
None	6.0	1.1	1.2	1.9	29.5	2.2	4.1	0.8	6.0	8.3
R-3	0	0	0	0	2.6	0.8	0.3	40.8	9.6	5.9
R-7	0	6.3	6.6	0	8.5	9.7	5.9	2.9	15,1	7.3
R-I 1	91.1	92.6	91.9	90.5	59.2	86.4	89.7	55.5	69.2	77.8
R-19	0	0	0	5.7	0	0	0	0	0	0.4
Other	2.9	0	0.3	1.9	0.2	0.9	0	0	0. 1	0.3
Ceiling/Roof										
None	0	1.6	3.3	2.3	1.3	4.2	5.4	0.8	4.8	2.9
R-9	2.8	0.7	7.5	8.9	8.5	4.7	3.3	1.2	4.5	5.2
R-11	0	11.4	0	0	0.7	2.0	1.6	11.6	16.3	5.1
R-1 3	20.7	9.3	35.9	32.7	54.3	45.6	45.6	7.1	28.2	34.7
R-18	6.9	3.6	23.7	24.5	5.6	15.1	5.2	9.4	4.4	10.2
R-19	32.7	46.0	12.5	1.1	22.2	13.9	26.9	47.8	41.6	27.3
R-22	29.1	27.2	13.2	9.1	1.9	11.5	11.3	20.8	0.1	10.7
R-26	4.8	0.2	3.6	19.6	5.1	2.1	0.7	1.6	0	3.5
Other	3.0	0	0.3	1.8	0.4	0.9	0	0	0.1	0.4
Floor Joists										
None	62.2	53.4	79.9	69.8	50.8	52.4	39.6	83.4	83.6	63.4
R-7	0	7.7	1.4	0	0	0	0	1.0	0	1.0
R-11	28.6	38.9	10.7	0	49.1	47.1	60.4	15.6	16.4	32.1
R-19	8.1	0	7.9	29.6	0	0	0	0	0	3.4
Other	1.1	0	0.1	0.6	0.1	0.5	0	0	0	0.1

6. Average Number of Windows and Sliding Glass Doors Per House

Windows by Glazing	N.E.	M.A.	E.N.C.	W.N.C.	S.A.	E.S.C.	W.S.C.	M.	P.	Total U.S.
Single glaze - no storm	4.6	5.7	4.1	4.7	8.6	5.6	10.2	8.0	9.7	6.4
Double insulating glass	1.6	3.6	4.1	2.7	1.6	5.4	0.6	2.2	1.4	2.9
Single glaze with storms	6.2	4.7	6.3	6.3	2.2	2.2	0.2	0.6	0.3	3.0
Total	12.4	14.0	14.5	13.7	12.4	13.2	11.0	10.8	11.4	12.3
Sliding Glass Doors	0.6	0.8	0.5	0.8	0.6	0.4	0.9	0.9	1.0	0.7
Windows by Frame Type										
Wood	11.9	10.5	9.4	10.2	6.6	7.2	1.5	1.1	0.9	5.6
Aluminum	0.3	2.5	5.1	3.5	5.8	6.0	9.5	9.7	10.5	6.7
Other	0.2	1.0	0	0	0	0	0	0	0	0
Total	12.4	14.0	14.5	13.7	12.4	13.2	11.0	10.8	11.4	12.3

7. Average Number of Exterior Doors Per House

Doors by Type										
Wood	2.74	1.84	1.69	2.94	2.75	2.93	2.86	2.51	2.83	2.57
Steel (Insulated)	0.71	1.48	1.72	0.53	0.71	0.69	0.37	0.62	0.31	0.79
Other	0.03	0.06	0.04	0.10	0.16	0.04	0.02	0	0.03	0.05
Total	3.48	3.38	3,45	3.57	3.62	3.66	3.25	3.13	3.17	3.41
Storm Doors	1.90	1.20	1.80	2.70	1.50	1.70	1.00	1.30	1.10	1.50

8. **Weighted Average Thermal** Resistance (R) Values of All Other Materials in Walls, Ceilings and Floors

Exterior Wall "R" Values	N.E.	M.A.	E.N.C.	W.N.C.	S.A.	E.S.C.	W.S.C.	M.	P.	Us.	Total
Outside surface film	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17		0.17
Siding	0.71	0.35	0.37	0.71	0.67	0.52	0.51	1.02	0.48		0.57
Sheathing	0.68	0.79	1.24	0.91	0.69	1.07	0.82	0.55	0.44		0.82
Interior surface material material	0.44	0.44	0.46	0.44	0.44	0.44	0.45	0.44	0.46		0.44
Interior surface film	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68		0.68
Subtotal	2.68	2.43	2.92	2.91	2.65	2.88	2.63	2.86	2.23		2.68
Insulation	10.30	9.30	10.60	11.30	7.20	10.30	10.30	6.70	8.80		9.20
Total	12.98	11.73	13.52	14.21	9.85	13.18	12.93	9.56	11.03		11.88
Ceiling/Roof											
Outside surface film	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61		0.61
Interior surface material	0.44	0.44	0.46	0.44	0.44	0.44	0.45	0.44	0.46		0.44
Interior surface film	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61		0.61
Subtotal	1.66	1.66	1.68	1.66	1.66	1.66	1.67	1.66	1.68		1.66
Insulation	17.90	17.90	15.70	16.60	14.80	15.10	15.10	18.10	14.60		15.80
Total	19.56	19.56	17.38	18.26	16.46	16.76	16.77	19.76	16.28		17.46
Wood Floor											
Inside surface film	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92		0.92
Finished flooring	0.98	1.05	1.25	1.36	1.20	1.32	1.25	1.24	1.25		1.22
Underpayment & sheathing	1.19	1.09	1.12	1.06	1.13	1.22	1.21	1.17	1.46		1.19
Underfloor surface film	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92		0.92
Subtotal	4.01	3.98	4.21	4.26	4.17	4.38	4.30	4.25	4.55		4.25
Insulation	4.80	4.80	2.80	5.70	5.40	5.20	6.60	1.80	1.80		4.30
Total	8.81	8.78	7.02	9.96	9.57	9.58	10.90	6.05	6.35		8.55

1973 Housing Characteristics

This section contains characteristics of about 84,000 homes built in *1973*, a pre oil embargo year. Data are summarized by four census districts: Northeast, North Central , South and West.

1a. Finished Floor Area By Region

	North East	North Central	South	West	Total U.S.
Under 1,000 SF	23	6	*	1	4
1,000 - 1,199	28	23	9	25	19
1,200 - 1,399	15	26	15	21	19
1,400 - 1,599	8	17	17	25	18
1,600 - 1,799	5	6	21	11	13
1,800 - 1,999	4	6	15	6	9
2,000 - 2,199	3	6	11	7	8
2,200 - 2,399	6	3	7	3	5
2,400 - 2,799	5	4	3	1	3
Over 2,800	3	3	2	*	2
Total	100	100	100	100	100
Average SF	1,514	1,515	1,676	1,548	1,588

1b. Finished First Floor Area - Percent By Region (Estimated)

Percent on 1st Floor	71.4	76.6	89.3	84.4	81.2
Square footage	1,081	1,160	1,497	1,306	1,289

1c. Wood Frame vs. Concrete Slab First Floor, By Region (Estimated)

Wood frame %	92	92	26	48	64
Wood frame SF	995	1,067	299	627	825
Slab %	8	8	80	52	36
Slab SF	86	93	1,198	679	536

* Less than 1%

2. Number of Stories Percent by Region

Type House	North East	North Central	South	West	Total U.S.
One Story	34.3	47.9	76.5	66.2	57.8
Two Story	32.7	20.4	12.2	17.6	18.9
Bi-Level	25.7	15.4	5.8	7.8	13.8
Split Level	7.3	16.3	5.5	8.4	9.5
Total	100.0	100.0	100.0	100.0	10.0
Average Stories/House	1.4	1.4	1.2	1.3	1.3

3. Square Footage of Exterior Wall, by Region

Opaque Wall	1,187	1,178	1,186	1,133	1,171
Windows and Doors	286	287	312	291	298
Total SF	1,473	1,465	1,498	1,424	1,469

4. Heating and Cooling Equipment - Percent by Type

	North East	North Central	South	west	Total U.S.
Heating Equipment					
Warm air furnace	43.3	93.?	83.3	80.2	80.8
Hot water system	21.4	2.0	0.4	0.5	3.4
Heat pump	0.1	0.4	6.0	4.3	3.3
Electric baseboard	30.3	2.0	4.0	1.2	5.7
Electric radiant ceiling	C.4	1.2	0.3	8.7	2.4
Other	4.5	1.3	6.0	5.1	4.4
Heating Fuel					
Gas	38.7	70.4	31.6	80.9	51.9
Electric	42.2	28.9	67.2	19.0	45.1
Oil	19.1	0.7	1.2	0.1	3.0
Cooling Equipment					
None	59.2	37.9	5.2	47.5	29.2
Central system	36.2	61.4	88.8	46.4	66.7
Individual room	4.5	0.3	0	1.8	0.8
Heat pump	0.1	0.4	6.0	4.3	3.3
Cooling Fuel					
Gas	0.5	1.2	0.9	1.0	1.7
Electric	40.3	60.9	93.9	51.5	69.1

5a. **Thermal Resistance (R) Values of Insulation - Percent**

	North East	North Central	South	West	Total U.S.
Exterior Walls					
R-Values					
None	0	0.1	3.5	2.5	2.1
R-3	0,6	0.3	2.3	0.5	1.2
R-7	27.0	26.7	6.6	20.9	17.1
R-n	70.6	71.4	81.9	70.4	76.1
Other	1.7	1.5	5.7	5.7	4,5
Ceiling/Roof					
None	0.5	0.2	0.4	3.0	1.0
R-7	1.8	0.8	0.1	0.2	0.5
R-9	2.6	5.6	4.5	17.0	7.5
R-11	30.0	16.8	5.0	11,5	12.4
R-13	11.7	39.4	46.5	38.5	38.6
R-18	4.6	15.4	11.4	1.2	9.3
R-19	46.7	16.1	31.9	16.8	26.4
Other	2.1	5.7	0.2	11.8	4.3
Wood Floor					
None	53.9	70.5	44,9	82.0	61.4
R-7	6.2	3.6	28.2	10.2	14.1
R-n	35.1	18.5	16.0	6.9	17.6
R-19	3.7	6.3	6.5	0.2	4.8
Other	1.2	1.1	4.4	0.7	2.1

5b. Weighted **Average "R" Values**

Walls	9.8	9.9	10.1	9.6	10.0
Ceiling	15.2	14.2	15.2	12.7	14.4
Floor	5.0	3.5	5.2	1.5	4.0

6. Average Number of Windows Per House (Estimate)

Windows by Glazing	North East	North Central	South	West	Total U.S.
Single glaze - no storms	5.9	4.0	8.7	9.2	7.5
Double insulating glass	4.0	7.8	1.7	1.5	3.1
Single glaze with storms	3.8	2.4	1.8	0.5	2.0
Total	13.7	14.2	12.2	11.2	12.6
Windows by Frame Type					
Wood	10.7	9.6	3.9	0.1	5.1
Aluminum	2.0	4.6	8.2	10.8	7.3
Other	1.0	0	0.1	0.3	0.2
Total	13.7	14.2	12.2	11.2	12.6

7. Average Number of Exterior Doors Per House

Doors by Type					
Wood	1.8	1.9	2.5	2.5	2.3
Steel (insulated)	1.6	1.6	0.7	0.5	1.0
Other	0.1	0.1	0	0.1	0.1
Total	3.5	3.6	3.2	3.1	3.4
Storm Doors	0.4	1.2	0.5	0.3	0.6

8. Weighted Average Thermal Resistance (R) Values of All Materials in Walls, Ceilings and Floors

	North East	North Central	South	west	Total U.S.
Exterior Wall Materials	2.5	2.9	2.7	2.5	2.7
Insulation	9.8	9.9	10.1	9.8	10.0
Total	12.3	12.8	12.8	12.3	12.7
Ceiling/Roof Materials	1.7	1.7	1.7	1.7	1.7
Insulation	15.2	14.2	15.2	12.7	14.4
Total	16.9	15.9	16.9	14.4	16.1
Wood Floor Materials	4.0	4.2	4.3	4.4	4.3
Insulation	5.0	3.5	5.:	1.5	4.0
Total	9.0	7.7	9.5	5*9	8.3

1961 Housing Characteristics

This section contains a summary of housing characteristic data for 1,000 randomly selected homes built in 1961. Data were collected by F.W. Dodge and are summarized by four census districts.

1961 HOUSING CHARACTERISTICS

1. Average Size By Region

Northeast	1,442 SF
North Central	1,358 SF
South	1,506 SF
West	1,497 SF
Total U.S.	1,448 SF

2. Number Of Stories Percent By Region

Region	One	Two or More	Split-Level
Northeast	60	15	25
North Central	92	4	4
South	90	7	3
West	92	8	1
Total U.S.	85	8	7

3. Foundations Percent By Region

Region	Basement	Crawl Space	Concrete Slab
Northeast	80	12	8
North Central	75	18	7
South	10	35	55
West	16	46	38
Total U.S.	45	28	27

4. Insulation Percent By Region

Region	Exterior Walls	Ceiling/Roof	Perimeter
Northeast	87	92	9
North Central	75	100	8
South	50	85	6
West	49	70	4
Total U.S.	65	92	7

5. Heating Fuel Percent By Region

Region	Gas	Electric	Oil
Northeast	50	1	49
North Central	81	2	17
South	70	1	14
West	89	6	5
Total U.S.	73	5	22

Builder Survey

This section contains the results of a survey of eighty-three single family home builders. An in-depth survey of all homes built in 1975 and 1976 revealed the names and locations of many builders who are installing more insulation than average and some builders who are installing less insulation than average. Following are comments from eighty-three of these builders.

BUILDER SURVEY RESULTS

1. **Sharon, MA builder of ten $87,000 homes.**

   Uses R-19 in walls and R-30 in ceiling with insulating glass windows. May consider more insulation if fuel costs continue to increase.

2. **Warwick, RI builder of fifteen $37,000 homes.**

   Uses R-13 in walls, R-22 in ceiling and storm windows. Recently improved insulation values in ceiling because of energy costs.

3. **West Haven, CT builder of forty to fifty $50,000 homes.**

   Uses R-n in walls, R-n in ceiling and single pane windows, all low values for New England. Builder does shade southerly facing windows with roof overhang. He offers R-19 insulation in ceiling as an option because he "offers the buyer the choice, not simply dictate what I or anyone else thinks best!"

   Builder believes fuel costs in a free economy will require maximum insulation levels without more regulations. "We have enough regulations al ready," he said.

4. **Warwick, RI builder of twelve $68,000 homes.**

   Uses R-13 in walls and R-19 in ceiling. Does not plan on changing levels of insulation in the next year. Provides storm windows. Energy costs may lead him to increase levels of insulation.

5. **Montpelier, VT builder of $38,000 homes.**

   Uses R-19 in walls, R-38 in ceilings and insulated glass windows with storm windows. Plants deciduous trees to provide shade in summer for south facing windows. Plans on retaining these levels in the next year. If climate turns **colder and** energy costs get higher, he will consider increased insulation levels.

6. **Boston, MA builder of 50 $37,000 homes.**

   Uses R-13 in walls and ceilings and single glazed windows. Plans on increasing to R-22 in ceilings next year because of energy savings.

7. **Burlington, VT builder of thirty** $28,000 **homes.**

   Uses R-13 in walls, R-30 in ceilings and storm windows in his homes which are low cost. He plans to improve levels by insulating basement walls, using insulated doors, polystyrene behind electrical outlet boxes and more liberal use of caulking. He will do these things because of customer demand and awareness.

   He may increase insulation levels because of economic factors and because of a sense of national and local responsibility.

8. Nashua, NH builder of sixty $43,000 homes.

Uses R-19 in walls , R-30 i n ceiling and storm windows. Does not plan on making any changes in future because, "We feel we have reached the cost/benefit ratio. "

9. Pittsburgh, PA builder of eight $67,000 homes.

Uses R-19 in walls, R-30 in ceilings and insulating glass windows. Plans on changing to R-38 in ceilings next year. Believes conservation features to be a marketing point and has built to these high insulation standards for past ten years.

10. Southern New Jersey builder of thirty $40,000 homes.

Uses R-16 in walls, R-30 in ceilings and storm windows. Achieves R-16 with R-11 fiberglass batts and Dow R-5 Styrofoam sheathing. Does not plan on making any changes because, "We are currently building houses which exceed all insulation standards now in effect." Rising fuel costs might cause him to increase insulation levels.

11. Pittsford, NY builder of twelve $74,000 homes.

Uses R-15 walls, R-30 ceilings and storm windows. Polystyrene sheathing is used to obtain R-15. Has been using this method for over a year. Plans on insulating basement walls next year because of Public Service Commission regulations. Public demand could cause him to increase insulation levels and public refusal to pay for increased levels might cause him to lower insulation levels.

12. Rochester, NY builder of twenty $45,000 homes.

Uses R-11 in walls and either R-30 or R-38 in ceilings. Also uses storm windows. Plans on increasing ceiling levels and insulating basement next year because of increased heating costs.

13. Fairport, NY builder of eight $58,000 homes.

Uses R-n walls, R-19 ceilings and storm windows. Plants trees to shade southern windows from summer sun. Plans on increasing ceiling to R-30 and insulating basement. Also plans to caulk around all doors and windows.

14. Reading, PA builder of fifteen $64,000 homes.

Uses R-n walls, R-19 ceilings and insulating glass windows. May increase levels in future if fuel costs increase or availability becomes a problem. Also may increase levels because of "sales appeal ."

15. Lancaster, PA builder of fifteen $75,000 homes.

R-19 in walls, R-30 in ceilings and insulating glass with storm

windows. Does not plan on making changes because "I feel present levels are adequate."

16. Rochester, NY builder of thirty $55,000 homes.

Uses R-n in walls, R-30 in ceilings and insulating glass windows. Does not plan on changing levels in the future.

17. Syracuse, NY builder of twenty $50,000 homes.

Uses R-13 in walls, R-30 in ceilings and storm windows. Plans on reducing air infiltration and improving wall sheathing for better R values.

18. Philadelphia, PA builder of twenty $40,000 homes.

Uses R-12 in walls, R-22 in ceilings and single glazed windows. Doesn't plan on making any changes next year.

19. Grand Rapids, MI builder of 75-100 $49,000 homes.

Uses R-13 in walls, R-36 in ceilings and storm windows. May go to triple glazed windows and sliding glass door in near future. Michigan energy code (effective 7/1/77) may influence builder to make changes. Public awareness of insulation levels may cause some increase in R-values.

Builder said "We will continue to look for new and better ways to achieve best standards possible using the cost/benefit approach."

20. Quincy, IL builder of eight $74,000 homes.

Uses R-19 in walls, R-40 in ceiling and storm windows. Does not plan on changing insulation levels but does plan on improving installation procedures. Builder says his customers are very satisfied at present. Higher utility bills might make him increase insulation levels.

21. Canton, OH builder of twenty $51,000 homes.

Uses R-13 in walls, R-37 in ceilings and triple glazed windows. Does not plan on changing next year. Will retain present levels because of fuel savings and because home buyers are requesting these levels.

22. Deerfield, IL builder of thirty $105,000 homes.

Uses R-11 in walls and R-13 in ceiling. Some single glazed, some insulating glass and some storms are installed as options. Low level of ceiling insulation is "standard" with higher levels offered as options to buyers. Believes in providing what customer requests and can afford to spend.

Energy crisis, government credits and customer, requests will influence builder to increase insulation levels.

23. Lindenhurst, ILL builder of twenty-five $58,000 homes.

Uses R-n in walls, R-19 in ceilings and storm windows or insulating glass windows. May increase insulation levels next year because of public awareness, conservation and utility costs.

24. Flint, MI builder of $70,000 to $140,000 homes.

Uses R-13 in walls, R-24 in ceiling and insulating glass windows. Does not plan on making changes next year. Believes he is at optimum now.

25. Green Bay, WI builder of twenty $50,000 homes.

Uses R-19 in walls, R-30 in ceiling and insulating glass windows. Builder believes that people are quite conscious of the value of insulation in saving heating dollars and are willing to pay initially for increased insulation. He also believes buyers tend to associate better insulating practices with better all around building practices.

Would decrease levels only if competitive building tends to reduce price of homes to a point where minimum levels of insulation would be acceptable.

26. Milwaukee, WI builder of 125 single family detached dwellings and 75 single family attached dwellings with $53,000 average selling price.

Uses R-13 wall and R-22 ceiling insulation and storm windows. 24″ overhang shades windows from summer sun. Plans on retaining present insulation levels because of fuel conservation. Lower cost insulation would prompt him to use more.

27. Fargo, ND builder of fifteen $70,000 homes.

Uses R-19 in walls and R-52 in ceilings. Windows are all insulating glass. Uses a 36″ overhang to shade south facing windows from summer sun. Believes he has already attained maximum insulating levels.

28. Independence, MO builder of 100 $41,000 homes.

Uses R-n in walls, R-13 in ceiling and storm windows. Will increase levels only if codes or competition require it.

29. Hutchinson, KS builder of $55,000 homes.

Uses R-19 in walls, R-38 in ceilings and insulating glass windows. 2'-6" overhangs shade south facing windows from summer sun. Plans on using 5/8″ foil-faced foam plastic sheathing in the future.

30. St. Louis, MO builder of 120 $45,000 homes.

Uses R-11 in walls, R-19 in ceilings and insulating glass windows. Plans on increasing insulation levels next year because buyers are asking for it. Will definitely increase levels if required by governmental regulations.

31. Shakopee, MN builder of fifteen $55,000 homes.

Uses R-18 in walls, R-38 in ceiling and triple glazed windows. Does not plan to add to present levels. Added polystyrene sheathing last year.

32. Sioux Falls, SD builder of twenty-five $79,000 homes.

Uses R-19 in walls, R-38 in ceiling and triple glazed windows in some homes. Next year will use more triple glazing.

33. Wichita, KS builder of twenty $44,000 homes.

Uses R-18 in walls and R-19 in ceiling. Also uses storm windows. Does not plan on making any changes unless utility costs force him to increase insulation.

34. Lincoln, NE builder of eighteen $47,000 homes.

Uses R-n in walls, R-19 in ceiling and storm windows. Plans on increasing insulation amounts and improving installation methods next year because home buyers are requesting it and because of energy savings.

35. Topeka, KS builder of five $56,000 homes.

Uses R-17 in walls, R-30 in ceiling and double glazed windows. He keeps glass area to a minimum and provides 24" overhang to shade windows from summer sun. Is considering **2x6** walls for electrically heated houses because of natural gas shortage. Builder believes added insulation is a selling feature and considers workmanship of insulation installation more important than high "R" values. Would prefer properly installed R-n to poorly installed R-19 with gaps, etc.

He believes we must encourage insulation of attached garage walls and ceilings, insulated basements or crawl spaces versus concrete slabs, open living areas for better air circulation, natural or artificial shade around A.C. compressor, attic power ventilators, etc.

He believes we must discourage high vaulted ceilings, ducted range hoods, excessive glass, fireplace chimneys on outside walls, etc.

36. Cedar Rapids, 1A builder of $51,000 homes.

Uses R-12 in walls and R-19 in ceiling. Plans on using more

insulation in ceiling to save fuel. Installs storm windows .

37. Winter Haven, FL builder of fifty $21,000 homes .

Uses no insulation in concrete block walls and R-9 in ceiling in these very low cost homes. Uses single glazed windows. Plans on making no changes in the future.

38. Myrtle Beach, SC builder of from three to six $112,000 homes.

Varies insulation from R-16 to R-19 in walls and from R-30 to R-38 in ceilings. Uses insulating glass windows. Some of his homes have large overhangs to shade windows from summer sun.

He offers good insulation package and sales pitch on what the low energy home should save in the long run. The final decision is the buyer's and his ability to pay.

Builder believes his customers are interested in low energy homes and takes pride in his homes and in giving the buyers what they want.

He normally uses l-inch thick polystyrene sheathing to obtain an R-16 wall but is considering another sheathing product which is more expensive but will increase the wall to R-19.

Builder uses heat pumps and would like to use more water to air heat pumps. Attics are ventilated by fan. Concrete slabs are insulated with rigid foam plastic around the perimeter. In crawl space hems, 6" batt insulation is installed between joists. He talks customers into using light shades of roofing.

39. Wilkesboro, NC builder of 120 $39,000 homes.

Uses R-17 in walls, R-30 in ceiling, R-19 in wood floors and insulating glass windows. Builder believes he has done all that is possible but will conform to any code requirement in the future.

The change to higher levels of insulation were made to help the customer. Will decrease level only if power company rates are lowered.

40. Ft. Lauderdale, FL builder of sixty $35,000 townhouses.

Uses R-19 in walls and R-19 in ceilings. Will increase insulation levels if consumers require it. Builder believes a developing market shortage is causing material cost increases to the point where inexpensive alternatives for low to moderate housing are not available.

41 Seminole, FL builder of fifteen $46,000 homes.

Uses R-5 in walls and R-19 in ceilings. Single glazed windows are used. Does not plan on making any changes next year.

42. Pinellas County, Fl builder of fifty $62,000 homes.

Uses R-8 in walls, R-22 in ceiling and single glazed windows. Uses overhangs and/or tinted glass to shade against summer sun on south facing windows. Does not plan on making changes because he believes his levels are adequate for Florida.

43. Warrenton, VA builder of twelve $77,000 homes.

Uses R-28 in walls, R-40 in ceilings and insulating glass windows. Builder believes he is at maximum insulation levels and therefore plans no changes. Uses 2x6 walls and 1" polystyrene sheathing.

44. Louisville, KY builder of twenty $40,000 homes.

Uses R-n in walls, R-19 in ceiling and storm windows. Plans on reducing air infiltration by using poly film vapor barrier in future. Plans on building 2x6 walls on a presold basis only. Believes pay back will be in from 5 to 7 years.

45. Lexington, KY builder of twenty $52,000 homes.

Uses R-13 in walls and R-25 in ceiling. Installs insulating glass windows.

46. Louisville, KY builder of twenty $60,000 homes.

Uses R-11 in walls, R-22 in ceiling and insulating glass windows. Does not plan on changing insulation level. "Consumer paranoia" would be the only reason he would increase levels.

47. Louisville, KY builder of thirty-five $77,000 homes.

Uses R-16 in walls and R-22 in ceiling. Installs insulating glass windows with storm windows. May change to polystyrene sheathing to conserve energy and satisfy buyers.

48. Louisville, KY builder of ten $54,000 homes.

Uses R-n in walls, R-30 in ceiling and storm windows. Does not plan on making changes in next year because "We feel that presently we have the best insulation for the area and dollar spent." Might increase in future if the cost of fuel increases.

49. Louisville, KY builder of twenty-three $65,000 homes.

Uses R-13 in walls and R-30 in ceiling. Will not increase because he believes levels are adequate for the climate.

50. Fort Thomas, KY builder of twelve $48,000 homes.

Uses R-19 in wall, R-30 in ceiling and storm windows. Plans on increasing walls to R-24 next year because he believes it will be cost-effective. Other increases may be made due to sales appeal.

51. Lexington, KY builder of seventy single family detached and 206

single family attached dwellings .

Uses R-8 in walls, R-14 in ceilings and storm windows. Will increase levels if sales are increased or if electric bills become excessive.

52. Birmingham, AL builder of twelve $66,000 homes.

Uses R-8 in walls, R-13 in ceiling and single glazed windows. Plans on increasing ceiling to R-19 because of increased fuel costs. Customer concern may also lead to increased insulation levels.

53. Lexington, KY builder of six $65,000 homes.

Uses R-19 in walls, R-38 in ceiling and storm windows. Plans on making no changes.

54. Lubbock, TX builder of 120 $28,000 homes.

Uses R-22 in walls, R-30 in ceiling and triple glazed windows. Uses roof overhang to shade south facing windows from summer sun. Builder upped insulation program this past year and will continue to update as new and better products come on the market. Is presently testing how various plans sold over 12 month period and is monitoring energy costs. Depending on results, insulation levels may be changed.

55. Tulsa, OK builder of forty $36,000 homes.

Uses R-23 in walls, R-39 in ceiling and insulating glass windows. Does not plan on making changes next year because he believes his homes are insulated well enough. He would increase levels of insulation if buyers showed enough interest.

56. Lewisville, TX builder of thirty $60,000 homes.

Uses R-16 walls, R-26 in ceiling and single glazed windows with storm windows as an option. Builder claims his homes meet utility company recommended levels so does not plan on making changes.

Builder will increase amounts when public demands it or when energy costs require it.

57. Arlington, TX builder of twelve $54,000 homes.

Uses R-19 in walls, R-30 in ceiling and insulating glass windows. Builder says he is dedicated to building energy efficient homes.

58. Tyler, TX builder of forty $28,000 homes,

Uses R-13 in walls, R-20 in ceiling and single glazed windows. Will increase insulation levels if market demands and if utility costs increase.

59. Dallas, TX builder of one thousand $34,000 homes.

Uses R-11 in walls, R-22 in ceiling and insulating glass windows. Builder does not plan on increasing levels because he believes the present levels are optimum for the climate.

60. Marion, AK builder of twenty-five $36,000 homes.

Uses R-19 in walls, R-38 in ceiling and triple glazed windows. Uses overhang to shade windows from summer sun. Builder does not plan on changing levels in the near future. This is the builder who developed the "Arkansas Story" method of building energy efficient homes.

61. Fort Worth, TX builder of three hundred $34,000 homes.

Uses R-11 in walls, R-22 in ceiling and storm windows. plans on retaining present levels because of buyer interest and energy conservation.

62. Boulder, CO builder of thirty $44,000 homes.

Uses R-19 in walls, R-30 in ceiling and insulating glass windows. Roof overhang shades south windows against summer sun. Plans on increasing roof insulation to R-40 and changing to wood windows. Builder believes it is very important to build much smaller homes, say 1,000 square feet. He says "We are totally going to run out of fuel. We have to reduce the size of homes! !"

63. Salt Lake City, UT builder of seventy-two $41,000 homes.

Uses R-19 in walls, R-38 in ceiling and insulating glass windows. Plans on no changes because present levels are considered sufficient.

64. Salt Lake City, UT builder of sixty $40,000 homes.

Uses R-n in walls, R-19 in ceiling and insulating glass windows. Plans on increasing ceiling insulation in the next year to help relieve the energy crisis and help sales.

65. Boise, ID builder of twenty $72,000 homes.

Uses R-13 in walls, R-30 in ceiling and insulating glass windows. Builder is unsure if he will make changes next year. If so, he will increase levels for energy savings.

66. Denver, CO builder of seventy five $77.000 homes.

Uses R-13 in walls, R-30 in ceiling and insulating glass windows. Plans no changes in future. Comments, "We insulate from frost line up."

67. Denver, CO builder of forty $57,000 homes.

Uses R-n in wall, R-19 in ceiling and insulating glass windows.

May possibly change insulation levels next year depending on market conditions and cost.

68. Colorado Springs, CO builder of seventy $58,000 homes.

Uses R-13 in walls, R-38 in ceilings and insulating glass windows. Plans overhangs to reduce summer sun effect on south windows. Plans no changes next year.

69. Mesa, AZ builder of twenty-five $35,000 homes.

Uses R-6 to R-13 in walls and R-30 in ceiling. Installs insulating glass windows. Overhang shades south facing windows from summer sun. Does not plan on any changes for next year. Will make changes based on customer demand.

70. Phoenix, AZ builder of fifteen $125,000 homes.

Uses R-6 or R-19 in walls, R-38 in ceilings and about one-half single glazed and one-half double glazed windows. An overhang of 2' to 3' helps shade south facing windows from the summer sun. Plans on using more insulating glass windows next year because it is a good sales feature. Increasing electric rates may someday result in increased insulation levels.

71. Mountain Home, ID builder of one hundred $35,000 homes.

Uses R-19 in walls, R-38 in ceiling and insulating glass windows. Uses trees to shade south facing windows. Builder does not presently plan on any changes, but says, "If a better product becomes available, we will make use of it. We have a very strong energy conservation program and will continue to use new energy saving concepts. It is our intent to give our customers the best deal possible for his housing dollar."

72. Denver, CO builder of two hundred $73,000 homes.

Uses R-13 in walls, R-22 in ceilings and insulating glass windows. Shades south facing windows with overhangs, and porch and patio roofs. Does not plan on making any changes soon. "As long as natural gas is available at current rates, which are still low, there is no need to go further on insulation," he said.

Will increase when there is a demand from buyers or an awareness of future energy problems.

73. Phoenix, AZ builder of two hundred $36,000 homes.

Uses R-22 in walls, R-33 in ceiling and single glazed windows. Uses overhang to shade south windows. Plans no changes because, "We have the highest in town."

74. Denver, CO builder of one thousand, four hundred $45,000 homes.

Uses R-n in walls, R-30 in ceilings and insulating glass windows. Does not plan any changes because he believes it is not economical for homeowner or builder to increase R-values over above amounts. Might consider increase from R-n to R-13 wall insulation because of the minor cost increase. Builder believes it would be impossible for homeowner to recapture any additional costs passed on by the builder because of increased cost of insulation.

75. Fort Collins, CO builder of fourteen $69,000 homes.

Uses R-13 to R-21 in walls, R-35 in ceiling and insulating glass windows. Has 2' overhang to shade south facing windows. Plans on 2x6 exterior walls or use of styrofoam sheathing on 2x4 walls because customers are becoming more aware. Energy costs and public awareness of the value of well insulated homes will cause builder to consider increase in insulation.

76. Maui, HI builder of twenty $95,000 homes.

Uses no insulation in walls, no insulation in ceilings and single glazed windows because, according to the builder, "They are not needed in Hawaii."

77. Walnut Creek, CA builder of $110,000 homes.

Uses R-n in walls, R-19 in ceilings and single glazed windows. Not planning on changes because considers present levels adequate for climate.

78. Fresno, CA builder of forty $55,000 homes.

Uses R-19 in walls and R-30 in ceilings. Attempts to get **4 8 " overhang to shade south windows** in summer. Is considering using l-inch styrofoam sheathing. Increased levels of insulation good sales point.

79. **Seattle, WA builder of twenty-five $65,000 homes.**

Uses R-19 in walls, R-30 in ceiling and insulating glass windows. Does not plan on changes in future. Says, "We have always insulated this way".

80. Tampa, FLA builder of 150 $59,000 homes.

Uses R-3 masonry walls, R-13 in wood frame walls, R-26 **in ceilings and single glazed windows. Plans on no changes next year because, "We feel that, with our present levels, we are giving our buyers the best insulating envelope for their dollar. Increasing R values would spend our customer's dollar without adequate return".**

81. **Minneapolis, MN builder of twenty-four $97,500 homes.**

Uses R-20 in walls, R-30 in ceilings and insulating glass windows. Plans on increasing wall and ceiling insulation and triple glazing more windows to reduce energy costs and to upgrade homes.

82. **Hutchinson, Kans. builder of thirty $47,000 homes.**

Uses R-n in walls, R-19 in ceilings and storm windows. Shades south facing windows with wide overhangs and porches. Plans on increasing insulation amounts next year because of consumer demand and better sales. He also believes it to be in the public interest. He said, "We think the industry needs to establish (insulation) standards. All we are getting is slanted information from manufacturers".

83. **Indianapolis, Ind. builder of thirty $63,000 homes.**

Uses R-19 in walls, R-30 in ceiling and double glazing in windows. Does not know whether he will change insulation levels but may "To satisfy the buyer and conserve energy". Is concerned about increasing costs and buyer's ability to afford new homes.

The following three tables represent the homes built by the eighty-three survey builders. The data have little, if any, statistical validity because the sample was not chosen at random and the response distribution does not resemble the total population distribution.

The tables are presented only to give an indication of how the eighty-three respondents collectively insulate their homes and how much those homes cost.

Weighted Average Insulation and Price By Region

Region	Houses	Weighted Averages Ceiling R	Wall R	Glazing	Price
New England	222	21.2	14.9	1.6	$43,946
Middle Atlantic	184	27.8	13.9	2.0	53,223
East North Central	523	25.4	13.5	2.0	56,237
West North Central	372	21.6	13.2	2.1	51,393
South Atlantic	461	24.1	13.0	1.3	47,380
East South Central	434	17.7	13.1	2.0	53,115
West South Central	1567	23.4	12.5	2.0	34,121
Mountain	2321	30.0	13.1	1.9	44,655
Pacific (1)	85	22.9	14.5	1.3	66,882
Pacific (2)	65	30.0	19.0	1.4	58,231
Total U.S. (1)	6169	25.6	13.1	1.8	$44,532

(1) including Hawaii

(2) Excluding Hawaii

Weighted Average Insulation By Price Range

Price Range	Houses	Average Ceiling R	Average Wall R	Average Glazing
$25-35,000	1675	23.6	12.7	2.0
36-45,000	1008	26.5	12.6	1.7
46,55,000	2373	26.8	12.2	2.0
56-65,000	497	26.7	13.0	1.5
66-75,000	316	25.4	14.0	2.0
76-125,000	230	28.5	16.1	2.3
Totals	6099	25.9	12.7	1.9

Note: Not included in above were (50) $21,000 Florida homes with R-9 in ceiling and O in walls with single glazed windows and (20) $95,000 Hawaii homes with O in ceiling and O in walls with single glazed windows.

Average Price of Lot and House, By Region

Region	Lot	%	House	%	Total Selling Price
New England	$10,107	23.0	$33,838	77.0	$43,946
Middle Atlantic	9,846	18.5	43,377	81.5	53,223
East North Central	15,240	27.1	40,997	72.9	56,237
West North Central	7,555	14.7	43,838	85.3	51,393
South Atlantic	6,823	14.4	40,557	85.6	47,380
East South Central	10,410	19.6	42,705	80.4	53,115
West South Central	6,755	19.8	27,366	80.2	34,121
Mountain	7,993	17.9	36,662	82.1	44,655
Pacific (1)	19,195	28.7	47,687	71.3	66,882
Pacific (2)	16,712	28.7	41,519	71.3	58,231
National (1)	8,636	19.4	35,896	80.6	44,532

(1) Including Hawaii
(2) Excluding Hawaii

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