

Housing Costs: Rural-Urban Comparisons

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INTRODUCTION

One of the goals of our society is to provide adequate housing for all citizens. A variety of programs have been initiated to attain this objective. Many of these programs are directed toward the construction of new housing or the improvement of existing units. Information on the cost of making these improvements is scarce. It has been commonly assumed that the cost of constructing new housing and of remodeling older homes is less in rural areas than in urban places and that these costs are less in low income rural areas than in urban areas. Few actual studies have been made, however. Such information is essential in devising programs to improve the quality of rural housing in Ohio, in the North Central Region, and in the United States as a whole.

Many of the programs which have been enacted or proposed to help improve the quality of housing encompass some aspect of a loan or grant to help the individual finance the cost. Limitations are usually specified on the amount that any one individual can obtain. Within these limits, certain improvements can be made. To make housing improvement programs more effective, better information is needed on the cost of bringing housing up to certain standards or on the number of housing units which can be built or improved with various amounts of outlay. This study represents a beginning step in providing such information.

OBJECTIVES

The major objectives of this study were to determine the nature and cost of new house construction, of remodeling certain facilities, and of improving housing in selected urban and rural areas in Ohio. These areas represent environments where housing costs might be expected to differ.

This presentation is the first of a three-part study of "Cost, Patterns of Housing Quality, and Financing Housing in Selected Areas of Ohio." Findings in this portion of the study will be applied to secondary facts in Part Two of the study to estimate the funds necessary to bring sub-

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standard facilities up to a minimum level in the Ohio counties of Economic Subregions 30 and 48, central Ohio (an area around Columbus), and the entire state.

HYPOTHESES

Prior to conducting this study, it was hypothesized that a significant variation in construction and remodeling costs existed among the three sample areas. Further, it was hypothesized that central Ohio was the highest cost area and thus that construction and remodeling would be most expensive in this area.

SAMPLE AND PROCEDURE

Ohio Appalachia, which includes 13 counties² in Economic Subregion 30, Economic Subregion 48 (Ohio), and the six-county central Ohio area were the sources of primary data in this report (Figure 1). The selection of these areas was based on several factors and assumptions.

Economic Subregion 30 in Ohio is a part of the Appalachia area with a median family income in 1959 of \$3,400. The second sample area was the portion of Economic Subregion 48 comprised of 21 counties in northwest Ohio, a part of the Corn Belt, which had a median family income in 1959 of \$5,000. The justification for selecting these two areas was to measure the variation, if any, of construction and remodeling costs between an economically depressed area and a productive, higher income area of Ohio.

The third sample area of six counties in central Ohio was selected in an attempt to determine the influence that a large metropolitan area might impose on construction and remodeling costs. Central Ohio was representative of "urban sprawl" which has occurred in other metropolitan sectors. It also was selected as a sample area because of its proximity to the other sample districts.

In each of the subregions, three county seat towns were selected as sample areas from which to compile a list of building contractors to be interviewed. In an effort to eliminate variation in samples, the following criteria were considered. Counties were selected in both subregions so that they would compare with the county seats in the other regions in reference to: (1) the distance from large cities, (2) the type of highways and transportation systems connecting the county seat with cities, (3) demographic characteristics, (4) the type of industries located in the county seat, and (5) population. Since most contractors in central Ohio were located in Columbus and its suburbs, this area was the source of primary data in the central region.

²Scioto, Pike, Hocking, Vinton, Jackson, Lawrence, Gallia, Meigs, Athens, Morgan, Washington, Noble, and Monroe counties.

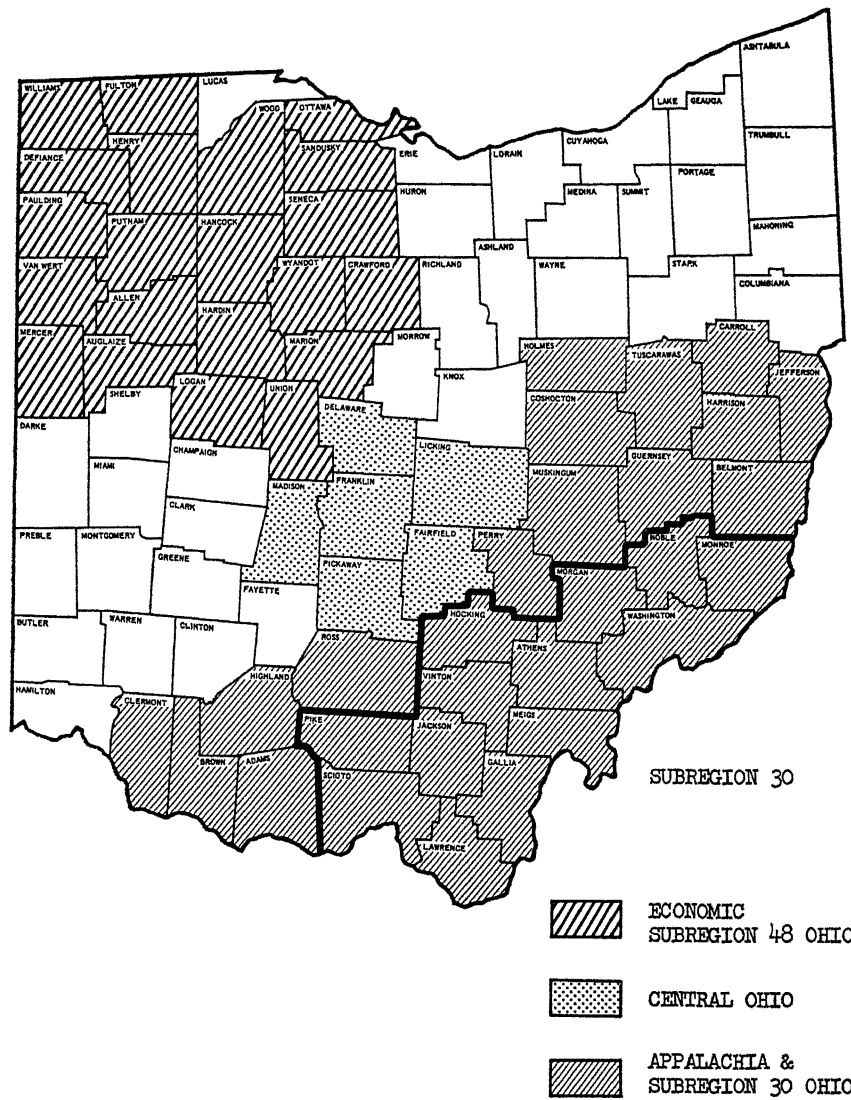


FIG. 1.—Central Ohio, Ohio Appalachia, and Ohio counties in Economic Subregions 30 and 48.

As expected, most contractors had their headquarters in county seat towns. After selecting the towns, each was visited and a tentative list of interviewees was compiled. All businesses on the list were contacted and their cooperation in completing the portion of the questionnaire relating to their particular trade was encouraged. However, some businesses were no longer in operation and others were not willing to divulge estimates. The cooperating businesses were contacted and data were obtained by personal interviews.

BUILDING CONTRACTORS' ESTIMATES

Procedure for Obtaining Housing Costs

One inherent problem of this study was determining the quality of workmanship by various contractors. It was recognized that contractors' estimates may include substantial variations in the quality of workmanship. For this study, it was assumed that the contractors who have

TABLE 1.—Costs per Square Foot of Living Area of Houses Financed by Farmers Home Administration and Estimated by Contractors in Appalachia and Economic Subregion 30, Economic Subregion 48, and the Central Ohio Area, by Three House Size Classes, 1967.

Region, Data Source, and Size of Houses	Number of Estimates	Cost per Square Foot of Living Area		
		Range	Average	Median
Appalachia and Economic Subregion 30				
Contractors' Estimates				
Less than 1,000 sq. ft.	6	\$11.83-15.00	\$13.71	\$14.10
1,000-1,200 sq. ft.	6	11.74-15.00	13.64	13.67
More than 1,200 sq. ft.	6	11.70-17.00	13.27	12.46
F.H.A. Financed				
Less than 1,000 sq. ft.	11	10.51-15.31	13.00	13.39
1,000-1,200 sq. ft.	40	10.16-15.02	12.53	12.72
More than 1,200 sq. ft.	20	10.23-13.78	12.09	12.18
Economic Subregion 48				
Contractors' Estimates				
Less than 1,000 sq. ft.	6	11.56-17.30	13.64	13.27
1,000-1,200 sq. ft.	6	12.63-16.90	14.11	13.58
More than 1,200 sq. ft.	6	12.43-15.32	13.60	13.03
F.H.A. Financed				
Less than 1,000 sq. ft.	4	11.73-14.12	12.80	12.67
1,000-1,200 sq. ft.	8	11.06-15.99	12.63	12.17
More than 1,200 sq. ft.	1		10.67	10.67
Central Ohio Area				
Contractors' Estimates				
Less than 1,000 sq. ft.	6	13.00-17.03	15.15	15.25
1,000-1,200 sq. ft.	6	12.00-15.96	14.36	14.60
More than 1,200 sq. ft.	6	12.00-15.45	13.57	13.56
F.H.A. Financed				
Less than 1,000 sq. ft.	4	11.46-15.76	13.63	13.65
1,000-1,200 sq. ft.	34	10.37-15.77	14.14	14.16
More than 1,200 sq. ft.	16	10.19-15.32	11.78	11.55

survived the competitive forces in the building field have provided adequate workmanship for their clientele.

Data were obtained in all areas from builders in reference to construction costs of three house plans: one less than 1,000 square feet (two bedrooms), another between 1,000-1,200 square feet (three bedrooms), and the third larger than 1,200 square feet (three bedrooms). (See Appendix I, II, and III).

These houses were similar to those financed by the Farmers Home Administration, U. S. Department of Agriculture. To substantiate builders' estimates of these three size groups, data were obtained from the state office of the Farmers Home Administration on the cost of homes financed in fiscal 1966 for each of the three sample areas of Ohio mentioned above.

Procedure for Obtaining Remodeling, Water, and Sewage System Costs

Remodeling costs were obtained for the construction of an additional bedroom, remodeling a kitchen and bath, adding a water supply and distribution system, and installation of hot air and hot water central heating units in the three house plans. Because of the variation in the structure of existing buildings, it was more difficult for contractors to arrive at realistic estimates for kitchen and bathroom remodeling.

Cost estimates were obtained from building contractors for installation of septic tanks and leaching fields for two, three, and four bedroom houses.

FINDINGS

Construction Cost Estimates—New Houses

The questionnaires used to procure data on new house construction costs consisted of a two-bedroom house plan and two three-bedroom plans showing the quantities and types of materials required. All homes were frame construction, one-story dwellings. Contractors were asked to estimate the building cost for each house plan on the basis of a completely finished structure. Facilities included as part of the house were a gas central warm air furnace, sewage system, water supply and distribution system, plumbing, electrical work, and other equipment assumed to be a basic portion of the plan. Estimates did not include built-in appliances or the cost of building sites. Houses financed by the Farmers Home Administration used in this research were also frame construction, with a full or partial basement and facilities similar to those mentioned above.

Housing must be adapted to the climate in various geographic regions of the country. In the Midwest and particularly in Ohio, the

wide seasonal temperature variation necessitates that a house be well constructed and insulated to provide a comfortable dwelling.

A primary concern of builders in Ohio has been to reduce the number of man hours spent in house construction at the building site. This has been accomplished by prefabricating the wall panels and trusses in the shop and transferring these to the construction site. With this type of construction, a frame house can often be enclosed in 1 day, thus eliminating the risk of adverse weather conditions.

Contractors' estimates for the three regions indicated that the average cost per square foot of constructing a house was inversely related to house size (Table 1).³ Central Ohio contractors' average estimates indicated a drop in average cost per square foot of \$1.58 for the more than 1,200 square foot size class as compared with the less than 1,000 square foot class. The smallest decline in average cost as house size expanded was \$.44 and was noted from contractors' estimates in Appalachia (Table 1).

Data supplied by Farmers Home Administration supported the inverse relationship between average cost and house size. The range between the Farmers Home Administration high and low estimates per size of house was comparable to the range of estimates by contractors for each size class in all regions.

The building contractors' cost estimates per square foot were not significantly different for any size house classification among the three sample areas.⁴ The Farmers Home Administration data were also tested for differences among the three areas. In the 1,000-1,200 square foot classification, the central Ohio area cost estimate of \$14.14 per square foot was significantly higher than the cost estimates of Subregion 48 (\$12.63) and Subregion 30 (\$12.53).

The statistical tests also indicated a significant difference between the average cost estimate per square foot from the building contractors (\$13.57) and Farmers Home Administration data (\$11.78) for the more than 1,200 square foot classification in the central Ohio area.⁵

From these data, it was concluded that economic or geographic areas of Ohio were independent of new house construction costs with the exception of the 1,000-1,200 square foot house size classification for Farmers Home Administration rural housing borrowers. The building

³The only exception was the contractors' estimates in Economic Subregion 48, which indicated a higher cost per square foot for the 1,000-1,200 size category than for the less than 1,000 square foot category.

⁴The Aspin-Welsh Test, which is more precise than the "t" test, was used to test the difference between means. This test assumes that the standard deviations of the populations are unknown and may not be equal.

⁵Due to the small sample sizes, the researchers concluded that more reliable cost estimates could be obtained by combining the two samples.

TABLE 2.—Combined Data of Farmers Home Administration Financed Houses and Contractors' Estimates of the Cost of Constructing Three House Size Classes in Selected Areas.

Region and Size of House	Number of Estimates	Cost per Square Foot of Living Area		
		Range	Average	Median
Appalachia and Economic Subregion 30				
Less than 1,000 sq. ft.	17	\$10.51-15.31	\$13.26	\$13.66
1,000-1,200 sq. ft.	46	10.98-15.02	12.68	12.98
More than 1,200 sq. ft.	27	10.23-17.00	11.91	12.36
Economic Subregion 48				
Less than 1,000 sq. ft.	10	11.73-17.30	13.30	13.08
1,000-1,200 sq. ft.	14	11.44-16.90	13.27	12.80
More than 1,200 sq. ft.	7	10.67-15.32	13.18	12.92
Central Ohio				
Less than 1,000 sq. ft.	10	11.46-17.03	14.54	14.84
1,000-1,200 sq. ft.	40	10.37-15.96	14.17	14.16
More than 1,200 sq. ft.	22	10.19-15.45	12.27	12.04

contractors' cost estimates also were slightly higher than Farmers Home Administration estimates for each size category in all sample areas.

After noting that the same trend existed between contractors' estimates and the Farmers Home Administration data, the two sources of data were combined for each region (Table 2). The consolidated data again indicated that the average cost of new house construction was inversely related to size. Subregion 48 had the smallest decrease in average cost per square foot of any region. With the exception of Subregion 48, the median cost also declined as house size expanded. Central Ohio had a slightly greater cost per square foot for the less than 1,000 and 1,000-1,200 square foot categories than either Subregion 30 or 48. However, this was not a significant amount. It was assumed that these estimates could be consolidated further for projections of costs for the entire state.

As noted in Table 3, assuming that the three sample areas were representative of Ohio, the average cost per square foot for the less than

TABLE 3.—Costs of New House Construction in Ohio for Three House Size Classes, 1967.

Region and Size of House	Number of Estimates	Cost per Square Foot of Living Area		
		Range	Average	Median
Economic Subregions 30, 48, and Central Ohio				
Less than 1,000 sq. ft.	37	\$10.51-17.30	\$13.62	\$13.41
1,000-1,200 sq. ft.	100	10.37-16.90	13.36	13.46
More than 1,200 sq. ft.	56	10.19-17.00	12.21	12.39

1,000 square foot house was \$13.62; for the 1,000-1,200 square foot house, \$13.36; and for the more than 1,200 square foot house \$12.21. A further observation indicated that the ranges of estimates were similar for each size category in these regions (Table 3). This observation led to the conclusion that the contractors within an area are the variable causing the cost of housing to fluctuate.

Remodeling Cost Estimates

Estimates were obtained for four types of central heating units: (1) forced warm air gas, (2) forced warm air oil, (3) hot water gas, and (4) hot water oil. Estimates were based on each contractor's usual quality of work and furnaces with a guarantee for 10 years.

The forced air systems used return air-flow systems and were centrally located in basements for efficiency of heating and minimum installation costs. The hot water systems were also centrally located, with circulating pumps, predominant use of copper tubing, and baseboard heat reflectors throughout the house plans. Generally contractors indicated that they would install the hot water systems by using heat zones for maximum warmth and heating efficiency.

Contractors were asked to estimate the charge for installation of each furnace for a two bedroom house with less than 1,000 square feet, a three bedroom house with between 1,000 and 1,200 square feet, and another three bedroom house with more than 1,200 square feet. Tables 4-7 present the summarized estimates for each type of central heating unit.

Forced Air: An analysis of Table 4 indicated that the installation charges for a gas-forced air furnace in houses with 1,000 to 1,200 square

TABLE 4.—Contractor Estimates of Installation Costs for Gas-Forced Air Central Heating Units in Selected Houses for Appalachia and Economic Subregion 30, Economic Subregion 48, and Central Ohio.

Region and Size of House	Number of Estimates	Cost of Installation		
		Range	Average	Median
Appalachia and Economic Subregion 30				
Less than 1,000 sq. ft.	6	\$400- 800	\$558	\$525
1,000 to 1,200 sq. ft.	6	500- 900	692	688
More than 1,200 sq. ft.	6	700-1100	917	950
Economic Subregion 48				
Less than 1,000 sq. ft.	6	450- 800	600	575
1,000 to 1,200 sq. ft.	6	525- 900	683	660
More than 1,200 sq. ft.	6	720-1000	820	800
Central Ohio				
Less than 1,000 sq. ft.	6	452- 650	563	575
1,000 to 1,200 sq. ft.	6	525- 750	651	763
More than 1,200 sq. ft.	6	650- 900	796	800

TABLE 5.—Contractor Estimates of Installation Costs for Oil-Forced Air Central Heating Units in Selected Houses for Appalachia and Economic Subregion 30, Economic Subregion 48, and Central Ohio.

Region and Size of House	Number of Estimates	Cost of Installation		
		Range	Average	Median
Appalachia and Economic Subregion 30				
Less than 1,000 sq. ft.	6	\$600-1075	\$ 742	\$ 700
1,000 to 1,200 sq. ft.	6	725-1200	900	863
More than 1,200 sq. ft.	6	825-1350	1083	1087
Economic Subregion 48				
Less than 1,000 sq. ft.	6	600-1000	750	737
1,000 to 1,200 sq. ft.	6	725-1100	841	787
More than 1,200 sq. ft.	6	860-1200	967	923
Central Ohio				
Less than 1,000 sq. ft.	6	675- 775	724	727
1,000 to 1,200 sq. ft.	6	750- 900	819	807
More than 1,200 sq. ft.	6	835-1200	1006	1013

feet and more than 1,200 square feet were lower in central Ohio than in either of the other regions. However, the cost of installing a gas-forced air furnace in the less than 1,000 square foot house was lowest in Subregion 30. Appalachia and Subregion 30 were the highest cost areas for the installation of this facility in the two larger houses.

There did not appear to be significant variations in costs of gas-forced air furnaces between the three regions for the less than 1,000 and 1,000 to 1,200 square foot classes. However, there were significant differences in costs for the more than 1,200 square foot plan, with Appalachia or Subregion 30 having a higher average cost than either Subregion 48 or central Ohio. Similar trends were noted when the median was used to evaluate the costs. A further point was that in central Ohio the interval between the high and low estimates for the furnace in each house was much smaller than in Subregions 30 and 48.

As noted in Table 5, contractors' estimates for oil-forced air furnaces were substantially greater than for the same furnaces using propane or natural gas for fuel in each region. These increased costs were due to the added oil storage tank and more elaborate burner.

Economic Subregion 48 had the lowest average increase in costs for oil furnaces as compared with gas for each of the three houses for which the costs were estimated. However, the total costs for installation of oil units in the less than 1,000 square foot and 1,000-1,200 square foot houses were lowest in the central Ohio region. Again, as for gas-forced air, the central Ohio contractors had a much smaller range of estimates for oil-forced air units than contractors in Subregions 30 or 48.

Hot Water Furnaces: Hot water furnaces were more expensive to install than forced air units in comparable structures. There were greater variations in estimates for hot water furnaces than for the forced air units.

Data on gas-hot water units indicated that central Ohio contractors had the least variation in estimates for such units. There appeared to be variations between regions in the average and median costs for furnace installations in the less than 1,000 square foot and 1,000-1,200 size categories (Table 6). Estimates indicated that the median costs of gas-hot water units for the less than 1,000 and 1,000-1,200 square foot classes were lowest in the more depressed economic subregion and highest in the central Ohio area. However, the median costs for the more than 1,200 square foot category were comparable among all regions (Table 6).

Oil-hot water furnaces were more expensive to install than the gas fueled units. Again, it was noted that in central Ohio variances between high and low estimates were smaller for the three installations compared with either Subregions 30 or 48. Estimates obtained from Appalachia and Subregion 30 indicated that this was the area with the largest variations in estimates and also the largest increases in average costs of oil over gas-hot water for each of the three installations. However, the median costs of oil over gas increased approximately the same for Subregion 30 and central Ohio, while the median costs for the less than 1,000 and 1,000-1,200 square foot houses in Subregion 48 did not increase in proportion to the other regions (Table 7). Median cost figures indicated the cost of installing oil-hot water units was lowest in Subregion 30 and highest in the central Ohio area.

TABLE 6.—Contractor Estimates of Installation Costs for Gas-Hot Water Central Heating Units in Selected Houses for Appalachia and Economic Subregion 30, Economic Subregion 48, and Central Ohio.

Region and Size of House	Number of Estimates	Cost of Installation		
		Range	Average	Median
Appalachia and Economic Subregion 30				
Less than 1,000 sq. ft.	6	\$ 675-1800	\$ 971	\$ 725
1,000 to 1,200 sq. ft.	5	800-1300	980	800
More than 1,200 sq. ft.	5	1025-1500	1275	1200
Economic Subregion 48				
Less than 1,000 sq. ft.	5	570-1100	864	950
1,000 to 1,200 sq. ft.	5	758-1250	982	1000
More than 1,200 sq. ft.	5	1000-1600	1033	1200
Central Ohio				
Less than 1,000 sq. ft.	6	785-1250	952	937
1,000 to 1,200 sq. ft.	6	855-1300	1059	1100
More than 1,200 sq. ft.	6	975-1500	1246	1263

Summary of Heating Installation Charges: Several conclusions were formulated in reference to installation costs of furnaces. First, the data indicated that the forced air units were least expensive to install in any area for each size house. Second, the initial costs of a gas furnace, either forced air or hot water, were substantially less than for the same unit with oil fuel. Third, the central Ohio figures, in most cases, had the narrowest range of estimates.

TABLE 7.—Contractor Estimates of Installation Costs for Oil-Hot Water Central Heating Units in Selected Houses for Economic Subregion 30, Economic Subregion 48, and Central Ohio.

Region and Size of House	Number of Estimates	Cost of Installation		
		Range	Average	Median
Appalachia and Economic Subregion 30				
Less than 1,000 sq. ft.	6	\$ 825-1925	\$1150	\$ 912
1,000 to 1,200 sq. ft.	5	925-1700	1185	950
More than 1,200 sq. ft.	5	1200-1900	1524	1420
Economic Subregion 48				
Less than 1,000 sq. ft.	5	700-1250	1005	1050
1,000 to 1,200 sq. ft.	5	875-1400	1114	1100
More than 1,200 sq. ft.	5	1200-1750	1179	1425
Central Ohio				
Less than 1,000 sq. ft.	6	925-1300	1095	1100
1,000 to 1,200 sq. ft.	6	1025-1350	1217	1275
More than 1,200 sq. ft.	6	1185-1625	1435	1450

TABLE 8.—Consolidated Estimates of Installation Costs for Hot Water and Forced Air Central Heating Units in Ohio.

Type of Furnace, Fuel, and Size of House	Number of Estimates	Estimated Installation Cost for Central Heating Units in Ohio		
		Range	Average	Median
Forced Air				
Gas				
Less than 1,000 sq. ft.	18	\$ 400- 800	\$ 574	\$ 550
1,000 to 1,200 sq. ft.	18	500- 900	675	675
More than 1,200 sq. ft.	18	650-1100	844	825
Oil				
Less than 1,000 sq. ft.	18	600-1075	739	727
1,000 to 1,200 sq. ft.	18	725-1200	855	807
More than 1,200 sq. ft.	18	825-1350	1019	987
Hot Water				
Gas				
Less than 1,000 sq. ft.	17	570-1800	933	900
1,000 to 1,200 sq. ft.	16	758-1300	1010	1050
More than 1,200 sq. ft.	16	975-1600	1253	1200
Oil				
Less than 1,000 sq. ft.	17	700-1925	1088	1050
1,000 to 1,200 sq. ft.	16	875-1700	1262	1175
More than 1,200 sq. ft.	16	1185-1900	1457	1423

Under the assumption that sample areas were representative of other areas in Ohio, Table 8 presents the probable costs of installing particular furnaces in various size houses throughout the state. Data in Table 8 will be used in Part Two of the study to estimate the cost of adding central heating units to structures having non-central or no heating installations.

Bathroom, Kitchen, and Bedroom: The costs of remodeling a bathroom, remodeling a kitchen, and adding a bedroom were obtained in all three areas. The items involved in remodeling a bathroom or kitchen are listed in Appendix IV and V. Contractor estimates for remodeling a bathroom were not significantly different in the three regions. However, Subregion 30 had the highest average and median costs of the three areas (Table 9).

Costs for remodeling a kitchen were highest in Subregion 30 and lowest in the central Ohio area, while the average costs of remodeling a kitchen were not significantly different between Subregion 48 and Subregion 30 (Table 9).

Costs of an additional bedroom ranged from \$1,289 to \$2,340. The average charges for an additional bedroom in Subregion 48 were \$1,734; in Subregion 30, \$1,890; and in central Ohio, \$1,963 (Table 9). The lowest median and average estimates were noted in Subregion 48 and central Ohio estimates were the highest (Table 9).

Table 10 was constructed under the assumption that the variations between these areas were not significant and hence that this population was representative of the entire state.

TABLE 9.—Contractor Estimates for Remodeling a Kitchen and Bathroom and Constructing an Additional Bedroom in Appalachia and Economic Subregion 30, Economic Subregion 48, and Central Ohio.

Region and Item	Number of Estimates	Estimated Cost		
		Range	Average	Median
Appalachia and Economic Subregion 30				
Bathroom	5	\$ 563- 790	\$ 662	\$ 670
Kitchen	5	1067-2200	1440	1340
Bedroom	5	1755-2145	1890	1800
Economic Subregion 48				
Bathroom	6	550- 730	633	624
Kitchen	6	1195-1717	1374	1323
Bedroom	7	1289-2340	1734	1649
Central Ohio				
Bathroom	6	535- 789	646	630
Kitchen	7	903-1650	1181	1111
Bedroom	5	1695-2150	1963	1980

TABLE 10.—Consolidated Estimates of Remodeling Costs for Bathroom, Kitchen, and Additional Bedroom.

Remodeled Item	Number of Estimates	Estimated Remodeling Cost		
		Range	Average	Median
Ohio				
Bathroom	17	\$ 535- 790	\$ 647	\$ 630
Kitchen	18	903-2200	1317	1287
Bedroom	17	1289-2340	1871	1950

Sewage Systems: Estimates for septic tanks and leaching fields were obtained for facilities with a capacity to handle a two, three and four bedroom house (Table 11). These estimates included a complete installation as well as connecting the unit with a main outlet at the foundation. Estimates were also obtained for the aeration sewage systems which were becoming more acceptable to health boards in various areas.

The aeration system operates on the principle of large city or industrial sewage treatment plants. The system generally has three compartments. The first compartment is for primary treatment, the second compartment has an aerator which forces oxygen necessary in the aerobic digestion process into the liquid, and in the third compartment suspended solids are precipitated and purified liquid is discharged. An aeration system may or may not need a leaching field, depending on health board requirements in each area.

TABLE 11.—Contractor Estimates of Installation Costs for Septic Tanks and Leach Fields and Aeration Sewage Systems for Various Size Houses in Appalachia and Economic Subregion 30, Economic Subregion 48, and Central Ohio.

Region, Size, and/or Type of System	Number of Estimates	Cost of Installation		
		Range	Average	Median
Appalachia and Economic Subregion 30				
2 bedroom house	9	\$300-475	\$372	\$350
3 bedroom house	9	350-585	462	450
4 bedroom house	9	400-800	567	575
Aeration system	6	600-900	687	650
Economic Subregion 48				
2 bedroom house	6	475-550	524	525
3 bedroom house	6	575-775	667	650
4 bedroom house	6	725-950	858	875
Aeration system	6	600-725	672	685
Central Ohio				
2 bedroom house	8	375-650	502	507
3 bedroom house	8	425-750	589	587
4 bedroom house	8	550-850	696	700
Aeration system	6	675-780	751	775

TABLE 12.—Consolidated Contractors' Estimated Costs of Sewage Systems, Ohio.

Type and Size of System	Number of Estimates	Cost of Installing Sewage System		
		Range	Average	Median
Ohio				
2 bedroom house	23	\$300-650	\$457	\$475
3 bedroom house	23	350-775	560	575
4 bedroom house	23	400-950	688	700
Aeration system	18	600-900	704	693

This type of sewage system is designed for areas where soil possesses poor leaching qualities and where high water tables are prevalent. Laundries, dishwashers, and garbage disposals may be used with an aeration system. The aeration system has a broad range and can be adjusted to process various output capacities, making this system more versatile.

Average cost estimates of septic tank installations in conjunction with two, three, and four bedroom houses were highest in Subregion 48 and lowest in Appalachia or Subregion 30 (Table 11). An observation in Subregion 48 indicated that contractors installed a larger number of aeration systems. This was due to the relatively poorer leaching properties of soil in this area, requiring larger leaching areas and thus increasing the cost of septic tank installations substantially. On the contrary, in Subregion 30, the required leaching area was approximately 100 feet less than needed in other areas, thus accounting for a portion of the markedly lower average cost.

Installation costs for aeration systems were approximately equal in Subregions 30 and 48, while central Ohio estimates were somewhat higher. However, central Ohio estimates for aeration systems varied the least (Table 11).

Under the assumption that sample areas were representative of the entire state, estimates on sewage installation costs were consolidated and figures were projected for the state (Table 12).

Water Systems: Contractors indicated that there are three divisions to consider in supplying a house with water. First is the well with casing; second is the pump, pipe, and screen which assure a supply of water to the foundation; and third is the hot and cold water distribution system within the structure. Estimates were obtained on each of these installations and summarized data are presented in Table 13.

Due to the various types of terrain in Appalachia, which includes Subregion 30, the depth of the water table ranged from 100 to 300 feet and generally averaged about 170 feet. So the cost of drilling a well was

TABLE 13.—Contractors' Estimated Costs for Drilling a Water Well with Casing, Installation of Pump and Piping to House, and Installing Hot and Cold Water Distribution System in Houses in Appalachia and Economic Subregion 30, Economic Subregion 48, and Central Ohio.

Region and Item	Number of Estimates	Costs of Various Portions		
		Range	Average	Median
Appalachia and Economic Subregion 30				
Drilled well and casing*	7	\$680-850	\$765	\$723
Pump and piping to structure	7	350-450	394	387
Hot and cold water system	5	425-600	488	475
Economic Subregion 48				
Drilled well and casing†	5	480-600	552	600
Pump and piping to structure	5	400-500	453	450
Hot and cold water system	5	400-525	482	500
Central Ohio				
Drilled well and casing‡	5	440-550	528	550
Pump and piping to structure	5	450-520	465	475
Hot and cold water system	5	475-600	526	525

*Drilled wells in Appalachia range from 100 to 300 feet in depth and average about 170 feet in most areas.

†In northwest Ohio, a good drilled well averages approximately 120 feet.

‡The average depth of drilled water wells is approximately 110 feet in central Ohio.

somewhat more expensive in this area than in Subregion 48 and central Ohio (Table 13).

Estimates for the pump and pipe to the foundation and for the hot and cold water distribution system in the structure were not significantly different between regions (Table 13). It was concluded that the increased cost of a water system was due to the variation in well depth and not to the cost of the pump or distribution system.

SUMMARY

A summary of data in this study is presented in Table 14. The data show the average cost of remodeling an existing structure in Ohio, the Appalachia area of Ohio, Subregion 48, and central Ohio. Costs of remodeling services were compared to the average costs of new house construction in each region. Table 14 was organized in accordance with the following assumptions:

- The structure undergoing remodeling was in acceptable condition on the exterior.
- The house had two bedrooms.
- An overcrowding condition existed, necessitating the construction of an additional bedroom.
- The structure did not have a central heating unit.
- The existing sewage system was inadequate.
- There was an inadequate water supply and distribution system.
- If the structure was replaced, a three bedroom house would be necessary.

TABLE 14.—Summary of Remodeling and Construction Costs in Ohio, Appalachia Region of Ohio, Economic Subregion 48, and Central Ohio.

Item	Average Cost			
	State	Appalachia Region	Economic Subregion 48	Central Ohio
Gas-forced air furnace for a 1,000-1,200 sq. ft. house	\$ 675	\$ 692	\$ 683	\$ 651
Bathroom remodeling	646	662	633	646
Kitchen remodeling	1317	1440	1374	1181
Additional bedroom	1871	1890	1734	1963
Septic system for 3 bedroom house	560	462	672*	589
Well and casing	600	765	552	528
Pump and piping to house	437	394	453	465
Water distribution system	<u>499</u>	<u>488</u>	<u>482</u>	<u>526</u>
Total cost of remodeling	\$ 6605	\$ 6793	\$ 6583	\$ 6549
Construction cost				
1045 sq. ft. 3 bedroom house	\$13961	\$13250	\$13867	\$14808
852 sq. ft. 2 bedroom house	\$11604	\$11212	\$11332	\$12388
1440 sq. ft. 3 bedroom house	\$17582	\$17150	\$18979	\$17668

*Average cost of aeration sewage system was used in Subregion 48 because of its adaptability to the type of soil conditions prevalent in that area.

Data indicated that new house construction costs did not vary substantially among economic or geographic regions. The costs of remodeling a kitchen and bathroom also were similar in all areas, as were the installation charges for the various heating facilities. There were variations in the costs of drilling wells in various areas but these were a result of a lower or higher water table.

Costs of new houses, as shown previously, indicated that larger houses were constructed at a lower cost per square foot than smaller structures.

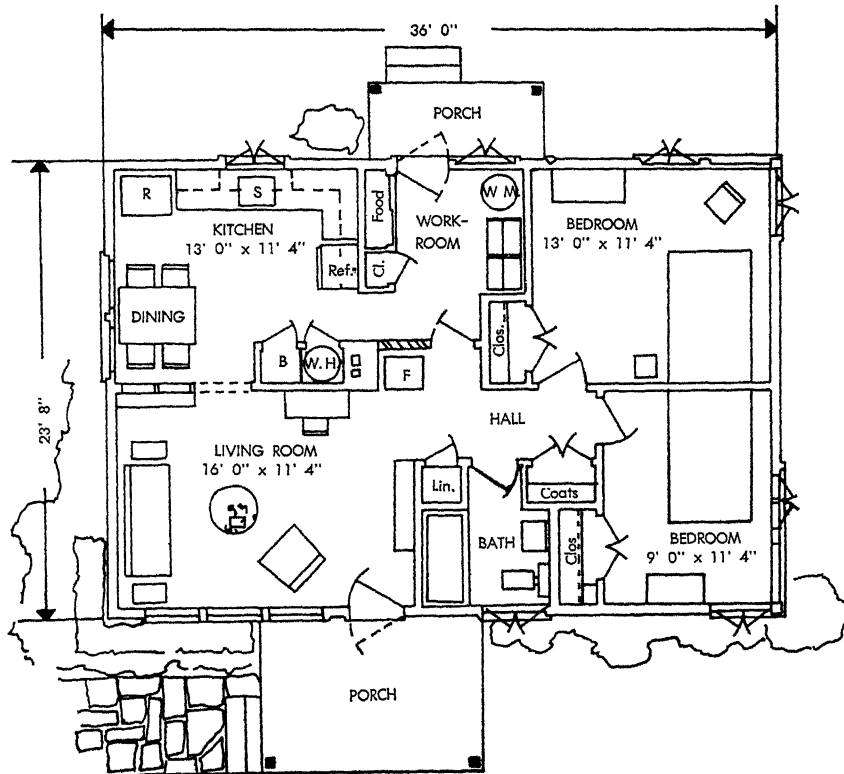
Central Ohio cost estimates, in general, had the least variation. This primarily resulted from contractors' use of estimate books published by several consulting firms. This service lists all types of remodeling in detail and indicates what the charge should be when using various quality materials.

The aeration type of sewage system is expected to be the predominant form used for residences in the future, primarily as a result of its approval by local and regional health officers.

One cost to be considered when constructing a house, not mentioned earlier in this report, is the lot or land cost. This matter was not overlooked by the researchers. However, the cost of land was found to vary drastically within a town or small area, making it impossible to quantify such costs in a study of this size. The scope of land costs varies enough for a separate study.

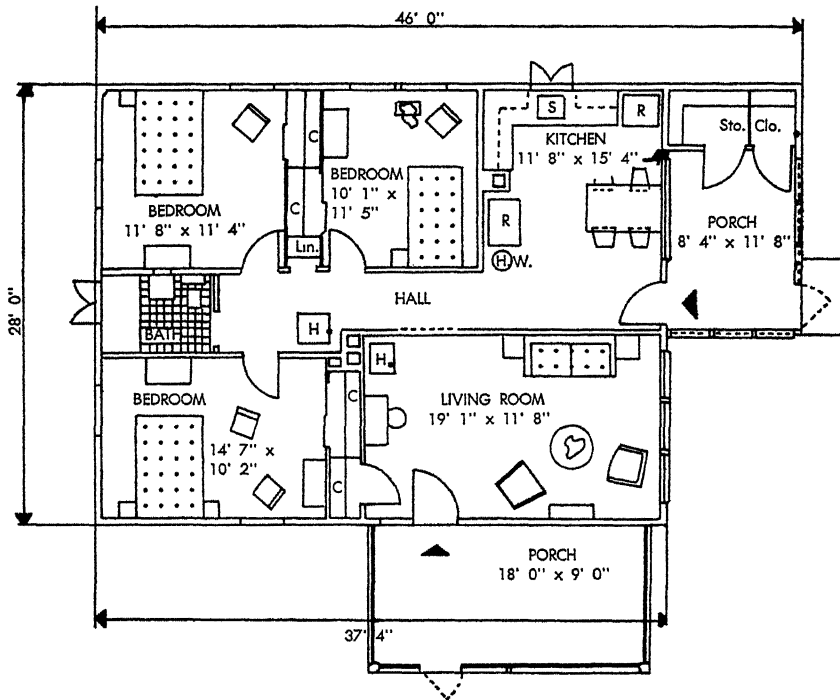
APPENDIX

I. TWO BEDROOM FARMHOUSE



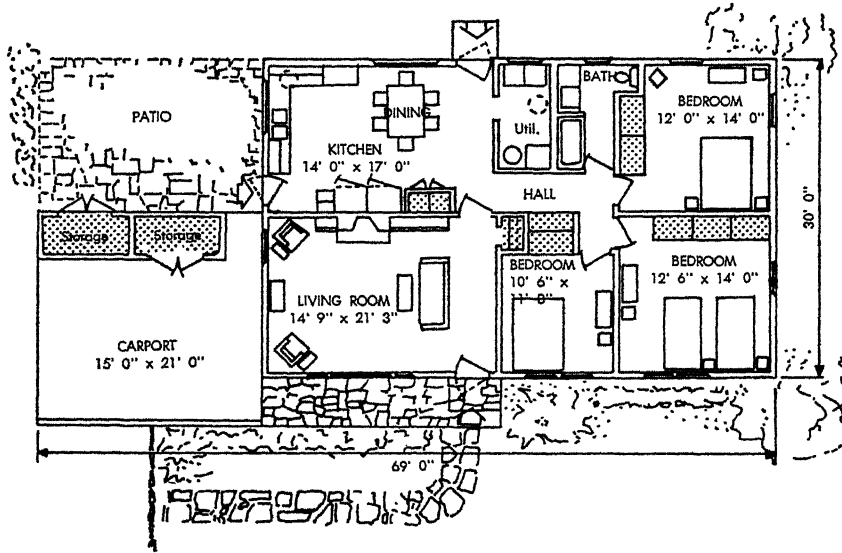
Source: House Plan 7089, U. S. Department of Agriculture.

II. THREE BEDROOM FARMHOUSE



Source: House Plan 7072, U. S. Department of Agriculture.

III. THREE BEDROOM FARMHOUSE



Source: House Plan 7138, U. S. Department of Agriculture.

IV. WORKSHEET FOR ESTIMATING COSTS OF REMODELING BATHROOM*

Estimated costs of remodeling a 7' x 8' x 8' bathroom:

- | | |
|---|----------|
| 1. Cost of tile for floor (56 sq. ft.).
(indicate quality of tile) | \$ _____ |
| 2. Dry wall (33 sq. yd.) | \$ _____ |
| 3. New bathtub and shower | \$ _____ |
| 4. New water closet | \$ _____ |
| 5. New lavatory | \$ _____ |
| 6. Paint (296 sq. ft.) | \$ _____ |
| 7. New faucets (lavatory and tub) | \$ _____ |
| 8. Estimate of labor cost | \$ _____ |

*These costs were estimated for remodeling the bathroom in house plan 7072, Appendix II.

V. WORKSHEET FOR ESTIMATING COSTS OF REMODELING KITCHEN*

Estimated costs of remodeling kitchen:

- | | |
|---|----------|
| 1. Tile floor (192 sq. ft.) (indicate quality of tile) | \$ _____ |
| 2. Construction of an island 5' long, 2½' wide,
and 42" high, with two cupboard doors. | \$ _____ |
| 3. Dry wall (524 sq. ft.) | \$ _____ |
| 4. Paint (600 sq. ft.) | \$ _____ |
| 5. Two additional electrical outlets and wiring
of fan and stove | \$ _____ |
| 6. Stainless steel double sink | \$ _____ |
| 7. Electric garbage disposal | \$ _____ |
| 8. Built-in four-burner electric stove with oven | \$ _____ |
| 9. Cost of hood with fan installed above stove | \$ _____ |
| 10. Estimate of labor cost for remodeling and
installation of fixtures | \$ _____ |

*These costs were estimated for remodeling the kitchen in house plan 7072, Appendix II.

The State Is the Campus for Agricultural Research and Development



Ohio's major soil types and climatic conditions are represented at the Research Center's 12 locations. Thus, Center scientists can make field tests under conditions similar to those encountered by Ohio farmers.

Research is conducted by 13 departments on more than 6200 acres at Center headquarters in Wooster, ten branches, and The Ohio State University.

Center Headquarters, Wooster, Wayne County: 1953 acres

Eastern Ohio Resource Development Center, Caldwell, Noble County: 2053 acres

Jackson Branch, Jackson, Jackson County: 344 acres

Mahoning County Farm, Canfield: 275 acres

Muck Crops Branch, Willard, Huron County: 15 acres

North Central Branch, Vickery, Erie County: 335 acres

Northwestern Branch, Hoytville, Wood County: 247 acres

Southeastern Branch, Carpenter, Meigs County: 330 acres

Southern Branch, Ripley, Brown County: 275 acres

Vegetable Crops Branch, Marietta, Washington County: 20 acres

Western Branch, South Charleston, Clark County: 428 acres