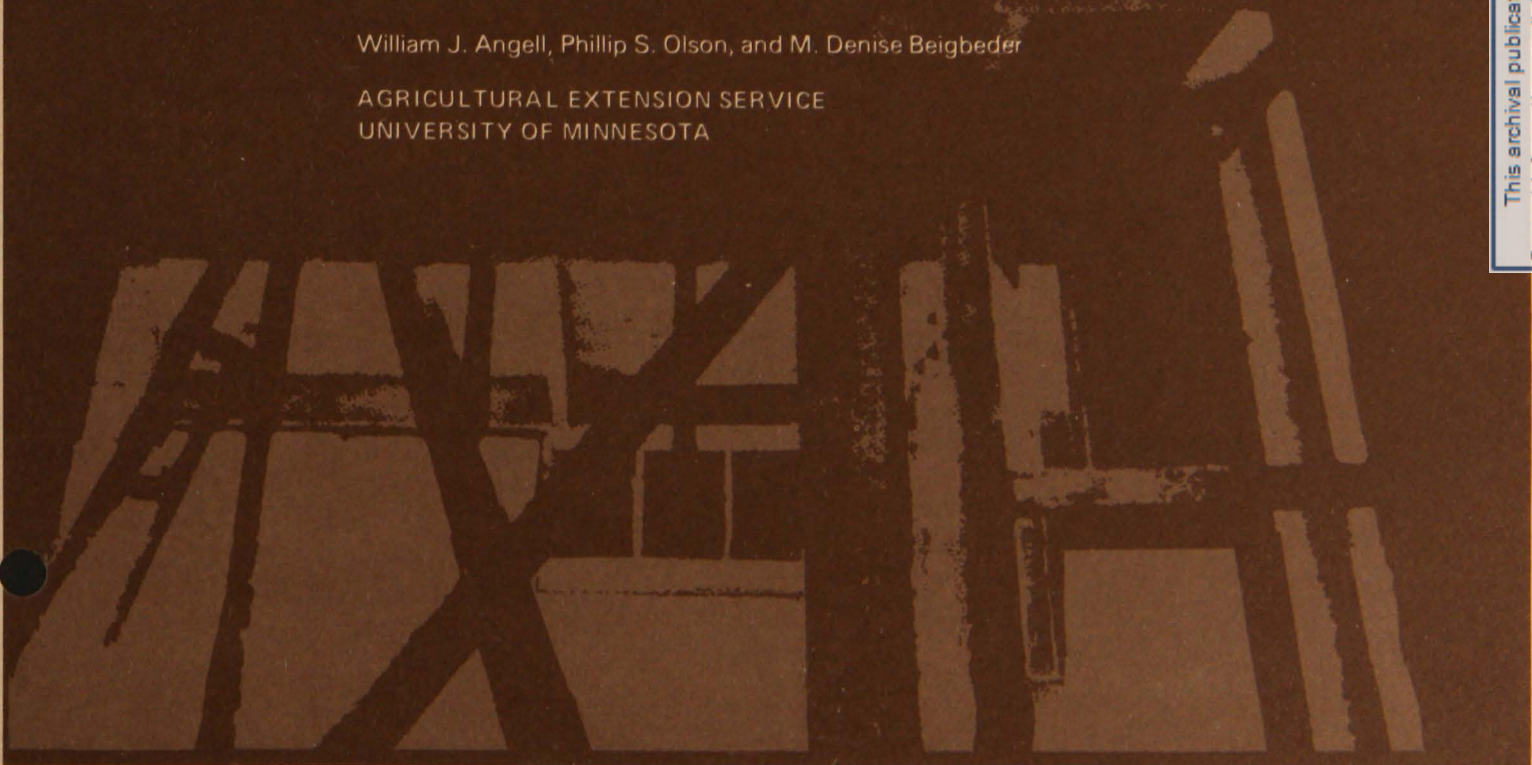




OWNER-BUILT HOUSING

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AGRICULTURAL EXTENSION SERVICE
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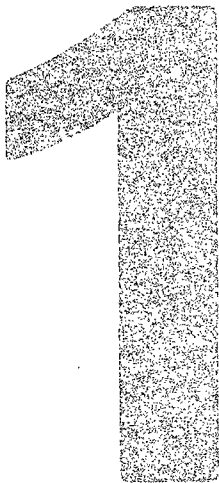
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Introduction

To many people, housing appears to be an endless complex of concerns and problems: excessive construction costs, prohibitive selling costs, high closing costs, material shortages, rising union wages, land speculation, scarcity of mortgage money, high interest rates, urban sprawl, remodeling frauds, landlord-tenant disputes, heating fuel shortages, residential segregation, and so on. Because of this complexity and because housing affects the quality of our lives, we need to recognize two elementary facts:

- Housing, like quality of life, should be considered in a dynamic sense: as a continuing process that influences our attempts to improve our lives.
- Residential construction significantly influences a much broader arena of housing. For instance, higher construction costs tend to increase the value and the rental scale of older houses as well as new ones.

Recognizing these facts, this report examines that area of housing which integrates housing as both a consumer and construction process. The basic focus of this report is on consumer builders who act as their own general contractors to design and build their own houses on their own land for their own occupancy. The report explores the basic design and construction phases of the owner-built housing process, examines the experiences, problems, and suggestions of several owner-builders, and describes available sources of assistance (human) and information (literature) on specific aspects of the design and construction process.

We recognize that other aspects of the owner-built process are equally important, but time restrictions and a general lack of descriptive studies necessarily limited this analysis. Perhaps this dearth of material reflects the need for further research into the owner-built process, as well as a continuing review of references and information available and useful to the do-it-yourselfer.

Using this report, the professional, including the extension educator, can gain an understanding of the basic nature, potential, problems, and needs inherent in the owner-built process. And with this understanding, the professional can realistically assess his or her own abilities to assist the owner-builder.

WHO IS THE OWNER-BUILDER?

Historically, the majority of settlers were owner-builders, a fact that takes on special significance when we realize that substantial areas of Minnesota were not homesteaded until the 1920s. With settlement, industrialization, and urbanization, however, residential construction gradually became more institutionalized. In the process, we as consumers lost a significant degree of control over and involvement in shaping our housing environment and, thus, influence over our quality of life.

Despite the trend toward institutionalization, a substantial percentage of new single family dwellings are still constructed by their owners. In fact, according to figures presented by Turner and Fichter (8),* between 10 and 20 percent of the new

*Numbers in parentheses refer to literature cited (see page 19).

homes built each year are owner-constructed (2). More recent Census data for the north-central region confirm the significant contribution made by owner-builders (4). These data indicate that nearly one-fifth of the new single family homes in this region of the country are owner-built to one degree or another.

Privately owned one-family homes started in 1972

Type of construction	North-central region	United States
	-----percent-----	
Built for sale (speculatively built)	59	66
Contractor-built on owner's land (custom-built)	23	20
Owner-built	18	14
Partially built by owner with paid help	(NA)	(9)
Built entirely by subcontractors	(NA)	(3)
Built entirely by owner	(NA)	(2)
	100	100

NA = not available.

Of course, individual owner-builders are involved in the construction process to varying degrees. As indicated by Census definition, there are three types of owner-builders (4):

1. In most cases, individual owners do some of the work themselves and rely on paid help for the remainder. **Partial do-it-yourselfers** represent the largest segment of owner-builders (about three of every five owner-builders fit this definition).
2. In some cases, individual owners function as **general contractors**, doing none of the actual construction themselves but subcontracting jobs to specific tradespeople. About one-fourth of all owner-built houses are constructed this way.
3. In a smaller number of cases, individual owners may build their houses entirely with their own labor. **Complete do-it-yourselfers** account for less than one-fifth of the owner-built houses constructed each year and contribute less than 2 percent of all new single family houses.

Census tabulations are not entirely accurate, nor are these classifications pure in their definition of owner-builders. According to Census officials, nearly 15 percent of new construction escapes recording because it takes place outside permit-issuing jurisdictions or because the owner simply fails to obtain a permit. Due to the nature of owner-built housing, as much as one-third of new owner-built construction may in fact escape Census tabulation.

Viewed collectively, several characteristics of owner-builders are significantly different from those of home buyers (8, 4):

- Income: the median income of owner-builders is nearly one-third less than that of new house buyers.
- Age: the average owner-builder is 5 to 10 years younger than the new house buyer.
- Residence: owner-builders are more likely to locate in rural areas. In fact, owner-builders are three times more likely to build outside metropolitan areas (24 versus 8 percent of new housing units in rural as opposed to urban areas are owner-built).
- Financing: owner-builders are more likely to pay cash than to finance their homes, as buyers predominately do (54 percent of owner-builders paid cash compared to only 4 percent of new house buyers in 1971).

We can thus infer that owner-building is a method whereby younger families, especially those with lower incomes in rural areas, obtain a new house. Furthermore, owner-builders apparently are more likely to build on a pay as you go basis, thus balancing financial and human resources with family priorities.

WHAT ARE THE BENEFITS OF OWNER-BUILDING?

According to some sources (8), the owner-builder can "save" 22 to 53 percent of the construction costs of developer-built housing. Compared to the initial costs of a developer-built house (6), the potential saving can be realized in the following ways:

Percentage of total costs	Type of expenditure	Potential saving for owner-builders
19	On-site wages (labor)	All
36	Materials and equipment	None*
14	Profit and overhead	All
25	Improved land	One-third
6	Miscellaneous	One-half
<u>100</u>		<u>Approximately</u> 45 percent

*If owner-builder must purchase or rent equipment and cannot obtain a contractor's discount for materials, his or her costs may be greater than a professional builder's costs.

The above example assumes that the developer's markup on materials is included under profit and overhead and that construction financing accounts for half of the miscellaneous category. Although as much as 45 percent of the costs of developer-built housing can be realized in the extreme and rare instance where a do-it-yourselfer successfully does all the work himself, most owner-builders save considerably less.

Furthermore, when the occupancy costs rather than the initial costs of housing are considered, the potential economic saving to the owner-builder is further reduced. Occupancy costs include the mortgage payment (principal and interest), taxes, insurance, utility charges, and charges for maintenance-repairs. If we compare these expenses for two hypothetical houses of similar characteristics built by an owner and a developer, the owner-builder's *potential* saving of 45 percent again diminishes, since monthly occupancy costs are similar for both. This comparison can be illustrated by modifying an example presented by Angell (1).

Market value of both houses: \$30,000.

Initial costs: developer-built house = \$30,000, owner-built house = \$16,500 (45 percent potential saving).

Financing for both houses: \$7,500 down payment, FHA loan at 8 1/2 percent for 30 years.

Principal: developer-built house = \$22,500, owner-built house = \$9,000.

Item	Developer-built costs		Owner-built costs	
	Monthly	Percent	Monthly	Percent
Principal and interest (30-year average)	\$173.01	51	\$ 69.21	30
Taxes (2 1/2 percent market value per year)	62.50	19	62.50	27
Insurance (1/2 percent market value per year)	12.50	4	12.50	5
Utilities (2 1/2 percent market value per year)	50.00	15	50.00	22
Maintenance-repairs (1 1/2 percent market value per year)	37.50	11	37.50	16
Total	<u>\$335.51</u>	<u>100</u>	<u>\$231.71</u>	<u>100</u>

The maximum potential saving in monthly expenses the owner-builder could receive in this example is approximately \$104 or 31 percent.

Although a saving in occupancy expenses is potentially significant, it is unlikely that such a saving would exceed one-third of the costs for a similar developer-built house. In most cases, in fact, it would be substantially less. Thus, we must recognize that owner-built housing is only a partial solution to the problem of escalating housing costs.

Perhaps more important than the economic saving is the general and less tangible benefit of personal involvement, control, and therefore opportunity for self-fulfillment. The owner-builder has the unique opportunity to shape his home to fit his needs; he doesn't have to adjust his needs and desires to fit a house built by a developer for a hypothetical average buyer. Furthermore, he can be self-reliant to the extent that he can gauge the speed of construction according to his own skills, the time he has available, and the money he has to spend.

The Home Building Process

OVERVIEW

Building a house on a do-it-yourself basis, functioning as a general contractor, or simply appreciating the process of home building requires an understanding of the sequence of design and construction activities. To the owner-builder, this understanding is fundamental and essential if time-consuming bottlenecks and other costly delays are to be avoided. The owner-builder must be able to organize work, direct subcontractors, and even adjust schedules and plans when critical factors (bad weather, lack of materials, equipment breakdowns) affect construction. To gain this expertise, the owner-builder must thoroughly understand the tasks involved in building a home and the interrelationships among them.

Formal and graphic methods of determining (and illustrating) important activities and relationships are known as Performance Evaluation and Review Techniques (PERT) or as the Critical Path Method (CPM) (5). Both methods isolate the critical steps involved in any process, including construction. To use either method for planning, analyzing, or scheduling a project, three simple questions must be answered:

- What steps must be completed before this step begins?
- What steps can be carried on concurrently with this one?
- What steps cannot begin until this one has been completed?

Depending on its sophistication, a PERT may include time estimates for completing each step, as well as a schedule of individuals responsible for doing the work or activity. At a minimum, it indicates individual events or activities and the relationship or flow between activities. Generally, either squares or circles are used to indicate specific events or activities, whereas lines and arrows indicate the flow or interrelationship between the activities.

Simple PERT diagrams, along with brief annotation, are presented on pages 8, 10, and 11. These diagrams represent an average or typical flow of activities in the planning and construction of a house. By reviewing them, an individual will have a basic understanding of the owner-built process. Recognizing, however, that his situation probably will vary from those presented, the owner-builder should develop his own PERT diagrams.



PRE-CONSTRUCTION (PLANNING) PHASE

Building a house requires careful planning and efficient management of labor, equipment, materials, finances, and so on. It is thus imperative that the builder recognize each individual step of the building process and then organize these steps into an orderly progression. With adequate planning and efficient management, the owner-builder can save money and time as well as avoid unnecessary problems.

According to owner-builders like Stillman (7), the important phases of planning include:

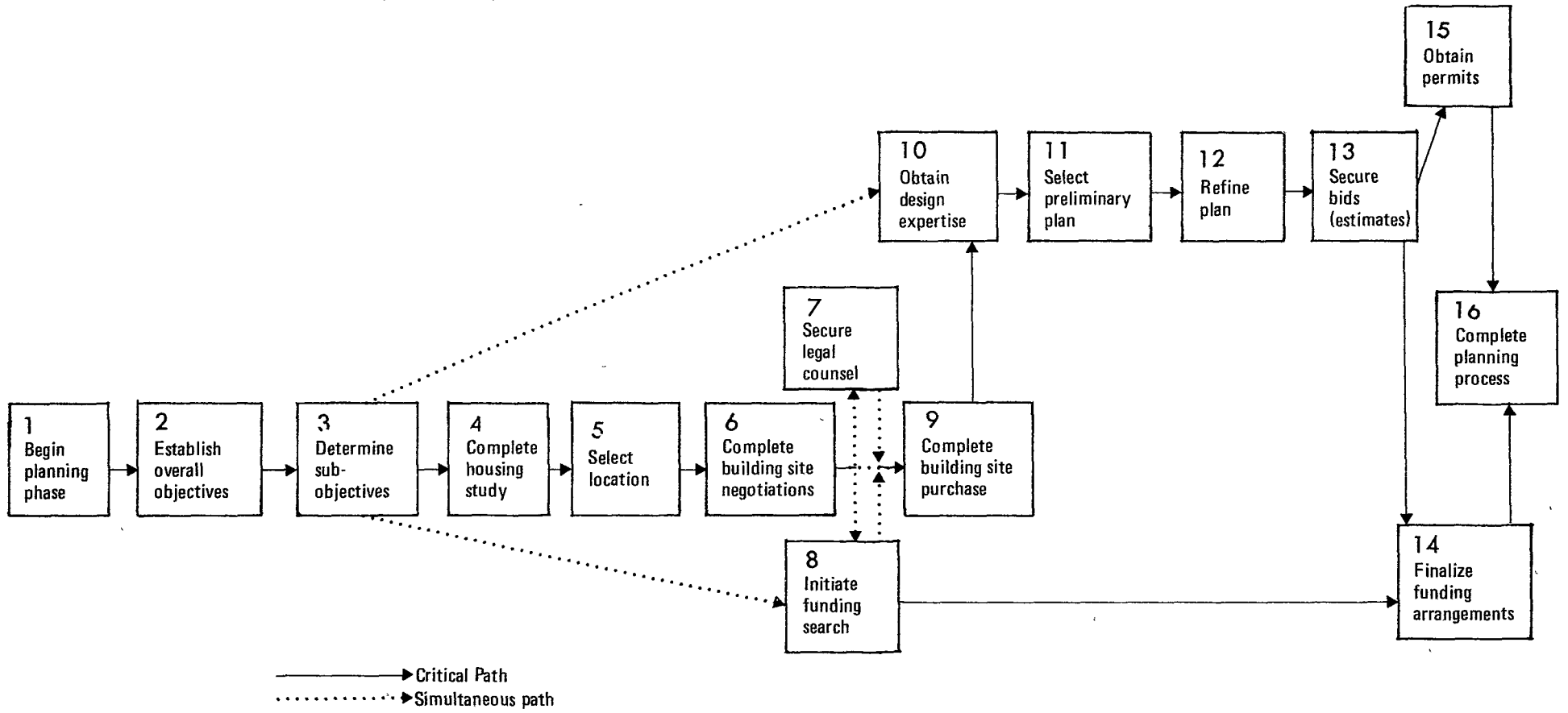
- reviewing relevant literature.
- talking with building experts.
- observing residential construction.
- considering location.
- weighing design alternatives.
- projecting necessary financial and time demands.
- selecting material suppliers and subcontractors.

To describe the sequence of pre-construction (planning) stages, Stillman presents a PERT chart that reflects his own experience. A modified version of Stillman's PERT appears on the following page.

STAGE EXPLANATION: PRE-CONSTRUCTION (PLANNING) PHASE

1. Begin planning phase: Individual considers his basic and general needs and alternative techniques to meet them, including the degree of owner involvement in building.
2. Establish overall objective: Individual decides to build his own home within a defined time and budget.
3. Determine sub-objectives: Individual refines his overall objective into more specific goals such as those relating to:
 - Location (proximity to work, schools, etc.; zoning and land use controls; property values; neighborhood characteristics; physical and topographical features).
 - Anticipated cost, both initial costs and monthly expenses.
 - Type and style of house. At this point, the individual may also seek preliminary design assistance (see stage 10) or initiate a search for construction financing (see stage 8).
4. Complete housing study: Owner-builder qualifies and modifies his objectives by reading newspaper and magazine articles, visiting sites, and talking with building authorities such as other owner-builders, lumberyard dealers, building inspectors, tradespeople, and so on.
5. Select location: After weighing and examining all factors, owner-builder selects a general location. At this stage, it is critical that the individual check local building restrictions such as zoning subdivision regulations with local officials.
6. Complete building site negotiations: Individual conducts verbal negotiations, pays earnest money, and may sign written contracts.
7. Secure legal counsel: Owner-builder may retain a lawyer to review all documents and contracts and to examine any titles before signing any documents or paying any earnest money.
8. Initiate funding search: Individual searches for construction financing and may contact many banks, savings and loan institutions, and other sources of financing (Farmers Home Administration, credit firms, relatives). If individual does not have experience in construction, obtaining construction financing may be difficult. (This stage may begin earlier.)
9. Complete building site purchase.

PRE-CONSTRUCTION (PLANNING) PHASE



10. Obtain design expertise: Owner-builder may seek design assistance for developing the house plan and perhaps for selecting the building site. Sources of design expertise may range from professional architects to recommendations from the neighborhood lumberyard and other similar informal sources.
11. Select preliminary plan: Owner-builder finds or is presented with a plan that meets his basic approval.
12. Refine plan: Owner-builder (or designer) modifies plan, completes material lists, and develops specifications. The individual may seek preliminary approval from the lender and local regulatory officials at this stage.
13. Secure bids (estimates): Owner-builder who wishes to function as a general contractor or to subcontract any work may ask several tradespeople to bid on the work. He also may ask several material suppliers to submit bids.
14. Finalize funding arrangements: Owner-builder finalizes construction and mortgage financing plans according to completed plans, specifications, bids, and cost estimates.
15. Obtain permits: Depending on local codes, owner-builder initiates any necessary review of plans and obtains permits. Responsibility for obtaining permits may rest with either the owner-builder or with subcontractors, depending on the terms of the contracts used.
16. Complete planning process: Owner-builder resolves any problems concerning cost estimates, financing, local regulations, and so on, and finalizes all plans.

CONSTRUCTION (BUILDING) PHASE

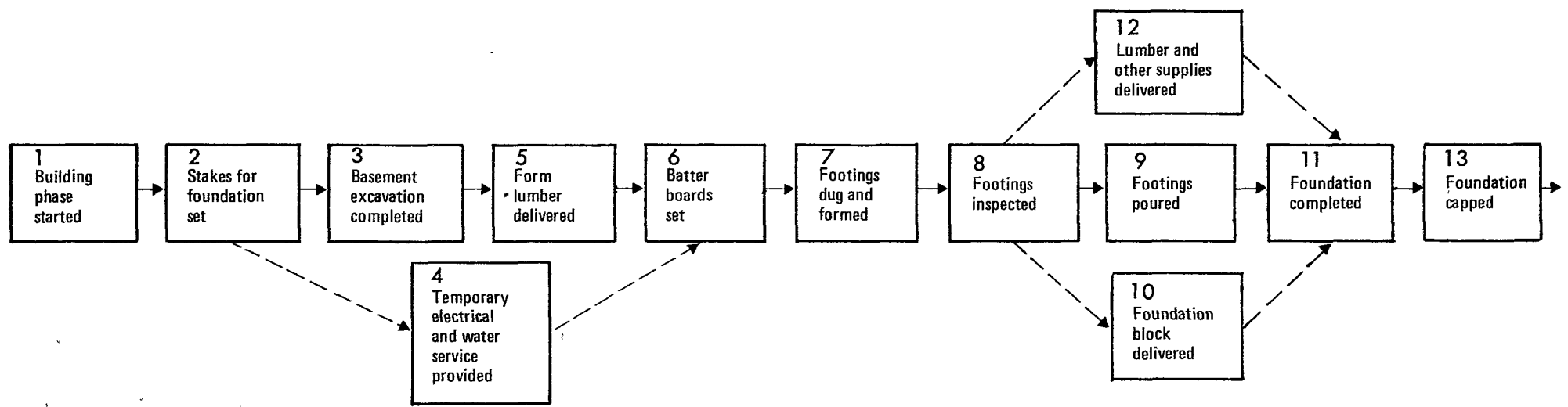
After plans have been completed, actual construction can begin. If the owner wishes to subcontract any work or do work himself, it is imperative that he understand each step and the logical progression of steps within the home building process. With this understanding, the builder can schedule the work of subcontractors and the delivery of materials and can otherwise manage the flow of construction.

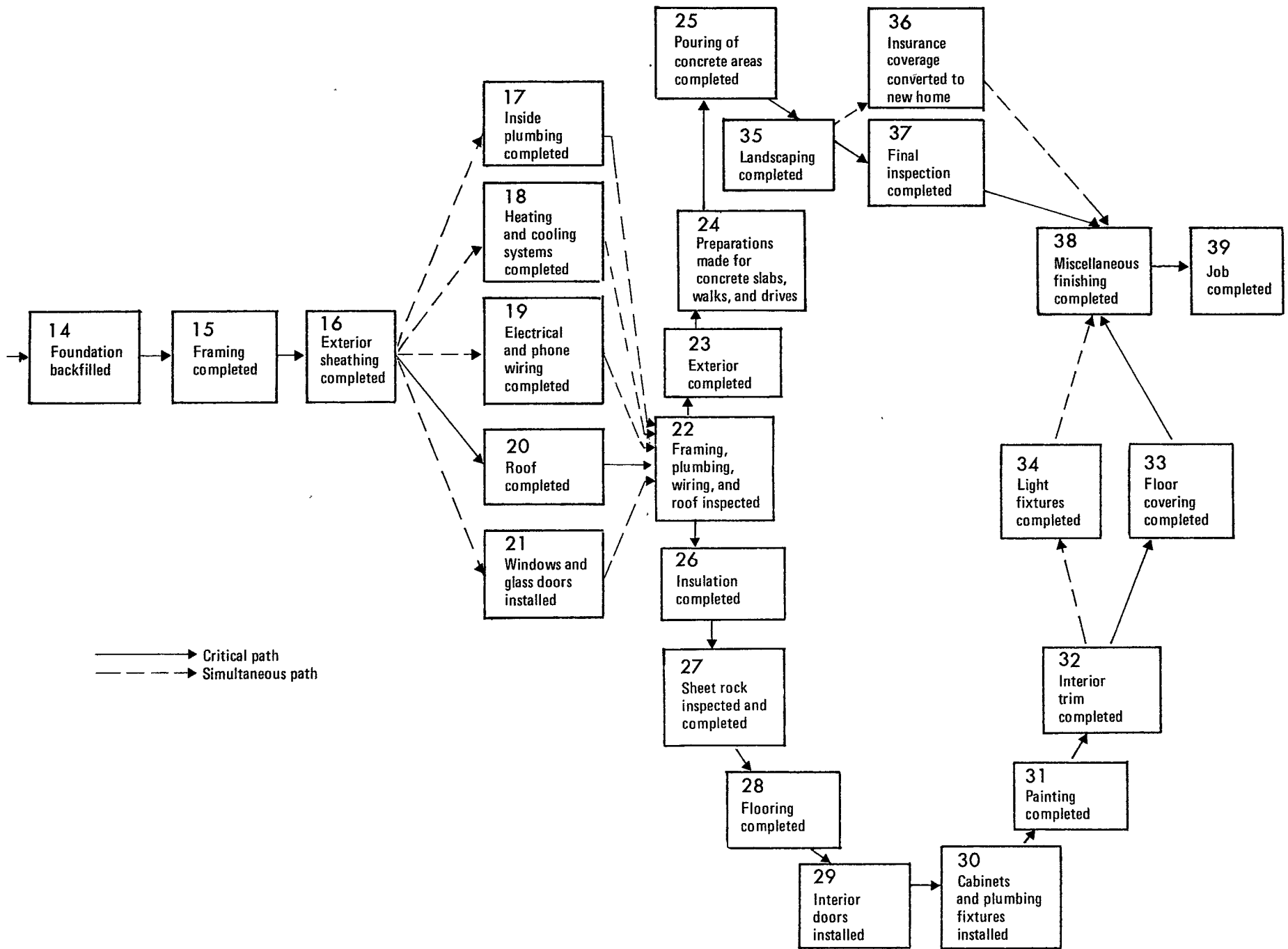
The following modified version of Stillman's (7) PERT illustrates the typical sequence of construction activity.

STAGE EXPLANATION: CONSTRUCTION (BUILDING) PHASE

1. Building phase started: Owner-builder discusses construction methods with others involved (spouse, subcontractors) and reviews the forthcoming project, including material scheduling.
2. Stakes for excavation set: House position on the site is identified relative to excavation. This stage includes tree removal or protection and identification of areas where removed earth can be piled for later use.
3. Basement excavation completed: Depth of excavation is verified with contractor.
4. Temporary electrical and water service provided: Water service needed for masonry work and electrical power for equipment is provided.
5. Form lumber delivered: 1 x 8's or 1 x 10's for foundation footings are placed in the excavation.
6. Batter boards set: From the survey, batter boards are placed, insuring the house is square. Diagonal measurements also can be used to check squareness.
7. Footings dug and formed: Owner-builder should carefully check the height, soil firmness, and level of footings.
8. Footings inspected: Examination and approval by a local building inspector may be required before concrete can be poured.
9. Footings poured: Owner-builder should make sure a proper concrete mixture (as required by load conditions) is obtained.

CONSTRUCTION (BUILDING) PHASE



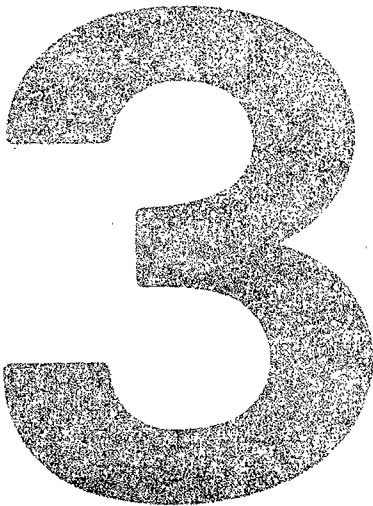


10. Foundation block delivered: Owner-builder should check block for proper size and amount. Blocks as well as mortar and sand should be placed inside excavation, if possible, for easier handling.
11. Foundation completed: Owner-builder should examine foundation for squareness (from batter boards) and proper level and should check for raked joints wherever they are desired.
12. Lumber and other supplies delivered: Owner-builder should select delivery-storage locations carefully to insure ease of handling.
13. Foundation capped: Sill plates, floor joists, and subflooring are installed, providing covered shelter for tools and materials.
14. Foundation backfilled: Top of footing and all below grade exterior foundation walls are sealed. Backfilling requires compaction every 1 to 2 feet to guard against cave-ins (settling).
15. Framing completed: Exterior and interior framing walls, roof trusses, ceiling joists, and stairways are constructed.
16. Exterior sheathing completed: Plywood or insulation board is installed on exterior walls and roof. Owner-builder should check for adequate fastening of this material.
17. Inside plumbing completed: All water, drainage, and vent lines are installed. Proper preparations for inspection must be made.
18. Heating and cooling systems completed: Ductwork, chimney flues, and the heating/cooling plant are installed. Owner-builder should check for proper routing of ductwork and for clearances.
19. Electrical and phone wiring completed: Owner-builder should check for proper positioning of outlets and fixtures, including thermostats and doorbells.
20. Roof completed: Underlayment, shingles, and any necessary sheet metal for flashing or gutters are added.
21. Windows installed: Owner-builder should check windows carefully for proper operation and fastening. A close examination here can save much time and money later.
22. Framing, plumbing, wiring, and roofing inspected: Owner-builder should review these areas with the inspector prior to doing such work himself. This often-failed inspection is the most important one made by the local building official.

(Note: Many of the following steps can be undertaken simultaneously. See PERT diagram.)

23. Exterior completed: Siding, doors, and trim are installed. Owner-builder should check doors carefully for proper swing and seal.
24. Preparation made for concrete slabs, walks, and drives: Owner-builder should check for proper depth and adequate reinforcing.
25. Pouring of concrete areas completed: Owner-builder should be sure the desired finish has been obtained on the concrete and the pitch of the slab is correct.
26. Insulation completed: Exterior walls, roofs, and ceilings, as well as any required vapor barriers, are constructed. Be careful around ceiling light fixtures.
27. Sheet rock inspected and completed: Interior walls and ceilings are enclosed and inspected by the local building official before joints and fasteners are taped and finished.
28. Flooring completed: Final hard surface is added over subflooring, and finished treads are added to stairways.
29. Interior doors installed: Owner-builder should check doors for adequate swing and seal, as well as for proper clearance for future flooring materials.

30. Cabinets and plumbing fixtures installed: Owner-builder should check these for proper operation.
31. Painting completed: Owner-builder should examine the type of paint used and its base and, if possible, obtain leftover paint for future use.
32. Interior trim completed: Baseboards, window and door trim, and other miscellaneous trim such as that for chair runners is added. Most trim should be stained or painted prior to installation.
33. Floor covering completed: Owner-builder should examine carpeting, tile, linoleum, etc., for proper color or pattern matching and should ask that all irregularities be resolved.
34. Light fixtures completed: Owner-builder should check for proper switch control.
35. Landscaping completed: All site work and plantings are finished. Owner-builder should check for proper drainage before any planting is done.
36. Insurance coverage converted to new home.
37. Final inspection completed: Local building inspector will give owner-builder a certificate of occupancy if all is well.
38. Miscellaneous finishing completed.
39. Job completed.



Case Studies

The case studies that follow illustrate the experience of three owner-builders, including their problems, their relative success, their suggestions, and, of course, the basic procedures they followed. The three cases were chosen in part according to the individual's willingness to participate. The owner-builders described here were recommended by building inspectors and material suppliers as typical owner-builders. Although an original objective of this study was to examine cases in rural, fringe, and central city locations, an urban case could not be located in the time allotted for the project.

Preliminary review of the three case studies indicates:

- varying degrees of owner involvement in both the design and construction process.
- little difficulty in obtaining construction or mortgage financing (perhaps because the incomes of these owner-builders were above the state average).
- varying levels of design quality.
- consistently high levels of workmanship and construction quality.

This examination includes two basic parts: (1) general demographic and background information and (2) observations, including the observer's initial reaction to the home as well as the owner's personal analysis. In reviewing these case studies, it may be helpful to consider the PERT diagrams along with the individual owner-builder experiences.

CASE STUDY I

BACKGROUND AND BUILDING PROCESS

The husband, age 41, is employed as an electrician for a local electrical contractor. He earns approximately \$15,000 annually. The wife works part time as a local hairdresser, earning around \$6,000 per year. They have three children ages 12 to 18. In 1971 the family undertook the construction of their own home because they needed more space and wanted to save money on construction.

Choosing a rural Minnesota setting, they constructed a four-bedroom split level contemporary home of about 2,000 square feet for an estimated \$30,000. After construction, the house was appraised at \$40,000 for market value, which amounts to a 25-percent saving in development and construction costs. The family had previously lived in a tract-type development home. Because of his 20 some years of involvement in the construction industry, the husband felt qualified to do much of the work himself and had numerous contacts in areas where he lacked construction experience. After looking at numerous designs in magazines and books, the couple purchased plans for their house through the local lumberyard for \$100. They purchased a lot for \$1,500, and construction began. The owner subcontracted the excavation and heating system. The remainder of the house was constructed entirely by the family over a period of 1 year. Lumberyard personnel proved to be the family's best source of help, providing answers throughout the construction period.

OBSERVATIONS AND ANALYSIS: A CRITIQUE

This house is little different from a typical development house. The family must walk through the center of the living room to get from the garage to the kitchen, as evidenced by a worn and dirty path. Orientation is extremely poor, with 80 percent of the glass on the north side of the house. For an unknown reason, the basement remains unfinished after 2 years of occupancy.

The family has obviously adapted its lifestyle and needs to fit the house, as they adapted the site to the home (since the site was purchased after the design had been selected). The home is successful in its aesthetic expression of the family and has provided them the intangible satisfaction of having constructed it themselves. The construction is of exceptional quality, by far the best of the three cases. The owner indicated he would subcontract the masonry work if he were to build again. He also mentioned stockpiling materials prior to construction to avoid some of the delays he encountered in material delivery. His final comment was a wish for a better house. This house could have been better and would have cost less with proper design considerations.

CASE STUDY II

BACKGROUND AND BUILDING PROCESS

The husband, age 34, owns a local furniture store and is a free-lance landscape designer earning about \$25,000 per year. The wife is unemployed outside the home. They have two boys ages 6 and 10. In 1968 the family constructed a three-bedroom modern house in a fringe (suburban) location. The cost of construction was \$43,000, which, according to the owner, represents an estimated saving of 15-20 percent. The family had rented a house for 2 years prior to construction after moving to the community from Chicago in 1966. The husband's father was president of a wholesale lumberyard chain in Illinois, which gave the son some understanding of construction. The 2-acre lot was purchased in 1967 for \$4,000. The house was designed by a friend who is a Chicago architect. After spending a week with the family, the architect designed their house and furnished all plans. The husband installed the plumbing, sheet rock, and roofing and did all the interior finishing and landscaping. All other systems were subcontracted by the family. The house was financed with a 20-year conventional mortgage from a local bank.

OBSERVATIONS AND ANALYSIS: A CRITIQUE

This architect-designed house is a fabulous design and is most aesthetic. To use the architect's expression, it is a sculpture!

Family members seem reasonably happy with their home, although they made no mention of it as reflecting their lifestyle. (They were extremely reluctant to be interviewed, however, and offered the least information of the three.) The house is not laid out modularly and thus doesn't make optimum use of materials. The house seems to be more a pattern of spaces within a sculpture than a functional home. Construction quality is adequate, yet there is a water pressure problem as well as condensation in winter. The house is well situated on the site and makes the most of views and light. The husband indicated he would not install the sheet rock himself if the couple were to build another house. He also would check with the local inspector more often during construction to avoid pitfalls. The major problem, he said, was time (construction took twice as long as expected). He thought better scheduling of labor and materials would have helped greatly. Again, the family's predominant source of assistance was the material supplier.

CASE STUDY III

BACKGROUND AND BUILDING PROCESS

The husband, age 29, is employed by a state agency as a finance director and earns approximately \$15,000 annually. The wife is a free-lance interior designer earning \$10,000 per year. They had no children at the time of construction. The fringe location lot was purchased in 1971 for \$6,000. In 1972, the family constructed a three-bedroom home at a cost of \$28,000. Two years after construction, it was appraised at more than \$45,000 (adjusting for inflation, this represents about a \$3,000 savings, or less than 10%).

The couple had lived in an apartment complex for 4 years after their marriage in 1968. They were tired of apartment life and wanted their own home as an expression of themselves and their future family. They estimated a cost saving of 15 percent by building their own home. The husband made no mention of any prior construction experience. The husband and wife designed their own home, largely through the interior design experience of the wife and the help of the local lumberyard. The lumberyard translated their drawings and sketches into working drawings, laying things out modularly to save costs by using dimension lumber. The lumberyard also supplied the names of subcontractors to contact for bids, and furnished the necessary plans. The couple did no actual construction themselves, but contracted all work to the lowest of two or three bidders. They did most of the interior decorating, including carpeting and wallpapering. Construction took about 4 months.

OBSERVATION AND ANALYSIS: A CRITIQUE

This proved to be the most enlightening case examined, primarily because the house was owner-designed. The couple took tremendous pride in their home and were eager to have the interview and express themselves. Their pride stems primarily from the knowledge that the house is working for them and is adapted to their needs. They are proud, also, of the cost saving factor and of the aesthetic expression of their home. The house is beautifully decorated and furnished. Construction quality is adequate, and no problems have arisen yet. The one problem obvious was the house position on the site, which did not make the most of views or natural lighting.

CASE STUDY SUMMARY

A few general conclusions of major importance to anyone interested in the owner-built process can be drawn from the case studies. Obviously, the three cases can be interpreted differently, yet some strong similarities exist among them.

Probably the most obvious of the similarities is the cost saving factor, which ranged from 10 to 25 percent. The saving was directly related to the degree of owner involvement in construction. In case III, where the owners were the least involved, a 10-percent saving was realized; in case I, where owner involvement was greatest, the saving was 25 percent.

In all three cases, the lumberyard proved to be the major source of assistance during the construction process. In fact, the material supplier was the only source

consistently mentioned. Even in case III, where the owner functioned solely as a general contractor, the lumberyard translated the couple's design into a workable plan.

Quality of construction varied among the three. The highest or best quality was observed in case I, in which owner involvement in actual construction was the greatest (90-95 percent of the work done by the owner). Since the other two cases were relatively equal in quality yet differed in degree of owner involvement, no definite conclusions can be drawn. It seems logical, however, to assume that quality would improve with greater owner involvement in either a work or supervisory role — especially if the owner has construction training and experience.

Human Resources: Where Are the Experts?

Human resources play an important supportive role to the owner-builder. By its very nature, the do-it-yourself building process depends on a continuous flow of information, technical assistance, and advice. Although the literature includes many good references, each owner-builder encounters situations in which only personal advice and attention will help. Furthermore, the construction process dictates that the owner-builder deal with many individuals: building inspectors, material suppliers, lenders, electricians, plumbers, carpenters, masons, bricklayers, roofers, and so on. Each of these individuals can provide vital information based on firsthand experience and knowledge about specific phases of construction even if the owner-builder does not involve them during actual construction.

Perhaps the most important single source of potential information and assistance is another owner-builder. An individual who has successfully built a house can provide valuable insights into owner-building.

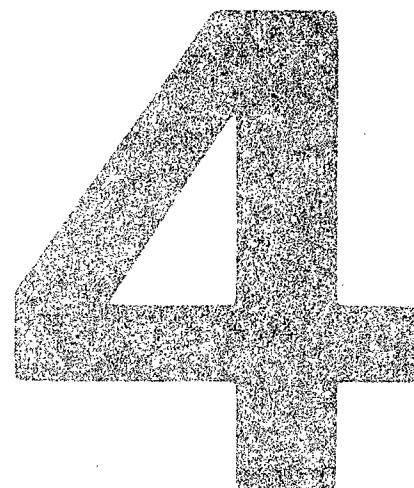
Another important source of assistance is the material supplier. Besides providing technical information about materials, building products, and construction phases, the supplier generally can recommend tradespeople who are easy to work with and lenders who loan funds to owner-builders. The material supplier also may be able to supply advice in areas such as how to work with building inspectors.

Other potentially helpful resource persons may include local building inspectors, planning officials, lenders, tradespeople, and vocational instructors. Sometimes representatives of federal and state agencies (Farmers Home Administration supervisors, Veterans Administration service officers, and so on) can provide **limited** assistance. Based on the case studies and other information, however, this assistance apparently is infrequent. Owner-builders should recognize that these individuals generally do not have the time to train do-it-yourselfers.

Three individuals appear to be the most relevant as sources of assistance to the owner-builder: local inspectors, the lender, and the material supplier.

Local Inspectors. In every area of Minnesota, home builders encounter regulations establishing minimum land-use and construction standards. Since these standards are enforced by local inspectors and often vary between communities, the owner-builder should check with the local unit of government concerning the following:

- zoning codes — establish land-use guidelines, height and set-back requirements.
- subdivision regulations — establish guidelines for lot and house sizes.
- well-drilling code — establishes statewide guidelines for installing a private well.
- septic-tank code — establishes statewide guidelines for installing a private sewage treatment system.



- State Building Code — which is comprised of the following:
 - Uniform Building Code (UBC) — establishes structural standards; enforced at the option of the community or county.
 - National Electrical Code (NEC) — establishes wiring standards; enforced statewide.
 - Minnesota Plumbing Code — establishes plumbing standards; enforced in communities with populations over 5000 or whenever a home is connected to public water mains.
 - Minnesota Mechanical Code — establishes heating, cooling, and ventilation standards; enforced at the option of the community or county.
 - Energy Conservation Regulations — establishes energy conservation standards; enforced statewide.

It can be beneficial to review applicable codes and talk informally with local inspectors before submitting the plan for approval. The first formal encounter with local inspectors, however, will be when the owner-builder submits plans and specifications for approval and pays for permits. Remember, codes generally establish minimum standards relating to the family's health and safety. The owner-builder will therefore want to meet or exceed code requirements. If plans or specifications are rejected, an individual should remain calm and ask the inspector what changes must be made.

In addition to reviewing the plan, local inspectors will visit the construction site as building progresses. Inspectors will examine the work to insure that the house is being built according to minimum code regulations. Beyond these official responsibilities, inspections may also provide the owner-builder with insights into other areas of concern:

- Union Regulations — In most areas of the state, owner-builders will encounter union regulations that strictly limit the services and work that persons in a specific trade will perform. Furthermore, the regulations may rigidly establish minimum rates these workers can charge for their services. Generally, plumbers, electricians, block layers, and sometimes carpenters operate under such union regulations. Inspectors can tell an owner-builder how to check union standards he or she may encounter. The inspector may also be able to suggest ways to reduce both conflict and costs through proper scheduling.
- Subcontractors — Inspectors may occasionally provide a list of subcontractors whose work generally passes inspection. Sometimes inspectors can give an owner-builder an idea of prices charged by subcontractors and how to deal with them effectively. Please recognize, however, that this type of information represents the inspector's personal opinion and not an official endorsement. Many inspectors do not wish to get involved in recommending contractors or quoting prices.
- Material Suppliers — Some inspectors may unofficially recommend suppliers who can meet the owner-builder's information needs and who give discounts for material purchases. Again, realize these comments are the inspector's personal opinion and if he or she feels uncomfortable making recommendations, do not press for them.

Material Supplier. All owner-builders must rely on material suppliers. They generally can expect the supplier to be knowledgeable about building products and materials, to know which items offer the greatest value, and to know which items are interchangeable. Furthermore, most owner-builders rely on the supplier to explain grades, standards, and other guidelines when they purchase materials. Among other services, material suppliers may be able to provide information on:

- Component Fabrication. Structural elements such as roof truss and joist systems can be designed and fabricated to realize a substantial saving of both time and expense.
- Dimensioning. The supplier may be able to review and modify the plan so standard dimension lumber can be used. Using dimension lumber reduces the labor necessary for cutting and reduces waste of material.
- Subcontractors — If the owner-builder wishes to subcontract any work, the material supplier will be able to recommend the best individuals (with whom the supplier deals) with the skill, knowledge, and equipment to do the job. Sup-

pliers usually are in an excellent position to observe the work of subcontractors. Of course, the owner-builder should be aware that the supplier may base his recommendations on personal friendships, too.

- Other Suppliers — If the material supplier does not handle certain products (plumbing fixtures, for instance), he will be able to recommend specialty suppliers.
- Financing — Because the material supplier has worked with other owner-builders and because he has a profit incentive to do so, he may be able to assist the owner-builder in obtaining construction financing. His assistance may include recommending a specific mortgage officer or recommending a specific format to be presented to the lender.
- Other Owner-Builders — Material suppliers usually are happy to share the names of owner-builders who have successfully built their own homes.
- Literature — Suppliers frequently can recommend references that deal with specialized construction topics of interest to the owner-builder.

In general, the material supplier can be one of the owner-builder's most valuable advisers, since no other individual is likely to be more knowledgeable or experienced.

Lender. For many owner-builders, the lender is more foe than friend. And, based on statistical information, there is valid reason for this feeling: few mortgage officers are anxious to lend money to do-it-yourself home builders, especially those without construction experience. (Many lenders remember with nightmarish clarity the times they had to foreclose on builders who defaulted on repayment, making them owners of unfinished houses that could not be sold.) According to Census data, owner-builders are approximately 10 times more likely to finance construction with cash than are buyers of houses built for speculation. Furthermore, data indicate that owner-builders who do obtain mortgage financing are most likely to obtain Federal Housing Administration (FHA), Farmers Home Administration (FmHA), or Veterans Administration (VA) mortgages.

This situation does not necessarily create an unbreachable gap between the owner-builder and the local banker or savings and loan officer. In fact, the owner-builder would be well advised to investigate local lending sources early in his planning and rather informally. If he encounters less than an enthusiastic reception, he should:

- Ask if other lenders in the area handle FHA (or VA) financing.
- Contact the county FmHA supervisor and inquire about FmHA financing (available only to moderate income families in rural areas with populations under 20,000).
- Contact the county VA service officer and inquire about direct VA mortgages (available only to qualified veterans).

Besides providing financing, many lenders can recommend reputable subcontractors and material suppliers, provide information about contracts with subcontractors and suppliers, and provide information about necessary fire and liability insurance.

Conclusions

Several basic conclusions in four areas can be drawn from this exploratory examination of the owner-built housing process.

COST SAVING POTENTIAL

- If an individual functions as his own general contractor (scheduling and coordinating all construction), he may "save" (earn) 10-15 percent, which otherwise would go for the builder's overhead and profit.

- The owner-builder can save the most by performing all the labor necessary to build his or her house. Adding this potential labor saving of 20 percent to the 10-15 percent saving realized when the owner functions as a general contractor, the owner-builder can reduce his costs by one-third or more.
- The savings the owner-builder realizes through construction, however, may be effectively reduced if he or she loses income from employment or if he or she must pay for existing housing while also paying for materials and other costs associated with the new house.

CONSTRAINTS

Even though some 20 percent of all new homes are owner-built, the owner-builder receives practically no support from the financial, educational, and political institutions of any state. At worst, he or she may receive inaccurate information from unknowledgeable building "experts."

PROBLEM OF PROPER SCHEDULING

- Because the typical owner-builder has neither broad experience in the building process nor access to relevant literature, he or she often is ill-prepared to do an adequate job of planning and scheduling. Many owner-builders consequently encounter unnecessary problems and excessive costs. This situation could be ameliorated through educational programs and technical assistance.

PROBLEM OF POOR DESIGN

- Although poor design is not unique to owner-built housing, it appears to be a major problem, as reflected in unnecessary costs and poorly functioning floor plans. This situation suggests a contradiction to the beneficial outcomes of total owner involvement. It certainly points out the need for a better understanding of design and the need for more accessible sources of design assistance.

In general, we think owner-built housing can offer the individual a uniquely satisfying experience and a significant financial saving. The dimensions of these benefits, however, will be influenced by the owner-builder's preparation and the relative support he receives from political, financial, and educational institutions.

Literature Cited

1. Angell, William J. *Housing Costs in the Mid-Seventies*. Extension Folder 315. 1975. Agricultural Extension Service, University of Minnesota, St. Paul.
2. *Characteristics of New One-Family Homes, 1969* (Series C25). 1970. U.S. Bureau of the Census, U.S. Department of Commerce, Washington, D.C.
3. *Characteristics of New One-Family Homes, 1972* (Series C25). 1973. U.S. Bureau of the Census, U.S. Department of Commerce, Washington, D.C.
4. *Characteristics of New One-Family Homes, 1973* (Series C25). 1974. U.S. Bureau of the Census, U.S. Department of Commerce, Washington, D.C.
5. *Construction Management* (TM 5-333). 1972. Department of the Army, Washington, D.C.
6. *The Report of the President's Commission on Urban Housing: A Decent Home*. 1968. U.S. Government Printing Office, Washington, D.C.
7. Stillman, Richard J. *Do-it-Yourself Contracting to Build Your Own Home*. 1974. Clinton Rock Company, Radnor, Pa.
8. Turner, John F.C., and Robert Fichter. *Freedom to Build*. 1972. The Macmillan Co., New York, N.Y.

Literature Resources: Where Is the Information?

Written references provide valuable insights into the many traditional methods and emerging technological, economic, and legal dimensions of owner-building. Before building a home, it is desirable to explore your library and bookstore. The time you invest will pay off in a better home at a lower cost, constructed with fewer problems and delays.

The references provided on the following pages have been selected to reflect the extensive amount of printed information. This list, however, is not inclusive since new publications become available daily. You should, therefore, check your local library and bookstore before ordering any of these references.

When searching the literature for helpful information, do not overlook magazines. There are two basic types of magazines you may wish to review:

1) professional or technical journals which are a good source of information about innovations in materials, construction, and design; and

2) popular journals providing more elementary and applied ideas. Examples of these types of magazines include:

PROFESSIONAL OR TECHNICAL

American Building Supply
Architectural Record
Building Products Guide
Concrete
Concrete Construction
Construction Specifier
Design and Environment
Forest Products Manual
Man and Environment
Progressive Architecture
Roofing, Siding and
Insulation
Wood and Wood Products

POPULAR AND NONTECHNICAL

American Home
Better Homes and Gardens
Building Ideas-Quarterly
Family Handyman
Home Improvements
House and Garden
(Building Guide, Plans
Guide, and Remodeling
Guide — all Semi-Annual)
House Beautiful
(Building Manual and
Home Remodeling —
— Semi-Annual)
(Houses and Plans —
Annual)
Interiors
Mechanics Illustrated
Popular Mechanics
Popular Science
Sunset

NOTE — The following list of references contains publications directly relevant to owner-building and publications often found in libraries, bookstores, and building supply outlets. For other, more difficult to locate publications, you may wish to review a bibliography containing 2500 annotated references, available from the Bulletin Room, University of Minnesota, Coffey Hall, 1420 Eckles Avenue, St. Paul, MN 55108 (HH-1, *Literature Relevant to Consumer Housing Education*, \$5.00).

Agan, Tessie, and Elaine Luchsinger.

1965. *The House: Principles/Resources/Dynamics*. S.B. Lippincott Co., Philadelphia, Pa. (Hardcover) \$6.95. Includes basic reading on family needs and space requirements, yet ignores many basic design elements. Helpful for defining needs in terms of space, but not design, requirements.

1976. *America's Handyman Book*. Charles Scribner's Sons, New York, N.Y. (Hardcover) \$12.50. Thorough and comprehensive, although generally overdone with details the average homeowner encounters only infrequently. Contains some designs. For the somewhat experienced "handyman."

Anderson, L.O.

1973. *How to Build a Wood Frame House*. Dover Publications, Inc., New York, N.Y. (Paperback) \$3.50. Similar to 1975 USDA publication, *Wood Frame House Construction* by Anderson.

Anderson, L.O.

1973. *How to Build Wood Frame Houses*. Drake Publishers, New York, N.Y. (Hardcover) \$6.95. Similar to 1975 USDA publication, *Wood Frame House Construction* by Anderson.

Anderson, L.O.

1969. *Low-Cost Wood Homes for Rural America: Construction Manual* (001-000-00747), U.S. Department of Agriculture, U.S. Government Printing Office, Washington, D.C. (Paperback) \$1.45. Another excellent construction manual by Anderson which every owner-builder should review. Covers material selection, floor systems, ventilation, and most other construction processes.

Anderson, L.O.

1976. *Wood Frame House Construction*. Craftsman Book Co. of America, Los Angeles, Calif. (Paperback) \$3.25. Similar to 1975 USDA publication, *Wood Frame House Construction* by Anderson.

Anderson, L.O.

1975. *Wood Frame House Construction* (001-000-01232), U.S. Department of Agriculture, U.S. Government Printing Office, Washington, D.C. (Paperback) \$2.60. The most complete construction manual reviewed. Presentation of the order of construction phases is somewhat illogical, but does not detract from overall thoroughness. Numerous illustrations and basic text make it appealing to persons of any skill.

Anderson, L.O. and Zornig, Harold F.

1972. *Build Your Own Low-Cost Home*. Dover Publications, Inc., New York, N.Y. (Paperback) \$5.95.

Contents appear to be entirely reprinted from material previously published by the U.S. Government Printing Office and appearing in this bibliography:

- *Low-Cost Wood Homes for Rural America* . . . by Anderson, \$1.45.
- *Designs for Low-Cost Wood Homes* by Anderson and Zornig, \$.25 (11 complete sets of plans \$14.75 in addition).

Anderson, L.O. and Zornig, Harold F.

1969. *Designs for Low-Cost Wood Homes*. U.S. Department of Agriculture, U.S. Government Printing Office, Washington, D.C. (Paperback) \$.25.

Brief descriptions of 11 house plans which the authors believe may be built at half the cost of similar size plans. Includes order blank for obtaining complete working drawings of the plans (prices range from \$1.00 to \$1.75 and include 4 to 10 sheets).

Anderson, L.O. and Winslow, Taylor F.

1976. *Wood-Frame House Construction*. Craftsman Book Company, Solana Beach, California. (Paperback) \$3.25.

Similar to 1970 USDA publication, "*Wood Frame House Construction*" by Anderson. Winslow adds an 11-page chapter on estimating construction costs.

Angell, William J.

1972. *Housing Handbook*. Agricultural Extension Service, University of Minnesota, St. Paul, Minn. (Three-ring binder) Not for sale.

A collection of more than 200 consumer and semi-technical publications from federal agencies, state extension services, and trade associations. Covers such topics as construction, utility systems, planning, maintenance-repair, site, specific areas within the house, etc. Available for review at county extension offices throughout Minnesota.

1971. *Basic Home Repairs*. Lane Books, Menlo Park, Calif. (Paperback) \$2.45.

Basic reference covering plumbing, gas and electric heating systems, doors, windows, walls and ceilings, floors, stairs, drawers, roofs, exterior walls, building terms, tools, and materials. Good for the new homeowner.

1975. *Basic Plumbing Illustrated*. Lane Books, Menlo Park, Calif. (Paperback) \$2.45.

Reference for plumbing failures and repairs. Information on remodeling old fixtures and installing new ones.

1975. *Bathrooms: Planning and Remodeling*. Lane Books, Menlo Park, Calif. (Paperback) \$2.45.

Includes information on solving structural and decorative problems. Selection of lighting, heating and ventilation, storage, and accessories are described and illustrated.

Beasley, M. Robert.

1963. *Fell's Guide to Buying, Building, and Financing a Home*. Frederick Fell Publishers, Inc., New York, N.Y. (Hardcover) \$4.95.

One of the better references on financing a home. One excellent section on financing a home presents interesting financial problems and solutions aimed at the novice home builder or buyer. Somewhat outdated in other sections, which assume substantial knowledge on the part of the reader.

Blustin, Lewis.

1976. *How to Subcontract Your House: Building/Remodeling*. Tab Books, Blue Ridge Summit, Pa. (Paperback) \$4.95.

An interesting case study of one novice's experiences building a home while acting as a general contractor. In an effort to simplify, however, the author over-simplifies many important considerations, relies frequently upon recommendations of individuals with limited knowledge, and presents techniques regionalized in character. Useful as general background reading.

Brainerd, John W.

1973. *Working With Nature*. Oxford University Press, New York, N.Y. (Hardcover) \$15.00.

Interesting and informative book emphasizing environments and their components. Would be of great value to the owner-builder interested in an environmentally adaptable design solution. Shows effectively how the site can form and relate to the house, providing a functional as well as an aesthetic solution.

Brann, Donald R.

(Dates indicated). *Easy-Bild Series*. Directions Simplified, Inc., Briar Cliff Manor, N.Y. (Paperback) Prices indicated.

Written for the novice; does a good job of communicating its message. Well illustrated and written. Available in many lumberyards.

Bricklaying Simplified (668), 1972, \$2.50.

Carpeting Simplified (683), 1973, \$2.50.

Complete Catalog of Publications (600), NK (NK = Date not known), \$1.25.

Concrete Work Simplified (617), 1973, \$2.00.

Easi-bild Simplified Electrical Repairs (694), 1973, \$2.00.

Forms, Footings, Foundations, and Framing (697), NK, \$2.50.

How to Add an Extra Bathroom (682), 1971, \$2.50.

How to Apply Paneling (605), NK, \$2.00.

How to Build a Dormer (603), NK, \$2.00.

How to Build a Fireplace (674), NK, \$3.50.

How to Build a One-Car Garage or Carport (680), NK, \$2.50.

How to Build a Two-Car Garage (663), 1973, \$2.00.

How to Build a Vacation or Retirement House (632), NK, \$2.50.

How to Build a Walk-In and Window Greenhouse (611), \$2.50.

How to Build an Addition (609), 1974, \$2.00.

How to Build Bookcases (664), NK, \$2.00.

How to Build Kitchen Cabinets (658), 1974, \$2.00.

How to Build or Enclose a Porch (613), 1974, \$2.00.

How to Build Patios and Sundecks (631), NK, \$2.00.

How to Build Storage Units (634), NK, \$2.00.

How to Build Wall-to-Wall Stereo Cabinets (612), NK, \$2.50.

How to Build Workbenches (672), 1974, \$2.00.

How to Install Protective Alarm Devices (695), NK, \$2.50.

How to Lay Ceramic Tile (606), 1971, \$2.00.

How to Modernize a Basement (615), 1974, \$2.00.

How to Modernize a Kitchen (608), 1974, \$2.00.

How to Modernize an Attic (665), 1974, \$2.00.

How to Rehabilitate Abandoned Buildings (685), NK, \$3.50.

How to Transform a Garage into a Living Space (684), 1973, \$2.50.

Plumbing Repairs Simplified (675), 1974, \$2.50.
Roofing Repairs and Application Simplified (696), 1974, \$2.00.

Browne, Dan.

1974. *The House Building Book*. McGraw-Hill, New York, N.Y. (Paperback) \$5.95, (Hardcover) \$12.95.

Written by a professional builder. Covers everything from site preparation to final trim. Uses many building terms the inexperienced builder may not understand. The excellent section on masonry illustrates the step-by-step process of building a house foundation. A general reference for the more experienced owner-builder.

1975. *The BOCA Basic Building Code, 1975*. Building Officials and Code Administrators International, Inc., Chicago, Illinois (Paperback) \$12.50.

The basic, model code establishing standards for light, ventilation, egress, structural components, material fire-resistivity, chimneys, and other aspects of constructions. Written in a legal, technical manner which may challenge the novice.

1975. *The BOCA Basic Mechanical Code, 1975*. Building Officials and Code Administrators International, Inc., Chicago, Ill. (Paperback) \$9.50.

The basic, model code establishing standards for heating, cooling, and ventilating systems; boilers; burners; fireplaces; and chimneys. Written in a legal, technical format which may challenge the novice.

1975. *The BOCA Basic Plumbing Code, 1975*. Building Officials and Code Administrators International, Inc., Chicago, Ill. (Paperback) \$9.50.

The basic, model code establishing standards for plumbing systems including: materials, drainage, venting, joints and connections, traps, cleanouts, hangers, and water supply and distribution. Written in a legal, technical fashion which may challenge the novice.

1972. *Basic Carpentry*. Lane Books, Menlo Park, Calif. (Paperback) \$2.45.

Written for the novice carpenter. Covers tools, materials, walls, ceilings, windows, doors, floors, planning, and paneling. Probably too basic for the average owner-builder, but contains information all should know about carpentry.

1974. *Basic Construction Techniques for Houses and Small Buildings Simply Explained*. Bureau of Naval Personnel, Dover Publications, Inc., New York, N.Y. (Paperback) \$4.50.

Deals thoroughly with most construction situations encountered in the home building process. Does not consider design. Includes unusual but very useful sections on material handling and scaffolding, and paints and preservatives. Although it is lengthy and covers some construction situations that would never occur in an owner-built home, it is well illustrated and could serve well as a basic construction manual for the do-it-yourselfer.

1974. *Basic Construction Techniques for Houses and Small Buildings Simply Explained*. Dover Publications, Inc., New York, N.Y. (Paperback) \$5.00.

Average reference on construction techniques. Especially good on concrete, masonry, grading, excavating, scaffolding, and heavy construction, but weaker in other areas.

Bruyere, Christian and Inwood, Robert.

1976. *Country Comforts. The New Homesteader's Handbook*. Drake Publishers, Inc., New York, N.Y. (Paperback) \$6.95.

Written as a follow-up to *In Harmony with Nature, Country Comforts* deals with secondary structures — greenhouses, animal shelters, root cellars — built by the "average person." Excellent section on wood-burning heaters and fireplaces. Based on actual experiences, it is not only informative, but entertaining reading.

Buckwalter, Len, et. al.

(Date not indicated). *Electrical Repairs and Projects for the Handyman*. Arco Publishing Co., Inc., New York, N.Y. (Hardcover) \$3.95.

Not reviewed.

1971. *Carpenter* (TM 5-551B). Department of the Army, U.S. Government Printing Office, Washington, D.C. (Paperback) \$2.60.

An excellent technical manual that covers construction print reading, construction techniques, building layout and foundation, concrete forms, frame construction, roof systems, etc. Easy to understand and well illustrated.

1968. *Carports and Garages*. Lane Books, Menlo Park, Calif. (Paperback) \$1.95.

Covers location, purpose, size, remodeling, space requirements, driveways, and plans. Deals with the little understood topic of the construction process. Should be interesting to the owner-builder as an idea book more than as a how-to-do-it piece.

Castellano, Carmine and Seitz, Clifford P.

1975. *You Fit It: Insulation*. Arco Publishing Co., Inc., New York, N.Y. (Paperback) \$3.95.

Not reviewed.

Cobb, Hubbard H.

1970. *How to Buy and Remodel the Older House*. Collier Books, New York, N.Y. (Paperback) \$3.95.

Originally in hardcover as "The Dream House Encyclopedia", this book presents information on phases of remodeling the older home. Especially good are chapters on finding and inspecting the older dwelling, determining renovation costs, and space planning considerations. Although not as detailed as other references on construction techniques, it does provide good basic information.

1973. *Complete Do-It-Yourself Manual*. Reader's Digest Association, Inc., Pleasantville, N.Y. (Hardcover) \$15.95.

The best all-around manual of its kind reviewed. Extremely thorough and explicit. Simple and well illustrated for the beginner or expert. Covers methods and materials as well as offering ideas for home improvement and repair. Invaluable as a basic reference for the homeowner.

1975. *Concrete and Masonry* (TM 5-742). Department of the Army, U.S. Government Printing Office, Washington, D.C. (Paperback) \$2.70.

An excellent technical manual that covers concrete components, concrete mixtures, form design, construction procedures, concrete (block) masonry, brick and tile masonry, etc. Easy to understand and well illustrated.

1975. *Construction Management* (TM 5-333). Department of the Army, U.S. Government Printing Office, Washington, D.C. (Paperback) \$2.80.

An excellent technical manual, but useful only to an individual who is functioning as a general contractor building several houses at one time.

1974. *Construction: Principles, Materials and Methods*. U.S. League of Savings Associations, Chicago, Illinois. (Hardcover) \$16.95.

One of the most complete easily understood (written for mortgage officers) references available. Covers nearly all conceivable aspects of material selection, designs, and construction practices. This publication is a must for anyone seriously interested in home building.

1974. *Construction with Surface Bonding* (001-000-03340). U.S. Department of Agriculture, U.S. Government Printing Office, Washington, D.C. (Paperback) 45¢.

This publication outlines a simple do-it-yourself technique for building masonry block (foundation) walls. Well worth the price.

Dalzell, J. Ralph and Merritt, Frederick J.

1973. *Repairing and Remodeling Guide for Home Interiors*. McGraw-Hill, New York, N.Y. (Hardcover) \$8.95.

Interesting, clearly written, well illustrated (although illustrations somewhat dated) remodeling guide covering: woods, fasteners, insulation, ceilings, walls, floors, basements, kitchens, attics, bathrooms, storage, lighting, and air conditioning.

Dalzell, James Ralph.

1972. *Plan Reading for Home Builders*. McGraw-Hill, New York, N.Y. (Hardcover) \$8.95.

Discusses the language and symbols of construction drawing to aid the homeowner in building, improvement, and maintenance.

Daniels, George.

1967. *Home Guide to Plumbing, Heating, and Air Conditioning*. Harper & Row, New York, N.Y. (Hardcover) \$3.95.

An exceptional reference for the beginning plumber or homeowner. Covers numerous topics of concern to the owner-builder: how plumbing and heating systems work, tools, installation, service, common repairs, and planning systems. Well illustrated and easy to understand. An excellent reference.

Day, Richard.

1969. *Concrete and Masonry*. Arco Publishing Co., Inc., New York, N.Y. (Hardcover) \$4.95.

Not reviewed.

Day, Richard.

1967. *How to Remodel Your Attic or Basement*. Arco Publishing Co., Inc., New York, N.Y. (Hardcover) \$3.95.

PR — Information about transforming basements and attics into livable space.

Day, Richard.

1974. *Practical Handbook of Plumbing and Heating*. Fawcett Publications, Inc., Rockville, Mass. (Paperback) \$2.98.

Covers servicing or additions of plumbing and heating systems, although much is applicable to new construction. Written for the beginner. Well illustrated and easy to apply to the construction process. A good reference. (A 1974 revision is available from Crown Publishers, Inc., New York, N.Y. in paperback for \$2.98.)

Day, Richard.

1968. *Remodeling Rooms*. Arco Publishing Co., Inc., New York, N.Y. (Hardcover) \$3.50.

PR — Presents information about ceilings, floors, and walls.

DeCristoforo, R.J.

1969. *Carpentry Handbook*. Arco Publishing Co., Inc., New York, N.Y. (Hardcover) \$4.95.

Good basic reading for the inexperienced owner-builder. Deals with all conceivable carpentry situations encountered in the home building process. Lacks adequate illustration, which could be helpful for on-the-job guidance.

1973. *Decks: How to Build*. Land Books, Menlo Park, Calif. (Paperback) \$2.45.

Selecting the best location and plan for expanding the outdoor living area.

1963. *Design*. U.S. League of Savings Associations, Chicago, Ill. (Paperback) \$4.00.

Although this reference is 12 years old, it presents some of the most relevant principles of design in an easy to understand, easy to apply way. Covers basic principles of design, the plan-site relationship, plan analysis, exterior appearance, and so on. A must for every owner-builder.

Dietz, Albert G.H.

1971. *Dwelling House Construction*. M.I.T. Press, Cambridge, Mass. (Paperback) \$3.95, (Hardcover) \$17.50.

For the money, one of the best construction manuals reviewed. Presents topics logically, contains numerous illustrations, and is well written. Contains any information an owner-builder should need for constructing a house, regardless of skill.

Duffin, D.J.

1962. *Modern Carpet Installation*. Van Nostrand Reinhold Co., New York, N.Y. (Hardcover) \$7.95.

Complete, well written, and easy to understand. Emphasis is on ease of installation: tools, techniques, mathematics, measuring, and estimating. One of the few available books that deals with carpet installation on a nontechnical basis. Using this book as a reference, the owner-builder should be able to install carpeting with ease.

1976. *Dwelling Construction Under the Uniform Building Code*. International Conference of Building Officials, Pasadena, Calif. (Paperback) \$3.00.

Concise explanation of the Uniform Building Code constraints on dwelling construction. A reference that any owner-builder should review.

1972. *Dwelling House Construction Pamphlet*. International Conference of Building Officials, Pasadena, Calif. (Paperback) \$1.60.
Applications of the Uniform Building Code to the home builder.

Endacott, G.W.

1972. *Woodworking and Furniture Making*. Drake Publishers Inc., New York, N.Y. (Paperback) \$4.95.
For more than just the occasional home craftsman. Contains information on creating a satisfactory work area, necessary hand and power tools and their care, material selection, basic woodworking procedures, and basic furnishings projects.

1973. *Electrical Repairs and Projects for the Handyman*. Arco Publishing Co., New York, N.Y. (Hardcover) \$3.95.
Includes tips on new materials and equipment, installation procedures, and troubleshooting.

1973. *Fireplaces*. Lane Books, Menlo Park, Calif. (Paperback) \$2.45.
Deals mainly with different types and styles of fireplaces, not with how to build them. Good section on prefabricated fireplaces. Should be used as an idea book for application in the owner-builder's home. Basic and easy to apply to most situations.

Gotlieb, Lois.

1965. *Environment and Design in Housing*. MacMillan Co., New York, N.Y. (Hardcover) \$5.95.
Fair publication dealing with the effects of design on the environment. Best section is "The Dwelling as a Personal Expression." Also covers professional assistance and developing a plan and a home. For the interested designer.

Hall, Edward T.

1969. *The Hidden Dimension*. Anchor Books, Doubleday and Co., New York, N.Y. (Paperback) \$2.50.
Interesting book dealing with space and its effects on people. Would be helpful to those interested in good design who want to understand proxemics, visual space, and space perception.

Harrison, Henry S.

1973. *Houses*. National Association of Realtors, Chicago, Ill. (Hardcover) \$15.00.
Illustrated guide to construction, design, and utility systems. Excellent chapters on basic construction, building materials, and mechanical systems. Also covers location, interior design, styles, material manufacture, reading plans, and "house types" (the last section ignores many basic design elements). Informative for the novice.

Harvey, Robert O., et al.

1961. *When I Have a House*. Guideways, Inc., Champaign, Ill. (Hardcover) Cost unknown.
A fair to good guide to decisions about home building and remodeling in a question-answer format. Contains an excellent chapter on exterior and interior color design. A book to be read and analyzed according to the user's needs, not as a reference piece during construction. Format is somewhat difficult to follow.

Hasenau, J. James.

1976. *Build Your Own Home: A Guide for Sub-Contracting the Easy Way*. Holland House Press, Northville, Mich. (Hardcover) \$11.95, (Paperback) \$6.00.
Covers in detail the whole story of building a house from the builder's view of acquiring the land, making plans, financing, insurance, paying workers, and inspections.

1968. *Heating, Ventilation, Air Conditioning and Sheet Metal* (TM 5-745). Department of the Army, Washington, D.C. (Paperback) Not generally available, see page 25.

A thorough, well illustrated technical manual that covers the following aspects of thermal systems: properties of air and human comfort, heating load, types of heating (steam, hot water, air), ventilation, air cleaning, air conditioning, etc. Should be valuable to anyone planning to design or build a heating-cooling system.

Heim, David.

1975. *Basic Carpentry for Apartments*. St. Martin's Press Inc., New York, N.Y. (Paperback) \$4.50.
A simple, easy-to-follow guidebook for the inexperienced or would-be carpenter. Includes sections on choosing and using tools and materials, planning small-scale projects, and instructions for building more than 40 furniture and storage pieces.

Higson, James D.

1977. *The Higson Home-Builders Guide*. Craftsman Book Co., Solana Beach, Calif. (Paperback) \$7.00.
Good reference dealing primarily with decision-making: choosing architects, contractors, and suppliers; financing; design; etc. Thoroughly presents and analyzes alternatives in decision-making when the owner-builder functions as a general contractor (planning and supervising). Points out many details the owner-builder might overlook. Highly recommended as basic reading material.

1965. *Hillside Homes*. Lane Books, Menlo Park, Calif. (Paperback) Out of print.

Contains information on small homes, two-story homes, unusual designs, hill-hugging homes, design details, landscaping, plants, and gardening, and includes hints for buyers facing special site applications. Considers mostly expensive designs but offers good ideas for the skilled owner-builder.

(Undated) *Home Pro Guides*. Hardware-Paint Division, 3M, St. Paul, Mn. (Paperback) \$1.95 each.

Written for the novice, clearly written and illustrated. Available in many building supply stores.

Bathroom and Kitchen Remodeling Guide
Brick, Concrete and Stonework Guide
Carpentry Guide
Electrical Installation and Repair Guide
Floor and Carpeting Installation and Repair Guide
Paneling and Woodboard Guide
Plumbing Guide
Roof and Gutter Installation and Repair
Wallpaper and Paint Guide

Hornbostel, Caleb.

1961. *Materials for Architecture*. Reinhold Publishing Corp., New York, N.Y. (Hardcover) Out of print.
Encyclopedia-style guide to building materials

written for the advanced builder. Somewhat outdated, but easy to understand and to relate to the construction process. Deals with what the building material is made of and its properties.

1975. *Interior Wiring* (TM 5-760/AFM 85-24). Departments of the Army and Air Force, U.S. Government Printing Office, Washington, D.C. 20402 (Paperback) \$1.95.

Excellent military manual that covers the fundamental principles of electricity as well as basic skill and technique information. Includes information on safety, design and layout, cable wiring, conduit wiring, and maintenance.

Kelsey, W. Eric.

1973. *House Construction and Purchase*. David and Charles, Inc., North Pomfret, Vt. (Hardcover) \$9.95.

A guide to buying, building, and living in your own home. Deals with home building from a contractor's viewpoint. More of an overview than a how-to-do-it book. Examines many pitfalls in obtaining a home. A book to be read and discussed rather than a reference piece.

Kern, Ken.

1972. *The Owner-Built Home*. Charles Scribner's Sons, New York, N.Y. (Hardcover) \$12.95.

The standout of all references reviewed. Should remain the standard textbook for owner-builders for some time. A must for any owner-builder.

1974. *Kitchens: Planning and Remodeling*. Lane Books. Menlo Park, Calif. (Paperback) \$2.45.

Designs stress efficiency in space and workability; includes ideas for storage systems, pass-throughs, and baking centers.

Klingebeil, A.A.

1967. *Know the Soil You Build On* (001-000-00655). U.S. Department of Agriculture, U.S. Government Printing Office, Washington, D.C. (Paperback) 35¢.

An overview of possible soil and site problems to avoid when building. Emphasizes the importance of checking with local planning officials and local Soil Conservation Service offices and the importance of having a soil survey before construction.

Koch, Carl.

1958. *At Home With Tomorrow*. Rinehart and Company, Inc., New York, N.Y. (Hardcover) \$7.95.

Effectively analyzes how design can improve the function of a house and save time and money from a construction as well as a maintenance standpoint. Interesting and informative reading for any owner-builder.

1971. *The Last Whole Earth Catalogue*. Whole Earth Truck Store, Menlo Park, Calif. (Paperback) \$5.00.

A compendium of human knowledge and tools. A thorough reference to many sources of information.

Leitch, William C.

1976. *Hand-Hewn: The Art of Building Your Own Cabin*. Chronicle Books — San Francisco, CA. (Paperback) Cost unknown.

Interesting 120-page look into the art of building a log cabin. One of many recent books on log cabins available through local libraries.

Love, T.W.

1973. *Construction Manual: Concrete and Formwork*. Craftsman Book Company, Solana Beach, Calif. (Paperback) \$3.75.

Comprehensive manual. Information and illustrations provided on properties of concrete and cement, proportioning and mix, excavation, layout procedure, concrete forms, form materials and their use, reinforced concrete construction, cleaning, etc.

Love, T.W.

1974. *Construction Manual: Finish Carpentry*. Craftsman Book Company, Solana Beach, Calif. (Paperback) \$4.75.

Comprehensive instruction manual for doing roofing, gutters, and downspouts; windows and frames; siding; stairs; cabinets; floors; etc. Section on estimating helpful. Illustrations easy to understand.

Love, T.W.

1976. *Construction Manual: Rough Carpentry*. Craftsman Book Company, Solana Beach, Calif. (Paperback, looseleaf) \$6.75.

Comprehensive manual. Includes instruction on wood product selection, framing, roofing, windows, stairways, insulation, etc. Illustrations and materials tables provide additional knowledge.

1973. *Manual of Individual Water Supply Systems* (055-001-00626). U.S. Environmental Protection Agency, U.S. Government Printing Office, Washington, D.C. (Paperback) \$2.45.

A thorough manual that should be helpful to anyone building beyond municipal water systems. Well illustrated and written. Covers such topics as water source selection, use of surface water, water treatment, pumping, distribution, and storage.

Markowitz, Isadore.

1965. *Design and Estimating Guide for Plumbing*. Technical Guide Publications, Inc., Hollywood, Calif. (Hardcover) \$10.95.

Highly technical guide to design and estimating standards for plumbing. For the seasoned plumber only. Most valuable portion of this guide is the estimating tables.

1973. *Masonry Structural Design for Buildings* (TM 5-809-3/AFM 88-3, Chapter 3). Departments of the Army and Air Force, Washington, D.C. (Paperback) Not generally available, see page 25.

A thorough technical manual covering many aspects of masonry design, including characteristics and specifications, crack control, structural design, brick masonry, cavity walls, composite walls, shear walls and bearing walls, lintels, high strength mortars, hollow clay tile walls, etc. Since this reference was published for architects and engineers, it should be of interest to owner-builders who want to build with masonry products. Well illustrated, loaded with examples, written in technical language.

1976. *Minnesota Building Code*. Minnesota Department of Administration-Documents-Section. St. Paul, Minn. (Paperback) \$5.00.

Must reading for every owner-builder. However, difficult to read and use.

Mitchell, Frank V. and Robert W. Mitchell.

1974. *The Installation and Servicing of Domestic Oil Burners*. Arco Publishing Co., Inc., New York, N.Y. (Paperback) \$1.00.
Not reviewed.

1975. *National Electrical Code, 1975*. National Fire Protection Association, Boston, Mass. (Paperback) Available for \$5.50 from State Board of Electricity, 1954 University Avenue, St. Paul, Minn.

The basic, model code for all types of electrical wiring and equipment used in new and remodeled construction. Enforced throughout Minnesota. Written in a legal, technical format which may challenge the novice.

Neal, Charles D

1975. *Build Your Own Greenhouse* Chilton Book Co., Radnor, Pa. (Hardcover) \$9.95.

An excellent reference for both the would-be greenhouse gardener and the established greenhouse owner. Deals with all aspects of greenhouse essentials — locating, building, equipping, and maintaining — whether you build a window greenhouse in a city apartment or a full-scale greenhouse in a rural setting. Clearly written and illustrated.

Neal, Charles D.

1973. *Do-It-Yourself House Building, Step-By-Step*. MacMillan Publishing Co., Inc., New York, N.Y. (Hardcover) \$12.00

Complete and up-to-date examination of the owner-built process, including: planning and financing, obtaining tools, reading and interpreting working plans, choosing a building site and excavating, constructing a waterproof basement, framing and roofing, building a fireplace and chimney, exterior and interior finishing, and insulation, plumbing, and electrical installation.

The best section is the one on mechanical systems installation; the weakest is the one on planning. A practical and logically presented book aimed at the novice or experienced person building a cabin or one-story house.

1975 *One- and Two-Family Dwelling Code*. Building Officials and Code Administrators International, Inc., Chicago, Ill. (Paperback) \$8.00.

Similar in content and format to *Uniform Building Code*. Delineates constraints that affect the basic code for single family houses. Minnesota's State Building Code is patterned after this model code.

1971. *Outdoor Landscaping With Concrete*. Portland Cement Association, Skokie, Ill. (Paperback) \$2.50.

A basic guide for planning and constructing concrete driveways, walks, steps, and patios. Shows the different finishes and methods available to the owner-builder. Contains good information on the characteristics of concrete and its quality control by simple tests. Well illustrated for the novice.

1969. *Paints and Protective Coatings* (TM 5-618/NAVFAC MD-110/AFM 85-3). Department of the Army, U.S. Government Printing Office, Washington, D.C. (Paperback) \$11.25.
Not reviewed.

1976. *Paneling, Painting & Wallpapering*. Lane Books, Menlo Park, Calif. (Paperback) \$2.45.

Decorating ideas and do-it-yourself instructions helpful even to the beginner. Selection and use of materials and equipment includes special features on shingles, bamboo, grass cloth, fabric, and murals.

1971. *Patio Book*. Lane Books, Menlo Park, Calif. (Paperback) \$2.45.

A thorough, comprehensive guide covering planning, structure, planting, and extended spaces. Useful to the owner-builder interested in how outdoor spaces relate to a house in terms of function and aesthetics. Contains many good ideas the owner-builder can handle easily.

1971. *Patio Roofs: How to Build*. Lane Books, Menlo Park, Calif. (Paperback) \$2.45.

Patio coverings suited to a variety of designs, climates, and budgets, including basic building techniques.

1967. *Planning Your New Home*. Lane Books, Menlo Park, Calif. (Paperback) \$2.45.

An idea book emphasizing planning in relation to family needs and site characteristics.

1972. *Plumbing* (TM 5-810-5/AFM 88-8/Chapter 4). Departments of the Army and Air Force, Washington, D.C. (Paperback) Not generally available, see page 25.

A fairly technical military manual that provides information about the design of plumbing systems, mostly for large-scale kitchens and latrines.

1971. *Plumbing and Pipefitting* (TM 5-551K/40P-1-131). Departments of the Army and Air Force, Washington, D.C. (Paperback) Not generally available, see page 25.

A manual used to train military plumbers (MOS 51K). Well written and illustrated. Covers the following aspects of plumbing: reading construction drawings; bills of materials; types of pipe, fittings, valves, faucets, and traps; basic plumbing procedures; fixtures; stacks; ventilation; water supply systems; insulation; and pumps. Includes an important section on dangerous connections.

1973. *Power Hand Tools* (022-003-00902). General Services Administration, U.S. Government Printing Office, Washington, D.C. (Paperback) 45c.

An elementary publication with little technical information. Oriented to the occasional hobbyist. Do-it-yourself builders will find more thorough information in periodicals or in *Tools and Their Uses*.

Ramsey, Charles T., and Harold R. Sleeder.

1970. *Architectural Graphic Standards*. John Wiley and Sons, New York, N.Y. (Hardcover) \$39.50.

Standard of the building industry. Highly technical, but relatively easy to understand. Deals with space and the structural and material requirements for almost any construction situation. For the ambitious owner-builder only.

1969. *Remodeling Your Home*. Lane Books, Menlo Park, Calif. (Paperback) \$2.45.
Contains many useful ideas for remodeling and adding on. Unfortunately, many of the ideas are expensive and too complex for the owner-builder. Not a how-to-do-it book. Overlooks design and assumes the reader knows what space would be best and how best to obtain it.
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1958. *Repairs and Utilities: Buildings and Structures, Lathing and Plastering* (TM 5-621). Department of the Army, Washington, D.C. (Paperback) Not generally available, see page 25.
A short reference that presents useful, but dated, information about new work and repairs involving portland cement plaster, Keene's cement plaster, and stucco.
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1958. *Repairs and Utilities: Preventive Maintenance for Heating Plants and Systems* (TM 5-643). Department of the Army, Washington, D.C. (Paperback) Not generally available, see page 25.
A basic reference that is out of date in many respects but nonetheless may be of interest to individuals who want information about the maintenance and operation of different types of heating systems.
- Roberts, Rex.
1964. *Your Engineered House*. M. Evans and Co., Inc., New York, N.Y. (Hardcover) \$8.95.
Elementary and thorough reading on planning a house, although many important design elements are overlooked. Includes sections that will help the owner-builder analyze his needs and desires concerning space and design requirements.
- Salm, Walter G.
1967. *Remodeling Your Kitchen or Bathroom*. Fawcett Publishing, Inc., Greenwich, Conn. (Paperback) 95¢.
Informative, basic reading with many good ideas for the do-it-yourselfer. Fails to develop a general concept or guideline for remodeling. Aimed at the novice as an idea book, introducing needs the owner-builder may not have. Also available from Arco Publishing Co. in hardcover for \$3.50.
- Scharff, Robert.
1975. *The Complete Book of Home Remodeling*. McGraw-Hill, New York, N.Y. (Hardcover) \$14.95.
Well organized and written as background reading for remodeling rather than as a do-it-yourself guide. Author integrates relevant information but fails to give credit to original sources; accuracy of information is therefore difficult to determine.
- Schuler, Stanley.
1971. *All Your Home Building and Remodeling Questions Answered*. MacMillan Co., New York, N.Y. (Hardcover) \$8.95.
Question and answer format. Thorough, but not easy to follow. For the seasoned builder.
- Schuler, Stanley.
1976. *The Floor and Ceiling Book*. M. Evans and Co., Inc., New York, N.Y. (Hardcover) \$8.95.
A clearly-written book that gives step-by-step instructions for rebuilding, repairing, decorating, and maintaining floors and ceilings. Efficiency and economy are emphasized in material selection. An excellent reference for the do-it-yourself home builder and remodeler.
- Schuler, Stanley.
1971. *The Homeowner's Minimum Maintenance Manual*. M. Evans and Co., Inc., New York, N.Y. (Hardcover) \$6.95.
Basic and interesting reading for proper home maintenance. Efficiently deals with building to reduce home maintenance. Best section discusses selection of low upkeep materials, equipment, and furnishings to reduce upkeep costs in the years following construction. Should appeal to any owner-builder.
- Schuler, Stanley.
1975. *How to Fix Almost Everything*. M. Evans and Co., Inc., New York, N.Y. (Hardcover) \$9.95, (Paperback) \$5.95.
An all-occasion reference for fixing all those things that need repairing — "the standard A-Z guide to 1001 household fix-it problems." Also contains a good basic how-to section and glossary.
- Schuler, Stanley.
1976. *5,000 Questions Answered About Maintaining, Repairing, and Improving Your Home*. Collier Books, New York, N.Y. (Paperback) \$9.95.
A comprehensive handbook for the homeowner, includes answers to questions ranging from minor maintenance to major repair procedures.
- Schuler, Stanley.
1974. *The Wall Book*. Evans and Co., Philadelphia, Pa. (Paperback) \$4.95.
A well written book that deals with interior walls in almost any way imaginable, including how to build or remove them and how to decorate. Probably the best chapter is on paneling. A very imaginative and interesting book, although its application to the owner-built process is limited.
- Scott, John S.
1974. *A Dictionary of Building*. Penguin Books, New York, N.Y. (Paperback) \$3.50.
This 400-page reference is extremely thorough. An excellent reference that is well worth the investment.
- Sherwood, Gerold E.
1976. *How to Select and Renovate an Older House*. Dover Publications, Inc., New York, N.Y. (Paperback) \$1.75.
- Small Home Council.
(Dates indicated) Circular Series. University of Illinois, Urbana. (Paperback) 25¢ each.
For the most part, excellent references that communicate their messages simply and easily. Some circulars are outdated, however.
Basements (F2.0), 1953
Bedroom Planning Standards (C.5.6), 1974
Brick and Concrete Masonry (F17.2), 1960
Cooling Systems for the Home (G6.1), 1971
Counter Surfaces (F9.1), 1958
Crawl Space Houses (F4.4), 1959
Electrical Wiring (G4.2), 1964
Flooring Materials (F4.6), 1955
Fuels and Burners (G3.5), 1971
Fundamentals of Land Design (B3.0), 1947
Garages and Carports (C5.9), 1969
Hazard-Free Houses for All (C1.1), 1958
Heating the Home (G3.1), 1971

Household Storage Units (C5.1), 1953
Insulating Windows and Screens (F11.2), 1968
Insulation in the Home (F6.0), 1947
Interior Design (H1.0), 1969
Kitchen Planning Standards (C5.32), 1964
Laundry Areas (C5.4), 1967
Living With the Energy Crisis (C1.5), 1973
Moisture Condensation (F6.2), 1975
Plumbing (G5.0), 1968
Plywood (D7.2), 1970
Roofing Materials (F12.3), 1963
Selecting Lumber (D7.0), 1971
Selecting Windows (F11.1), 1955
Split-Level Houses (C2.5), 1960
Termite Control (F2.5), 1963
Window Planning Principles (F11.0), 1954
Wood Framing (F3.0), 1954

Stevenson, Robert P.

1974. *How to Build and Buy Cabinets for the Modern Kitchen*. Arco Publishing Co., Inc., New York, N.Y. (Hardcover) \$10.00.
PR — Included working plans for 70 types of cabinets.

Stillman, Richard J.

1974. *Do-It-Yourself Contracting to Build Your Own Home*. Chilton Book Co., Randor, Pa. (Hardcover) \$8.95.
Suggests sound management principles to reduce costs and construction time and to assure a better quality home. A step-by-step managerial approach to subcontracting your own home. Includes invaluable PERT diagrams showing construction and planning sequences useful to any home builder. An excellent book for persons interested in having the job done right and obtaining a quality product. Does not include information on owner involvement other than the contracting and planning side of the building process.

1975. *Storage*. Lane Books, Menlo Park, Calif. (Paperback) \$2.45.
250 photographs show practical storage units for every part of the house or apartment.

Tassin, Ray.

1974. *Discount Homebuilding*. Drake Publishers, Inc., New York, N.Y. (Hardcover) \$7.95.
Similar to the *Higson Home Builder's Guide* in content and approach in that it deals with the owner-builder as a general contractor. Illustrates step-by-step preconstruction and construction process, with emphasis on hiring the right subcontractors. The book is somewhat incomplete, however, and makes numerous assumptions that can be costly.

(Dates indicated) Technical Manual Series. Department of the Army, Washington, D.C. (Paperback) Cost and availability unknown.

The following army publications include a great deal of information helpful to the owner-builder. Most of these references are well illustrated and clearly written. It may, however, be difficult to get these references from the military. First contact any local army national guard or reserve unit (especially engineering) to see if you can borrow or order these publications. Or contact your congressperson or senator and request assistance.

Building Construction Materials and Practices: Acoustical Treatment (TM 5-805-10). 1965.

Building Construction Materials and Practices: Caulking and Sealing (TM 5-805-6). 1965.

Repairs and Utilities: Electrical Facilities, Interior Electrical System (TM 5-680B). 1959.

Repairs and Utilities: Electrical Facilities, Overhead Distribution (TM 5-680C). 1963.

Repairs and Utilities: Sheet Metal (TM 5-625). 1964.

Roofing Design (TM 5-805-14). 1966.

Well Drilling Operations (TM 5-297 or AFM 85-23). 1965.

1974. *Tools and Their Uses* (008-047-00145). Bureau of Naval Personnel, U.S. Government Printing Office, Washington, D.C. (Paperback) \$1.95.

An excellent military publication that is thorough, to the point, and well illustrated. Covers common hand tools, power tools, measuring tools and techniques, fastening components and procedures, etc.

1973. *Tools and Their Uses*. Dover Publications, Inc., New York, N.Y. (Paperback) \$2.00.

Republication of same paperback available from the U.S. Government Printing Office.

Townsend, Gilbert, et al.

1968. *How to Plan a House*. American Technical Society, Chicago, Ill. (Hardcover) Out of print.

Slightly outdated and inadequate consideration of design, but still a good reference to consult for an understanding of scheduling and coordinating the construction and planning phases. Written for the enlightened, somewhat skilled owner-builder.

Ulrey, Harry F.

1970. *Carpenters and Builders Library*. Theodore Audel & Co., Indianapolis, Ind. (Hardcover) \$21.25.

This series of four volumes makes up the most complete guide to all phases of carpentry. Deals with tools and methods rather than process or order. Although lengthy and detailed, this set provides the basics needed for house construction at any skill level. Volume 1 covers joinery and hand tools and their uses. Volume 2 deals with mathematics, surveying, and practical drawing as they pertain to the carpenter/builder. Volume 3 covers layouts, foundations, framing, and other basics in house construction. Volume 4 deals with millwork, power tools, and painting.

1972. *Uniform Building Code*. Volume 1. International Conference of Building Officials, Chicago, Ill. (Hardcover) \$12.10, (Paperback) \$10.60.

The basic code for all types of construction. Written in legal language, so it is hard to read, understand, and use in general. (For aspects related to single family dwellings, see *One- and Two-Family Dwelling Code*.)

1974. *Using Coal and Wood Stoves Safely* (HS-8). National Fire Protection Association, Boston, Mass. (Paperback) \$2.00.

A reference that should be helpful to the do-it-yourselfer for selecting, installing, using, and maintaining wood or coal stoves. Well illustrated and

accurate in an area where mistakes can cause loss of life and destruction. (You may be able to borrow a copy from your county extension office [in Minnesota], local fire department, or insurance agent.)

1973. *Walks, Walls & Patio Floors: How to Build*. Lane Books, Menlo Park, Calif. (Paperback) \$2.45.

Guide to masonry outdoor projects with illustrations on using appropriate materials in construction.

Wason, Betty.

1968. *It Takes "Jack" to Build a House*. St. Martin's Press, Inc., New York, N.Y. (Hardcover) \$5.95.

Excellent reference that identifies the constraints affecting home building. Generally a negative view of house construction. For the person interested in the cons of building a house.

Watkins, A.M.

1962. *Building or Buying the High Quality House at Lowest Cost*. Doubleday and Co., New York, N.Y. (Paperback) \$2.50.

Contains an excellent section on design aimed at the novice and one on the five biggest causes for high upkeep in houses and how to avoid them. Includes a checklist for building or buying a house. A book to read and ponder rather than use as a reference. Deals more with theory than practice.

Watkins, A.M.

1971. *The Homeowner's Survival Kit*. Hawthorne Books, Inc., New York, N.Y. (Hardcover) \$7.95, (Paperback) \$2.95.

An excellent reference containing many useful tips on home improvement and remodeling. Contains an excellent section on heat bill savings and another on avoiding home repair bills.

Waugh, Andrew.

1976. *Drake's Handyman's Encyclopedia*. Drake Publishers Inc., New York, N.Y. (Hardcover) \$14.95.

Includes maintenance and repair information and techniques for jobs likely to be encountered in the average home. Illustrations are good. Glossary provides more detailed information. The projects are designed for persons with limited experience and tools. Subsequent projects detailed less fully as the craftsman gains experience and knowledge.

Wilson, J. Douglas.

1973. *Practical House Carpentry*. McGraw-Hill, Inc., New York, N.Y. (Hardcover) \$11.25.

Aimed primarily at the apprentice carpenter as an up-to-date textbook, but is nonetheless an excellent reference for the do-it-yourself carpenter. Covers all phases of construction involving carpentry. Includes useful information on lumber, tools, and types of joints used in construction. Thorough and up-to-date.

Yack, Fred

1975. *Building Your Own Home*. Arco Publishing Co., Inc., New York, N.Y. (Hardcover) \$8.95.

Good basic building manual for the do-it-yourselfer. Covers easiest, approved construction methods for the amateur ranging in logical sequence from site and plan selection through mechanical systems to finish work and landscaping. Detailed illustrations accompany the text.

Zahner, John R.

1975. *Builder's Guide to Contracting*. McGraw-Hill Co., New York, N.Y. (Hardcover) \$15.00.

Although written specifically for those in the construction industry, there is some application for the owner-builder. Topics covered include estimating and bidding, subcontract negotiations, and may be helpful to the individual in understanding the contracting process.

Appendix A: Design Commentary

The prospect of creating one's own environment goes beyond the technical problems of building a home. A truly satisfying home develops from an understanding and translation of one's innermost thoughts and feelings about his personal and environmental needs.

We are all builders, creators, molders, and shapers of the environment. In times past, people designed and built their own homes from knowledge passed down over generations. With industrialization, however, much of this knowledge has been lost. Today we have the increasingly critical problem of scarcity: fuel is in short supply, prices are skyrocketing, materials are scarce. The more we can provide for ourselves without infringing on the rights of others, the better off we will be and the more freedom and independence we will have.

People choose to build their own homes for two main reasons: because they can save money and because they can express themselves by helping to create their own environment. Owner design supports and reinforces both of these reasons.

Functioning as an architect, the owner-designer can save 10 percent or more of the total design-building costs he or she would otherwise have paid to have someone else (an architect) interpret his needs. And he or she can gain the tremendous satisfaction of knowing his house is functioning for the family, rather than the family having to adapt to a house someone else designed.

Any architectural environment, including owner-built housing, is based on reasonably well defined elements and principles of design: mass, form, harmony, contrast, etc. To fully understand these principles is to have a background and foundation for applying them to the design process. Of course, every owner-builder can't be expected to fully understand these elements and principles. But he should make it his business to be more aware of them by becoming conscious of his feelings and reactions and by identifying carefully his housing needs. Developing awareness can be the best design education.

A good grasp of the elements of design can be gained by reading the references in the preceding bibliography. Additional information and help can be sought from professionals. Many architects will review plans and suggest modifications at a moderate fee or on an hourly basis. As pointed out in the case studies, material suppliers also can be sources of design assistance, although the quality of this assistance varies greatly. A good approach could be of a joint nature where the individual identifies his own needs and then, in cooperation with someone proficient in the elements of design, translates those needs into an actual housing plan.

With a proper understanding of user housing needs and at least a feeling for the elements of design, most people can design their own homes. Besides the cost saving factor, they can experience the immeasurable personal satisfaction that comes through self-expression.

Appendix B: Common Construction Abbreviations*

ac	alternating current	fpm	feet per minute	oz	ounce(s)
amp	ampere(s)	fps	feet per second	pc	piece(s)
bbl	barrel(s)	ft	foot or (feet)	pcf	pounds per cubic foot
bhp	brake horsepower	ga	gauge	ph (or O)	phase(s)
Btu	British thermal unit(s)	gal	gallon(s) (US customary)	pr	pair(s)
cfm	cubic feet per minute	gpm	gallons per minute	psf	pounds per square foot
cfs	cubic feet per second	hp	horsepower	psi	pounds per square inch
col	column	hr	hour(s)	rcp	reinforced concrete pipe
CPM	Critical Path Method	hz	cycle(s) (electrical) (hertz)	S2S	surfaced two sides
cu ft	cubic foot (or feet)	in.	inch(es)	S4S	surfaced four sides
cwt	hundredweight (100 pounds, US customary)	int	interior	sec	second(s) (of time)
cy	cubic yard(s)	kva	kilovolt-ampere(s)	sf	square foot (or feet)
d	penny (nail measure)	kvar	kilovar(s)	SFCS	square feet of contact surface
dbhpy	drawbar horsepower	kw	kilowatt(s)	sk	sack(s)
dc	direct current	lb	pound(s) (US customary)	sq	square
dwg	drawing(s)	lf	linear foot (or feet)	sq in.	square inch(es)
ea	each	M	thousand	sy	square yard(s)
exc	excavate	md	man-day(s)	tph	tons per hour
ext	exterior	Mfbm	thousand foot board measure	vc	vitrified clay
fbm	foot board measure	mh	man-hour(s)	wk hr	working hour(s)
Fed spec	Federal specification	min	minute(s)	wt	weight
		mph	miles per hour		
		No. (or #)	number		

*Source for appendixes B-D: *Construction Management* (TM 5-333). 1972. Department of the Army, Washington, D.C.

Appendix C: Work Element Checklist (Material and Labor)

Remove existing structures	Structural steel	Alarm systems, burglar, fire	Plastering
Clearing and grubbing	Masonry — concrete block, brick, structural tile	Electric service	Ceramic tile
Layout	Flashing	Telephone service	Electric fixtures
Blasting	Framing floors, walls, roofs, stairs	Wallboard	Plumbing fixtures
Grading	Sheathing walls and roof	Lathing	Finish flooring
Fill, place, and compact	Subflooring	Stairways	Tile flooring, asphalt, rubber, vinyl, cork, etc.
Landscaping, seeding, and sodding	Door bucks and frames — wood	Metal studs and partitions	Acoustical tile or ceiling
Excavation and backfill	Door bucks and frames — metal	Insulation, walls and ceilings	Interior trim
Relocate existing utilities	Overhead doors	Downspouts and gutters	Handrails
Concrete foundations and footings	Window frames	Exterior doors	Caulking
Pipe sleeves	Conduit in slabs and walls	Screen doors	Painting
Under floor conduit and plumbing	Piping in walls	Windows	Curbs and walks
Grade beams	Electrical rough-in	Window screens	Parking areas
Ground floor slab	Plumbing rough-in	Jalousies	Fencing
Jet anchor bolts or plates	Siding — wood	Exterior trim	Cleanup
Concrete columns, beams, girders	Metal siding and roofing	Glazing	Air conditioning
Concrete floor and roof slabs	Hoods and ventilators	Louvers	Compressed air systems
Precast wall and roof panels	Insulation, roof	Cabinets	Dehumidifiers
Precast structural members	Roofing	Closet units	Exhaust fans
Precast sills and lintels	Asphalt or wood shingles	Mirrors and medicine cabinets	Heating system
Concrete canopy and entrances	Ductwork	Paneling	Laundry equipment
Treads and nosings	Intercom system	Interior doors	Pumps
Pipe sleeves and openings		Metal doors	Refrigerator

Appendix D: Equipment and Tool Checklist

MASONRY

Brick trowels
Line and line holders
Brick hammers
Pointing trowels
Mason's levels (4 ft.)
Block saw and replacement blade
Joint finishing tools
Scaffolding
Mortarboards
Mixing bins or boxes
Mortar hoes
Shovels
Mortar mixer
Pliers or side cutters
Squares (framing)
Rules (6 ft.)
Tapes (50 or 100 ft.)
Water hose or barrels
Hoisting equipment
Transportation equipment

CONCRETE WORK

Cement finishing trowels
Wooden or metal floats
Edgers
Jointers
Shovels
Concrete mixer
Transit mix trucks
Batch plant
Weighing devices
Hoisting equipment
Wheelbarrow
Belt conveyor
Scaffolding
Heating equipment (cold weather)
Transportation equipment
Curing equipment required
Boots and gloves, kneepads
Vibrator (air-gas-elect)
Handtools for forming
Sledge hammers
Picks
Trenching equipment
Hand levels (4 ft., 2 ft., etc.)
Pliers
Mechanical finishing trowels
Rules (6 ft.)
Aggregate production equipment
Cement storage requirements
Pumps (keep excavations free from water)
Concrete pump
Gunite machine
Water hose
Subbase compaction equipment
Wrecking bars
Pry bars
Concrete paving machines
Pointing or cleaning requirements
Power tools for form work
Grinding tools
Field office requirements

REINFORCING BARS

Folding rules (6 ft.)
Leather gloves and jackknife
Side-cutting pliers (7 in.)
Tape measure (50 ft.)
Boltcutter (24 in.)
Hoisting equipment as required
Clawhammer
Oxyacetylene cutting equipment
Arc welding equipment
Portable shear
Portable bender
Hickey
Set of blocks, 3/4-inch manila line
Snatch block (for hand hoisting)
Transportation equipment
Sand screens

Floats

Rubber
Cork
Angle
Wooden
Carpet
Curing or drying equipment
Electric blowers, fans, etc.

PLASTER

Hoisting equipment
Scaffolding requirements
Trowels
Margin
Pointing
Pipe
Angle
Plasterer's
Brushes
Browning
Finish
Tool
Straightedges
Darbies
Hawks
Mixing machine
Wheelbarrow
Mortarboards
Pliers, shears, boltcutters, etc., for metal lath
Handtools, for wood lath
Mechanical plastering machine
Material storage requirements
Transportation equipment
Safety equipment, gloves, goggles, etc.
Water hose or pails
Transportation equipment
Expansion bit
Field office requirements
Storage area requirements

PAINT

Brushes
Spray guns
Hoses (air-paint)
Compressor
Scaffolding
Dropcloths
Paintpots
Safety equipment
Goggles
Face mask
Safety mask
Transportation equipment
Hoisting equipment
Putty knives
Paint scrapers
Wire brushes
Dusting brushes
Sanders (hand power)
Storage requirements (tarps, etc.)
Field office requirements
Spare parts for spray equipment
Hose fittings
Paint gun extension
Paint mixer
Wrenches

CARPENTRY

Hammers and handles
Saws, crosscut, rip, keyhole, and compass
Ripping chisels
Wood chisels
Brace and bits
Squares, framing, "T" and combination
Plumb bob
Hand levels
Screwdrivers
Files
Sharpening stones
Wrecking bars

Pliers

Rules (6 ft.)
Tapes (50 ft., 100 ft.)
Dividers
Hatchets
Nail aprons
Pencils
Hacksaws
Power equipment
Radial arms saw
Table saw
Jointers
Planers
Shapers
Drill press
Grinders
Chain saws
Routers
Portable electrical hand saws
Sanders
Adzes
Sledge hammers
Wrenches
Scaffolding
Hoisting equipment

INTERIOR WIRING

Pliers, diagonal
Pliers, lineman's
Pliers, long nose
Rules (6 ft.)
Screwdrivers
Lineman's toolbag
Wrenches
Clawhammers
Brace and bits
Auger bits
Keyhole and compass saws
Files
Soldering irons
Electrician's knives
Wire tapes
Circuit hickies
Blowtorch
Fire pot
Ladle
Testing equipment
Crosscut saw
Scaffolding materials
Storage requirements
Safety gear
Transportation requirements
Toolboxes
Tool belts

SOIL PIPE AND INTERIOR PLUMBING

Oil can
Cold chisels
Round nose chisels
Hacksaw blade
Half round file, bastard, 10 inch
Handle, file
Hacksaw, frame adjustable
Saw nest, keyhole and compass
Pliers, slip (8 in.)
Hammer, claw
Hammer, ball 1-1/2 pound
Hammer handle (14 in.)
Wrench pipe (10 in., 14 in., 18 in.)
Screwdrivers
Handle, hammer, machine
Mechanic's toolbox
Level, 2 plumb adjustment (28 in.)
Rule, wood folding (72 in.)
Wire brush
Shear, type "D"
Reamer, pipe burring
Cutter, pipe 4 x 6
Cutter, pipe 1/8 to 2 inches
Stardrills, 1 set

