LOW COST OWNER-BUILT HOUSES OF THE PACIFIC NORTHWEST

by

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INTRODUCTION

From the earliest prehistorical attempts to fashion a shelter, man has held the responsibility to construct and maintain his own house. Even today the majority of the dwellings in the world are constructed and maintained by the families who live in them. It is only in the cities and industrial nations of the world that most dwellings are constructed by someone other than the occupant -- by the so-called professional builders.

Even in these industrialized nations of the world where a majority of the new houses are constructed by professional builders, the percentage of owner-built houses is quite high. A study by the author of the records from Lane County, Oregon shows that 38% of the new houses started this year in rural areas were built by the owners. This agrees with national figures which show that owner-builders account for some 40% of all new housing in rural areas, 20% of all new single-family housing and 12% of all housing begun each year in the United States.[1] Every year

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[1] William C. Grindley, "Owner-Builders: Survivors with a Future," in Freedom to Build, John Turner and Robert Fichter, eds., (Macmillan, 1972), p. 4.

some 160,000 families in the United States build their own houses.[2] These figures only take into account the houses that are built from the ground up. The author found that 90% of the additions, alterations, and repairs to existing houses (in Lane County, Oregon) are done by the owner himself.

It is discouraging that, as widespread as this activity is, there seems to be no movement within the architectural profession to try to assist these owner-builders to build better houses. Architects profess to be concerned with the development of mass low-cost housing, and yet the profession as a whole seems to ignore this very large segment of the nation's houses that are presently being built at a very low cost. The mass housing projects seen in architect's offices and architecture schools are generally grand schemes designed to be constructed by the largest construction companies using tools and materials that haven't yet been developed. The occasional project that does get built usually turns out to be so phenomenally expensive (or of such poor design) that it is never attempted again. While this is happening thousands of low-cost owner-built houses are being completed each year.

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[2] Ibid., p. 3

While it is true that almost all owner-built houses are built without the aid of the architectural profession, it does not follow that professional assistance would not be useful. The converse is true. Owner-builders in this country are not usually familiar with the complexities of designing a house, with the methods of constructing it, or with the regulations pertaining to it. They are novices and will grasp for any assistance they can find. They have been fortunate to have such books as Domebook One and Domebook Two by the Portola Institute and the Owner-Built Home by Ken Kern, and such services as the People's Architecture in Berkeley available; but these sources, excellent as they are, only begin to answer the myriad questions owner-builders are likely to have. This is why the profession of architecture, which deals in precisely those areas in which owner-builders need the most help, could make a real contribution toward the betterment of low-cost mass housing by assisting owner-builders.

I must admit that when I first became interested in the area of owner-built housing, I had no idea of the dimensions of the phenomenon. I was building a houseboat to be floated in San Francisco Bay, and I noticed that most of the houseboats were being built by their owners. These owner-built houseboats were not only less expensive than their professionally-built counterparts, but they

were also much more interesting in form. The owners of these unusual houseboats had designed them to suit their own needs and taste. At that time there were no codes regulating the construction of houseboats so it was legally possible to build a houseboat of any quality. I observed that the quality of the owner-built houseboats was far superior to that of the professionally-built.[3] The owner-built houseboats were lower in cost, more interesting in form, and of sounder construction than the professionally-built ones. When I considered that these superior houseboats were being built by inexperienced laymen, the concept of owner-built housing as a viable alternative to professionally-built tract housing seemed quite reasonable.

A survey of owner-built housing on land told me that the lessons I had learned from my experience with the houseboats could, in fact, be applied to housing in general. I saw many owner-built houses that distinguished themselves from ordinary housing in the same ways that owner-built houseboats had been superior to their professionally-built counterparts. Of course I saw many owner-built houses that were not interesting in form.

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[3] I use the term "professional" here and throughout this paper to refer to persons receiving pay. There is no implication of professionalism or of great skill or experience intended.

A majority of them, in fact, were close replicas of the familiar tract house. I did not let this discovery dampen my enthusiasm, however, because I realized that even these houses had a form which reflected the needs, taste, and talents of their owners.

When I decided to make owner-built houses the subject of study for my thesis, I realized that the topic had to be limited somewhat in order to make the project feasible. I wanted my study to result in a work that could be of direct benefit to as wide a range and as great a number of owner-builders as possible. I wanted to alert the architectural profession to the qualities and the potential of the owner-built house. In order to accomplish these objectives, I decided that the study should be limited to extremely low-cost[4] houses built from the ground up in which the owner-builder was also the designer. By setting these limits on the study, a great number of owner-builders were being eliminated; owner-builders using expensive materials, owner-builders making additions, alterations, or repairs to existing houses, and owner-builders working from plans which had been purchased. The group being eliminated contains a far greater percentage of all owner-builders than the group being studied, but I felt the elimination of this group was justifiable

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[4]An explanation of the limits on cost appears on p. 7

on the grounds that the group selected for study would be engaged in every activity particular to owner-builders in this country. Each owner-builder of the study group would have to design his own house, find his own sources of inexpensive materials, and build his entire house from the ground up.

Aside from being the group of owner-builders engaged in the widest range of activities, the study group interested me in another way. All the low-cost owner-built houses I had seen that had interested me from an architechtural point of view had been from this group. It seemed that owner-builder-designers were able to express themselves in their building in a way that owner-builders (who were not designers) and owner-designers (who were not builders) could not. It seemed as if there were something magical and yet very natural in combining owner, builder, and designer in the same person. Not being hampered by a strong tradition in house-building or being held back by a lack of materials, owner-builder-designers in this country are in a better position than anybody has ever been in the history of the world to exercise their control over the form of their own house. I was interested to see in what way people would use this opportunity to go further than anyone before them has been able to in the shaping of their own house.

All architects should be concerned with economy in

building. If I was going to impress anyone with the potential of the owner-built house, I knew it would have to be in the feild of low-cost housing. Of course all owner-built houses are low-cost merely by virtue of their being built by the owner. A typical "low-cost" tract house can be built for about $16.50 per square foot these days; about half of this ($8.25) is for labor, about a third ($6.25) is for materials, and the rest ($2.00) is for other services such as contractors. It did not seem reasonable to call an owner-built house "low-cost" merely because it did not include the cost of labor and other services. For this reason I decided that the figure for materials alone ($6.25 per square foot) would be a good cut-off point for including houses in this study. By making $6.25 per square foot the upper limit, all the houses included in the study would have to use materials more economically than the lowest of the present low-cost houses. Most of the houses included here are considerably below this figure.

I started this study with a number of general questions having to do with the nature of the owner-builder movement. I wanted to find out who was building these houses, what they were like, and why they were being built. In addition to these general questions, I had a number of more specific questions related to the areas in which owner-builders would have to achieve a certain degree of competence in

order to build a house. These are the areas of design, construction, codes, and economics. If my general questions are asking the "who", "why", and "what" of owner-built housing; the more specific questions are asking the "how". In order to get the most complete answers to these general and specific questions, I felt the need to see as many examples of owner-built houses as possible. I would interview owner-builders and take photographs at the site of their projects. By this technique of on-the-site interviews my observations could prompt further questions and the response of owner-builders would be accented with visual examples.

I have been working on this project for a little over a year now. In this period of time I have visited more than 60 owner-built houses and have corresponded with many more owner-builders whose houses, for one reason or another, I was unable to visit. I have talked with contractors, real estate agents, and building inspectors, and have read many books looking for answers to the questions I have had about the owner-builder phenomenon. The results of my investigation are presented in the following five chapters. The first chapter deals with the general question of the nature of owner-builder activity, and is written with the intention of satisfying the questions of the general public. Each of the following four chapters is devoted to a discussion of the forces at work in each

of the four areas in which owner-builders must function in order to build a house. The discussions in these last four chapters are intended to form the foundations for understanding the principles at work in these areas which, to my knowledge, have never before been explored.

CHAPTER ONE

THE OWNER-BUILDER AND HIS HOUSE

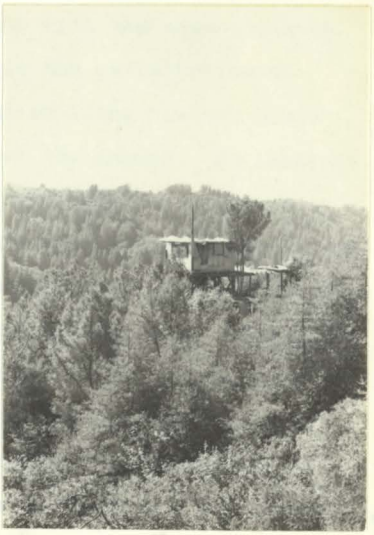
The owner-built houses being built today are only the vanguard of a wave of owner-builder activity of a magnitude that will surprise even the building supply and hardware retailers who are preparing for it. Just as some people are beginning to demand natural foods free from pesticides and preservatives, and just as they are realizing the benefits of bicycle transportation, so are they beginning to realize the benefits of designing and building their own house. We have yet to hear from a Rachel Carson or a Ralph Nader of the housing industry, but when we do, I predict the impact will be tremendous; people from all walks of life will begin to enjoy the benefits.

The people desinging and building their own houses today are as diverse a group as you could find in America. I have interviewed mill-workers, lawyers, students, drop-outs, teachers, and Texas cowboys. They share only a dissatisfaction with the choice of housing offered them by the American housing industry. The most frequently voiced dissatisfactions concern the cost of buying or renting a house, and the mundane design typical of most

housing in this country.

Most owner-builders I interviewed had never owned a house nor had they ever possessed the means to buy one in the conventional way. The very thought of being tied down to regular house payments spanning a period of 20 to 30 years was most distasteful. The frustration of paying rent prompted many of these owner-builders to start thinking about building their own house.

The other main area of dissatisfaction expressed by owner-builders -- the design of the typical low-cost American house -- seems as important as the consideration of cost in prompting them to look elsewhere for their



1. Access to this owner-built house is provided by a 100 foot suspension bridge with no handrails spanning a very deep gorge.

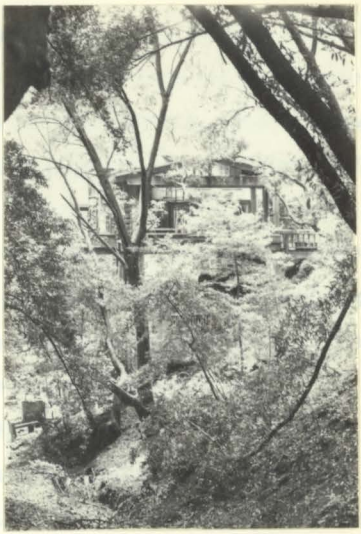
housing needs. The words "ticky-tacky", "little boxes", and "plastic" are used most frequently to describe their reactions and over-reactions. It is not only the repetition and lack of detail necessitated by the discipline of mass-production that is being reacted against, but also the inclusion in these houses of "amenities" the owner-builder would rather not have and would certainly not want to pay for. Some owner-builders do not need or want the minimum two bedrooms required by the FHA; some would rather do without electricity, would replace expensive heating systems with a pot-belly stove, or replace the toilet with a latrine.

Of course the question of why the owner-builder decides to start building his own house is only partly answered by his dissatisfaction with the mass-produced low-cost American house. It is the satisfaction he anticipates from designing and building his own house that provides the other part of the answer. He imagines being able to have a house of any shape he wants -- designed by himself to meet his most practical needs and most whimsical fancies. He wonders what it would be like if no one else made these decisions for him. What would it be like to be an artist-house-builder in the only true sense, in a way that architects who interpret clients' visions and builders who are allowed no visions at all cannot? What would it be like to touch all the materials,

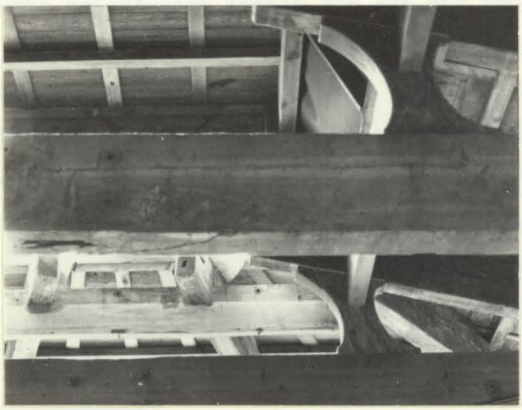
to learn about placing them one against another to make a house? What would it be like if the mistakes were made by his own hands instead of by the mechanisms of technology? What would it be like to have stories to tell about his house? These are exciting questions which each person can only answer for himself by deciding to proceed with the design and construction of his own house.

Almost every owner-built house is located in a rural setting. It is tempting to blame the higher land costs and stricter building codes of the city for this phenomenon, but this is only part of the story. Even the occasional owner-built house found within the city limits is located in the most secluded and forested parts of the city. When questioned about their motives for choosing a rural setting, a large percentage of owner-builders mention a desire to "get out of the city" or to "get close to nature". It is curious that many of these people have never lived in a rural area before.

The forms of the houses being built by today's owner-builders are as diverse and varied as the personalities of the owner-builders themselves. Still, there is a consistency of form running through them that cannot be ignored. They generally consist of simple shapes; they are constructed using standard construction methods; and the conveniences, when they are included, are the standard ones typical of the average American house. The reasons



2. Barely visible through the trees is the fourth floor of a 7000 square foot owner-built house in northern California. The owner bought a used crane to place the huge matched eucalyptus poles and the reclaimed timbers of which the house is built.



3. A detail of the roof framing over part of the owner-built house seen in figure 2, above. The house is so large that the top floor is covered with many smaller buildings such as this. (see also fig. 37)

for this consistency will probably be found in the same factors to which a consistency of house form is attributed in other cultures. These factors are climate, the availability of materials, the capabilities of the builder, and the traditions of the society.[1]

Climate - The climate of the region included in this study, the region between the coast and the mountain ranges from Northern California north to the Canadian border, is temperate but not uniform. Average yearly rainfall increases (from 12"/year to 120"/year) and temperature decreases (20°F design temperature difference) as we proceed northward. As a result of these climatic differences the owner-built houses of northern portions of the region favor orientation toward the sun and protection from the rain and cold to a greater degree than those of the southern portions. On the other hand I have found owner-built houses in the northernmost locations which compare almost identically to owner-built houses in the most southerly locations. While climate does seem to play a role in determining the form of owner-built houses, this role seems to be a relatively minor one when compared with other influences.

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[1] Amos Rapoport, House Form and Culture, (Prentice-Hall, 1969), pp. 18-45 for a thorough examination of these factors.

Availability of Materials - The quantity and variety of building materials available in this country at the present time would surpass the needs of the most eccentric owner-builder. Never before have people had such a wide array of building materials at their disposal. Of course, we are not dealing here with people who can afford to be eccentric. Perhaps we should remind ourselves that the need to keep the cost of materials as low as possible is foremost in the minds of the owner-builders included in this study. This need for low cost restricts the choice of materials available. In practical terms it has meant that these owner-builders have been restricted to free

4. A three story hexagonal owner-built house in northern Washington built by a psychologist and his hired carpenter. He has had trouble with the sloped windows leaking and, because of limited space, wishes he hadn't continued the sloped walls to the upper floors.

materials, to used materials, and to new materials at the very bottom of the price scale. The used materials generally available to owner-builders are the easily extractable pieces of buildings from the past -- windows, doors, fixtures, and lumber. The least expensive of the new materials tend to be the very materials used by contractors to build tract houses. Even if the use of these low-cost materials goes against their wishes as it often does, owner-builder are compelled to use these materials that they can afford. The American toilet, for example, is repugnant to many owner-builders who would prefer not to waste five gallons of water per flush and who would rather recycle the human waste. The alternative Japanese low-water-capacity toilet or the Swedish composting toilet are so costly in this country, however, that the owner-builder, if he wants a toilet at all, is driven to the American toilet every time. Even at design conferences such as Quick City where alternative power sources such as methane generation for light and electricity have been the major topic for discussion, the organizers have been unable to provide working examples. Not only the systems within the house but the very shape and scale of the house itself are strongly influenced by the price of materials. Two-by-four lumber is the least expensive lumber suitable for structural support. The best low-cost insulation is designed to fit between

two-by-four studs. It is the availability and the low cost of materials used in stud wall construction which make this type of construction so popular with the owner-builders. It is the widespread use of this type of construction which has a unifying effect on the shape and scale of owner-built houses.

Capabilities of Builder - The capabilities of the builder influence the form of houses in every culture. Owner-builders, of course, are a very unhomogeneous group. Having come from very diverse backgrounds, they have acquired very different capabilities. In fact, in the area of capabilities, the only thing owner-builders

5. An owner-built houseboat on the Columbia River just downstream from Portland.

seem to share is a lack of capabilities, a lack of experience in the area of house construction. Most of the owner-builders I interviewed said that before starting their own house they had had very little experience with house construction; many had had none at all. It is this inexperience which contributes most significantly to a consistency of form in owner-built houses. This lack of experience prompts most owner-builders to choose a simple design and a method of construction which has been tried and proven. The most tried and proven method in the Pacific Northwest is the two-by-four frame construction used by most contractors to build tract houses. By using these widespread methods (and materials), the inexperienced owner-builder is most capable of acquiring the instructions and guidance he will need to complete the tasks he has never done before. There are many books available explaining two-by-four frame construction and the wiring, plumbing and so on associated with it. Clerks in building supply outlets can usually explain how to install the parts they sell you. For better or worse two-by-four frame construction has become a part of the collective experience of this culture, and it is no accident that the inexperienced owner-builder most frequently will choose to take advantage of this. The only reason so many owner-builders have been building domes is that previous dome-builders have collected their experiences into two

excellent books, Domebook I and Domebook II, with explicit instructions which can be easily followed by the inexperienced.

Tradition - Tradition is another factor which tends to unify house form. Even after the climate, the materials, and the capabilities of the builder have limited the possibilities of suitable house form, there are always a number of possibilities remaining. It is tradition, having recorded the choices of previous generations in a model which is passed from one generation to the next, that helps the builder make the final choice. A dramatic example of the effects of a strong tradition can be seen along the banks of the Nile River where houses built today are almost identical to houses built 4,000 years ago. In this country where tradition has risen from a brief history of people from varied national and racial backgrounds, the tradition is not as strong and therefore influences house form in a less dramatic way. The traditional American house, a single-family detached house, rectangular in plan, with a pitched roof, a fireplace, and separate rooms for cooking, dining, sleeping and so forth, can be built in a variety of ways[2] and still conform to the guidelines of this generalized traditional

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[2]Any number of plans, shapes, materials, scales, and details have been used in the traditional American house.

form. This inability of American tradition to strictly define house form has allowed another form-defining factor to emerge. This is the factor of style, founded in the mood of the times as is fashion in clothing. The effects of style are much more short-lived than those of tradition. In this century alone, the traditional American house has passed through the Victorian style, the Bungalow style, and, most recently, the Ranch style. At present we seem to be emerging from the Ranch style and heading into (what I will call) the Barn style[3], which is very much in evidence in many of the owner-built houses I have visited.

Because owner-builders have matured in this culture with its tradition and with the circumstances which generate its styles, their houses reflect these influences. The traditional American house stands as a core around which deviations of style and individual fancy are made. The traditional model always remains; even the most bizarre examples seen in this thesis show some evidence of this model.

The following pages contain illustrations of some of the owner-built houses I have seen during the course of my study. I have selected these particular houses

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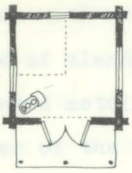
[3]The elements of "the Barn style" are; a large central space usually including kitchen, dining, and living areas; with high ceilings; bedrooms often upstairs; and an abundance of exposed (often roughsawn) wood.

6. Owner-builders enjoy the opportunity to express themselves, and traditional stylistic elements are used for this purpose even when the house type is not of traditional origin.

not only for their interest but also because I feel they represent a cross section of the houses I have observed. They should illustrate the consistency of form discussed in the preceeding paragraphs as well as the diversity of form brought to each project by the unique personality of each owner-builder. All plans are drawn to the same scale (1/16" = 1'0") and are oriented in the same direction for easy comparison. All cost figures are based on the finished house without its supporting systems such as water systems and septic systems. In cases where the house was incomplete at the time of study, cost figures are based on the owner's best estimate of the cost of the completed house.

Monte's Log Cabin



PLAN

cost	$45
square feet ...	228
cost/sq.ft. ...	$0.20

Description -

This is a one room log cabin with lofts in the back corner and over the front porch. Its plank floor is nailed to four logs supported by various stumps, short pilings, and stacks of wooden blocks. The log walls sit on the plank floor. The logs are notched to receive each other at the corners of the building and are cut off square where windows and doors appear. The logs are held in place at these openings by means of 2"x6" members bolted to the ends of the logs. The 2"x6" members act as

window and door frames holding used wooden windows and hand-made pegged doors. The walls are chinked with burlap held in place with wooden strips nailed to the logs. The roof is made of slender poles bolted at the top and covered with corrugated metal. Heat is from a small wood heater in one corner of the room with a flue that wanders across the room to emerge through the roof and be capped with an old hubcap. There is no running water, and there are no sanitary facilities.

8.

Comments -

Monte is a young man with a little money and lots of time. He decided it would be an interesting experiment to try to build his own house with his own two hands. The experiment, he thought, would be the first in a series of several, each one being slightly more difficult than

the previous one. In order that he might learn the most fundamental principles first, Monte decided he should use only the most elementary materials and the most elementary tools in this, his first experiment. This very comfortable log cabin is the result of his efforts. It is remarkable for its low cost (the only costs being bolts, nails and other hardware items), for its craftsmanship (especially the pegged double doors with carved latch), and for its resourcefulness (the floor planks came from the stage of a Grateful Dead concert). At the beginning of his experiment Monte was bolting everything together, but by the end everything was being doweled. He plans to replace the corrugated metal roof with hand-split cedar shakes.

Tim's Tiny House

FIRST FLOOR PLAN

cost $750
square feet ... 420
cost/sq.ft. ... $1.79

Description -

This is a very simple house with one room downstairs and a storage attic upstairs. The entire building is built of economy grade lumber -- all 2"x4", 2"x6", or 1"x8". The floor of 1"x8" cedar planking is supported on 12 precast concrete piers set 6 feet apart. The walls are of 2"x4" studs 24" on center covered with building paper and 1"x8" boards on the outside with the same boards on the inside. The second story floor of 1"x8" boards is supported by 2"x6" joists 24" on center. The roof of

1"x8" boards is supported by 2"x4" rafters 16" on center and waterproofed with 90# rolled roofing. Heat comes from a small wood cookstove and is retained by means of insulation in all the walls and the ceiling of the first floor. The attic is used only for storage as the ceiling nearly touches the floor on one side making it impossible to stand anywhere but against the opposite wall. Water is gathered from the roof in the winter, but must be carried in the summer. There is a latrine.

10.

Comments -

Tim wanted to find a place in the country to rent during the school year. He was out looking one day when he came across his present landlord living in a small house next to a country road. When Tim asked him if he had anything for rent, his landlord answered, "No, but

you are welcome to build something if you like." Tim was to build his own house and pay $25 per month rent. In exchange he would be able to live there as long as he liked. Since Tim was planning on being in school for three years in which time he would expect to pay $2,700 rent, and since he got kind of excited at the idea of building his own house, he decided to build the little house pictured here. It was built in a hurry with no plans and no building permit. Because he was in a hurry he bought all of his materials new except for the windows and cedar plank floor donated by his landlord. He built the shell of the house in a period of about three weeks using only a bow saw and a hammer, and he finished the rest during the next few months while he was attending school. In order to get electricity, which the power company would not connect unless the installation had been inspected, Tim told them he wanted to light a duck pond a short distance (but not visible) from his house. He installed a receptacle next to the pond according to code, and had the electrical inspector

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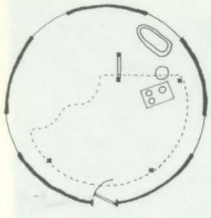
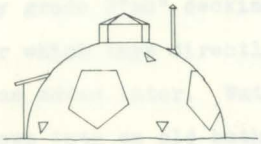
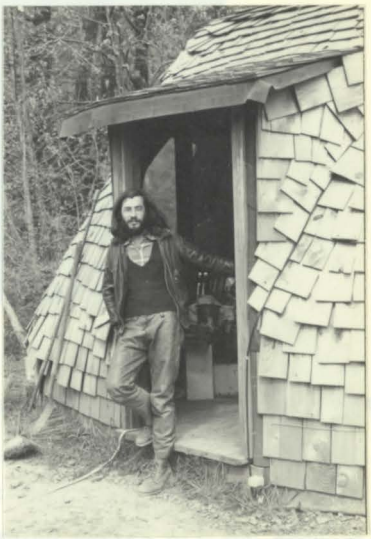
inspect it. The installation passed, and the power company connected the electricity. Tim's house now has power coming through a long extension cord leading from the duck pond.

Fred's Plydome







cost ... $300 sq. feet ... 575 cost/sq.ft. ... $0.52

Description -

This is a 24' plydome built from plans found in the bottom corner of page 27 of Domebook I. The basic structure consists of 30 sheets of 3/8" plywood bolted together to form a dome with pentagonal openings. The openings are covered with 10 mil vinyl to form windows. The plywood is covered with tarpaper and shingled with no. 4 (shim) shingles. After the dome was built, the floor, made of

13.

economy grade 2"x8" decking, was laid on a plastic moisture barrier which lays directly on the ground. The sleeping loft was added later. Water comes from an uphill spring and flows into an old bathtub which serves all the washing needs -- kitchen and body. The water is heated by an old-fashioned system which circulates water through the wood cook stove and stores the hot water in the tank adjacent to the stove. The cook stove serves not only for heating water and for cooking but also for heating the house. The place is so small and compact that, despite the lack of insulation, the small wood cook stove is sufficient to heat the space even in the coldest weather. There is a latrine a short distance downhill.

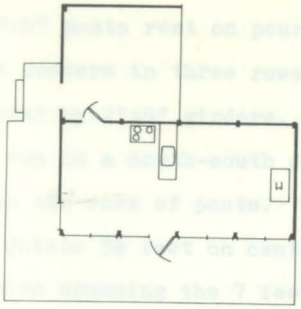
Comments -

Fred's dome was built on a friend's lot within the Portland city limits. Fred was going to build a house for his friend and the dome was to be his temporary shelter while he got organized. When construction on the house got under way, the dome was to be used as a job shack. Fred applied to the city for a permit to build the dome as a job shack, and the permit was granted. It took about two weeks to build the dome, and Fred moved in. By the time the plans to build his friend's house had fallen through, Fred had become very comfortable in his "temporary" shelter. He has lived in his dome for over a year now, and he's just beginning to hear the complaints of the Planning Commission. Fred says, "This is the only place I've lived in my entire life that I'm entirely satisfied with, and the Planning Commission says I can't live here. It's very

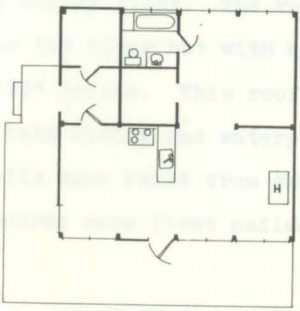
14.

comforting to know they can't just come and tear it down themselves." He plans on staying until he is forced to move, and, if and when this should happen, he figures he can disassemble the dome and move it with him. He is, in fact, presently thinking about applying to the city for a mobile home permit.

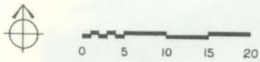
Ben's House

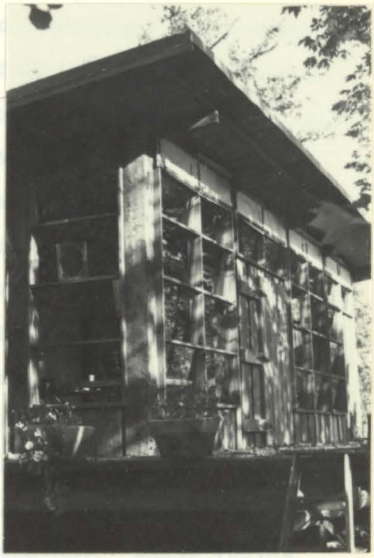


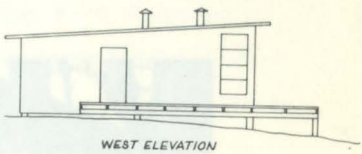
PLAN



PROPOSED PLAN







WEST ELEVATION

cost...$1,000 square feet...784 cost/sq.ft...$1.28

Description -

This house was built using post and beam construction. The 4"x8" posts rest on poured concrete pads and are on 7 foot centers in three rows 14 feet apart. The floor is supported by 2"x8" girders, one on either side of each post, which run in a north-south direction spanning 14 feet between the rows of posts. These girders in turn support 2"x6" joists 3½ feet on center running in an east-west direction spanning the 7 feet between girders. 2"x8" tongue and groove decking is laid over the joists making a very sturdy floor. The roof was built using the same plan as the floor but with smaller members - 2"x6" girders and 2"x4" joists. This roof structure was covered with 1"x8" barn siding and waterproofed with asphalt roofing. The walls were built from the inside-out. Rough 1"x10" barn boards were first nailed vertically between the

16.

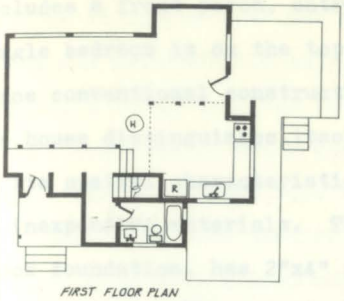
ceiling joist (or girder) and the floor joist (or girder). These boards were then covered on the outside with a layer of foil building paper. 1" boards were then nailed over this paper both diagonally (for bracing) and horizontally (for spacing). Another layer of paper and another layer of vertical boards finish the wall. The windows are fixed panes of glass set in frames of 1" cedar. They slope out at the top. Heat is from electric baseboard heaters since there is a minimum electric bill of $22.50 per month. There is no water system at this time, but a full kitchen and bathroom with a composting toilet are planned.

Comments -

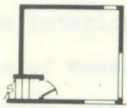
Ben and June were living in a tent on a large (52 acres) piece of land they had just acquired for the purpose of starting a commune. They were planning to build a dome when they found an old barn that a farmer was willing to give them. The nature of the materials they could get from this old barn led them to start thinking in terms of a rectilinear house rather than a dome. They found a copy of Rex Roberts' book, Your Engineered House, and, with the help of this book, they were able to incorporate most of the ideas they had planned for the dome into the delightful square house you see on these pages. With the help of some friends, the barn

was disassembled and the house was started. After about 2 months the house had a roof but no walls, and it was time for school to start again in the fall. Ben is a teacher so he had to finish weatherproofing the house on evenings and weekends, but by the time the really cold weather arrived two months later, he had made the place fairly snug. The following summer he finished the outside walls and deck, and next summer he plans to finish the back of the house.

Rob's House

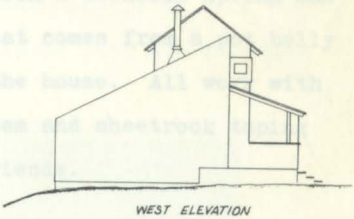


FIRST FLOOR PLAN



SECOND FLOOR

cost	$4,140
square feet ...	926
cost/sq.ft. ...	$4.47



WEST ELEVATION

Description -

This is a frame house on a six acre plot about 25 miles northeast of Eugene, Oregon. The house has three levels. The main level includes a kitchen, dining area, living area, and outside a large East and South-facing

deck. The entrance level, two feet above the main level, includes a front porch, entry halls, and a bathroom. The single bedroom is on the top level above the kitchen. Since conventional construction details were used throughout, the house distinguishes itself from ordinary housing only in its spatial characteristics and in the inventive use of inexpensive materials. The house sits on a continuous block foundation, has 2"x4" stud walls which support open-beam ceilings. The exterior walls and the roofs are shingled, the interior walls sheetrocked and covered with various types of wood. The walls are insulated with fiberglass batts, the ceilings with 1" rigid insulation. There is a finish floor of fir. Windows and doors were all purchased used except the front door which was made from scratch. Water is pumped from a downhill spring and drains into a septic system. Heat comes from a pot belly stove located in the center of the house. All work with the exception of the septic system and sheetrock taping was done by the owner and his friends.

Comments -

It was the beginning of the summer, 1970, when Rob and Terry decided it would be a good idea to build a house for themselves. Rob was an architecture student with two years of school remaining, and he liked the idea of getting practical experience in the very thing he was

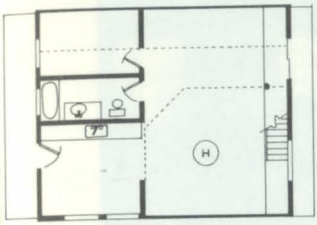
studying in school. Even though he had had considerable building experience, he had never built anything to code, and he was particularly interested in learning about building a house to code. He was also interested to learn exactly how much it would cost to build an owner-built house. (Exact records were kept and are listed in Appendix A.) Since they were particular about finding a secluded building site with a good supply of surface water, Rob and Terry spent the greater part of the summer looking for land. They finally found a site, and Rob hastily designed a house with the intent that it should be as small and simple as possible while taking full advantage of the unique setting. Plans were drawn, a permit was obtained, and construction begun; but by the time school had started again in the Fall, all that had been completed were the concrete footings. During the school year Rob finished

18.

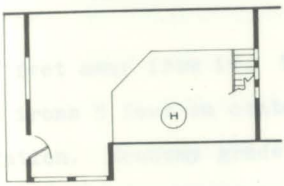
the foundation bit by bit in his spare time using concrete blocks. The following summer Terry's brother, Brad, arrived hoping to learn something about house construction. By the end of the summer the outside of the house had been finished and a workshop had been built. At this point Rob and Terry moved into their unfinished house, storing most of their belongings in the workshop. They ran extension cords from the temporary power supply, cooked on a wood cook stove, carried water from a neighbor's house, bathed in a galvanized tub, and used a latrine for about five months while Rob attended school and installed the plumbing, electricity, and water supply systems in his spare time. At the time of this writing, two years after the footings were poured and one year after the house was first occupied, the house is very near completion. All that remains to be done are the trim, the cabinet doors, and two stairs.

19.

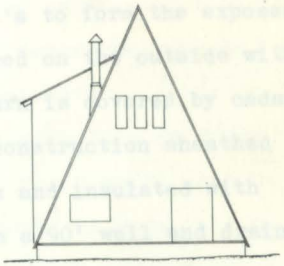
Ron's A-Frame



FIRST FLOOR



SECOND FLOOR



EAST ELEVATION

cost $5,220
square feet .. 1,127
cost/sq.ft. .. $4.64

Description -

This is an A-frame with a loft and a two-story dormer. It is situated on a 2 acre lot about 25 miles east of Eugene, Oregon. The house looks a lot larger in plan than it really is since the walls slope in considerably. A 6 foot person will bump his head on the wall when his feet

21.

are 3 feet away from it. The 4"x10" A's are bolted with angle irons 5 feet on center to a continuous concrete foundation. Economy grade 2"x8" tongue and groove decking is nailed to the outside of these A's to form the exposed wall-ceiling. The decking is covered on the outside with 1" styrofoam insulation which in turn is covered by cedar shakes. The gable walls are stud construction sheathed inside and out with 1" cedar boards and insulated with fiberglass batts. Water comes from a 90' well and drains into a septic system. Heat is expected to come from a circular stone fireplace with a metal hood and a small woodburner in the loft. All materials for the building were purchased new except for the used windows.

Comments -

Ron and Janet first started thinking about building

their own house when they decided it was crazy to pay $1,500 a year for rent. That money, they figured, could be applied toward a house of their own. Even though they didn't have the money to begin, they started planning the house they wanted to build. When relatives offered to loan them the money, they jumped at the chance. They bought some land and a teepee and moved to the site. This was during the spring, 1972. The house they wanted to build was an A-frame. Ron had always been fascinated by A-frames. He liked the high ceilings and the opportunity to include lofts easily. He figured it would be easy to build because of the simple structural system and the fact that the ceiling and walls are one and the same. Simplicity of design and of construction were of particular importance to Ron since in his lifetime he had never designed or built anything except a pair of speaker cabinets.

The design was drawn with a straightedge on graph paper only to meet the requirements for a building permit. Ron claims that the ideas for the building were so firm in his mind that drawings were not necessary for his own edification. It is also interesting that Ron was adamant about refusing to consult any books during the time the house was being designed. He wanted the design to be entirely his own idea, without any outside influences. "I've always had strong ideas about how I wanted my own house to be," he says, "When I finally got the chance to build it, I wasn't about

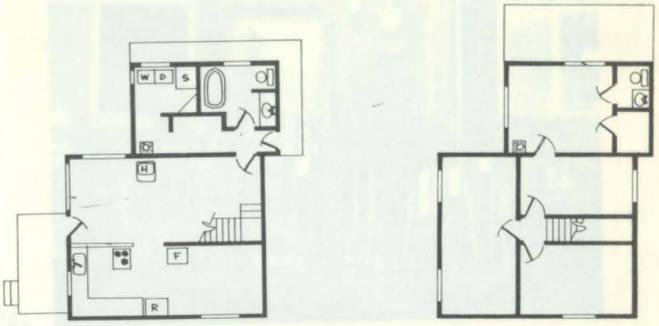
to stand aside and listen to someone else tell me how it should be done."

Construction began in late spring, and by mid-summer the basic shell had been completed. The building was shorter than originally planned since some trees had been in the way making the last A impossible to erect. Also Ron had mistakenly cut the overhang one foot too short. These difficulties combined to make the building about 5 feet short necessitating a reorganization of the interior spaces. The kitchen and bathroom were reduced in size to make room for a bedroom which was moved downstairs because a loft at the east end of the building had to be eliminated. The entire structure, to this point had been constructed without the aid of a plumb, a level, or a square.

It was at this point, in mid-summer, that Ron and Janet decided to move out of their teepee into their new house. The house was far from complete -- no water, no power, no windows or doors, and no shakes on the roof -- but the temptation proved too much to resist.

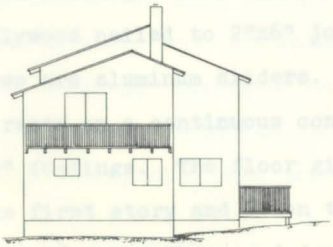
22.

Dale's House



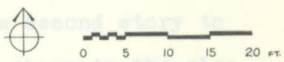
FIRST FLOOR PLAN

SECOND FLOOR



NORTH ELEVATION

cost ..... unknown
square feet ..1,356



Description -

This two-story frame house has been built in two stages. The first part to be built, the 20ft.x24ft. section containing the kitchen, dining area, living room, and three bedrooms upstairs, was originally intended to be a garage. It has a concrete slab floor, walls of standard 2"x4" frame construction sheathed with plywood, and a low

24.

(1" in 12") pitch roof of plywood on 2"x6" rafters covered with rolled roofing. The floor of the second story is made of plywood nailed to 2"x6" joists 12" on center. All windows are aluminum sliders. The smaller (11'x18') addition rests on a continuous concrete foundation supported by 18"x24" footings. The floor girders are cantilevered 30" on the first story and 7' on the second story to support the wooden walkway and deck shown in the plan. From the floor on up, the construction of this addition differs from that of the original building only in that the second floor and roof are made of 2"x6" tongue and groove hemlock on 4"x8" joists and rafters as opposed to the plywood on 2"x6" scheme used in the original building. Water comes from an uphill spring, but, as of now, supplies only the kitchen sink since the new bathroom and laundry have yet to be completed. There is an owner-

built septic system which will eventually receive waste water, but for now the family uses a latrine. The house is heated by electric baseboard heaters occasionally supplemented by an old wood burner.

Comments -

Six years ago, Dale, his wife and three children were living in town next to a public school. They disliked the noise of the school and were discouraged by the apparent difficulty of achieving privacy. One too many balls bounced against the side of their house, and, one day, they decided to move out of town. They bought 24 acres several miles from the nearest town. Dale admits he "had no business" buying so much land on the wages he was earning as a warehouseman, but he was determined to provide his family with some privacy and he did it anyway.

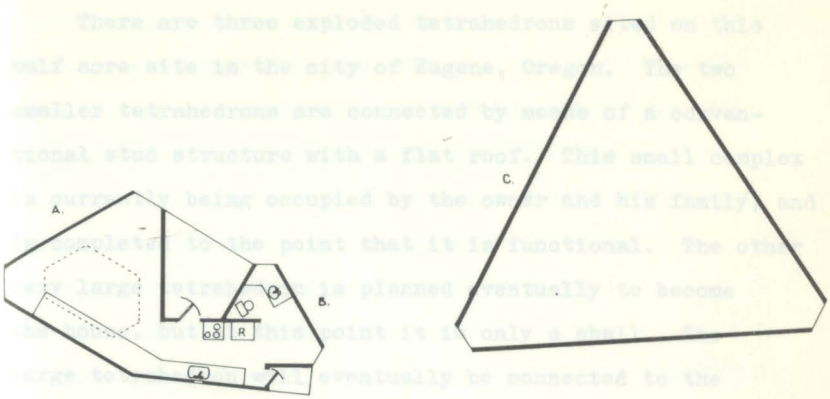
25.

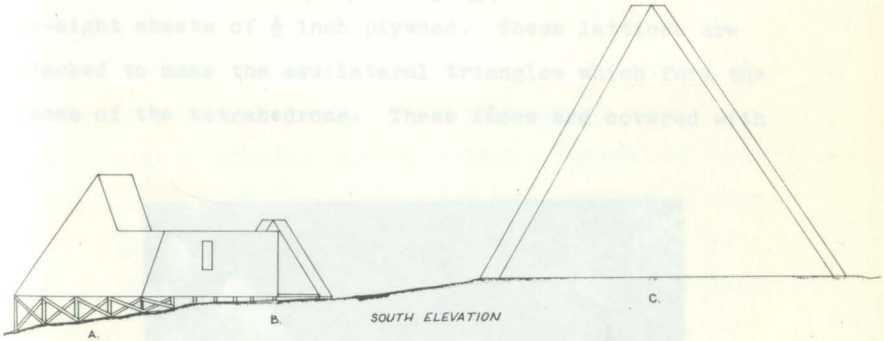
26.

The first thing to be built was a garage -- or so it was planned. Dale had never built a building before so he wanted his first attempt to be simple. Because of his limited budget he wanted it to be useful. He built the garage with the idea that his family could live in it temporarily until a house could be built. That was six years ago: Dale and his family (now increased to six members) have lived in this "garage" with no bathroom ever since. Dale hasn't been idle these six years. He has built a storage shed larger than the "garage"; he has laid concrete walks between his buildings; and he has made his entire septic system by hand. He dug the hole for the septic tank three feet too deep and had to fill it back in. The reason he hasn't started building the house is that he and his family decided that the garage would make a perfectly adequate house if a few additions were

made to it. Accordingly he has set about constructing the two-story bathroom-laundry-bedroom addition now in progress. When this is completed he has plans to remove the low-pitch roof over the garage portion of the building and replace it with a steeper double pitch roof with a clerestory like the roof shown in the elevation. He has further plans to expand his living room, to add an enclosed front porch, and to add a greenhouse.

Monte's Tetrahedrons





A & B		C (shell only)	
cost	$2,500	cost	$1,500
square feet ...	600	square feet ...	1,060
cost/sq.ft. ...	$4.16	cost/sq.ft. ...	$1.42

Description -

There are three exploded tetrahedrons sited on this half acre site in the city of Eugene, Oregon. The two smaller tetrahedrons are connected by means of a conventional stud structure with a flat roof. This small complex is currently being occupied by the owner and his family, and is completed to the point that it is functional. The other very large tetrahedron is planned eventually to become the house, but at this point it is only a shell. The large tetrahedron will eventually be connected to the other two which will then serve as a guest house and/or studio. The basic structure of all three tetrahedrons consists of two-by-four lattices designed to take four-by-eight sheets of ½ inch plywood. These lattices are stacked to make the equilateral triangles which form the faces of the tetrahedrons. These faces are covered with

28.

1" styrofoam insulation and then 90# rolled roofing. The floor framing of the two smaller structures consists of 2"x6" joists framed triangularly and supported by posts which sit on tetrahedronal pier blocks. This framework is covered with 3/4" plywood and particle board. The floor of the large tetrahedron is a concrete slab. The entire comples was stapled together with an air gun. Seconds, rejects, blows, and shorts were used for economy whenever possible. Water and sewer are connected to city systems. The two small tetrahedrons are heated electrically, but a large tetrahedronal fireplace is planned for the large one.

Comments -

Monte is a tetrahedron freak. He is building a three tetrahedron house supported on tetrahedronal piers and heated with a tetrahedronal fireplace. Behind the house are a tetrahedronal greenhouse and a tetrahedronal chicken coop. Monte was employed as a drafting instructor at a community college when he decided to build his own house. A degree in architecture had prepared him well for designing a house, and his position as an instructor gave him a good chance to test his ideas on his students. He soon finalized a concept for a 42 foot tetrahedron and, with the help of some enthusiastic students, built the panels he would later assemble with a crane. Instead

of erecting this monster, Monte decided to test his ideas on a smaller 18 foot tetrahedron. His plan was to build this smaller structure (A) so that he, his wife and son could live in it while constructing the large tetrahedron ultimately to be the house.

Only the framing of this small building was planned before construction began. Monte wanted to leave all other decisions to his intuition. He wanted the site and cost of materials to influence the design of the building as it was being built. When the framework was up he decided the building was too small, and another small tetrahedron (B) was begun. The two tetrahedrons (A and B) were linked, plumbing and wiring was installed, and Monte and his family moved in. The house was small and unfinished, but they enjoyed all the basic conveniences except a shower or bath. No sooner had they moved in than Monte started

29.

work on the partially pre-assembled giant tetrahedron.

At the time of this writing, seven months after the first tetrahedron (A) was started, the giant tetrahedron has been erected but stands as a shell, being used only for storage. Monte was forced to stop working on it in order to install a bath in the tetrahedron he occupies. A bath is required by the city in order to obtain a Certificate of Occupancy. The city building department is threatening to shut off all utilities unless Monte complies with this regulation.

It will be interesting to see if a Certificate is issued since Monte has been building his tetrahedrons in defiance of all building codes. He has very strong views about this. He sees himself as an inventor-designer on the forefront of a legitimate research area. He has been trained to work in this area and sees no reason he should be obligated to obtain permission to perform his experiments. His approach is to build his structures without so much as applying for a building permit. He gives three

30.

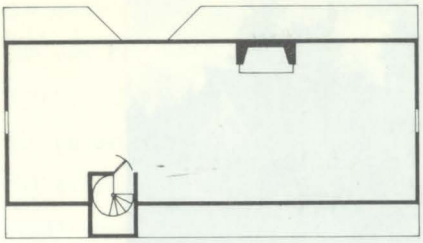
reasons for taking this approach. First; by ignoring the codes he doesn't have to worry about building his structures in contempt of any regulations since he has not agreed to follow any regulations in the first place. Second; he feels that there is no one at the building department qualified to pass judgement on certain structural aspects of his project. He claims that tetrahedronal geometry produces statically indeterminate structures impossible to calculate by the rectilinear coordinate methods used by the building department. Third; he assumes it would be very much more difficult for the building department to make him tear the house down and re-build it than it would be to make him build it according to building department specifications from the outset.

Up to this point his approach has paid off. He was caught in the act of building his first tetrahedron and

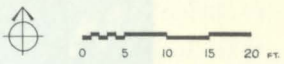
31.

was issued a Work Stop Order. He drew some plans and was issued an Experimental Building Permit, but by this time the building was almost complete. The same procedure was followed for both the second and third tetrahedrons; thus he was able to build all three tetrahedrons on his own terms. Whether or not he is issued a Certificate of Occupancy seems a moot point in light of Monty's determination to continue with his project. This is no temporary venture and no regulation is going to scare him away. He is planning to live in this house the rest of his life and hopes his children will too.

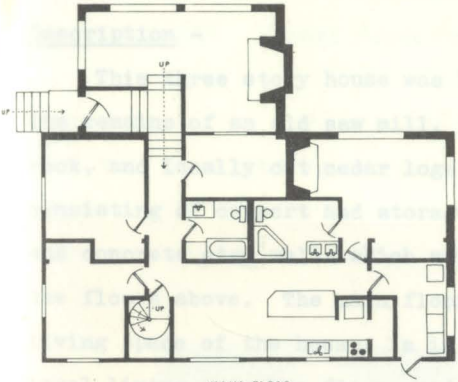
Slim's House



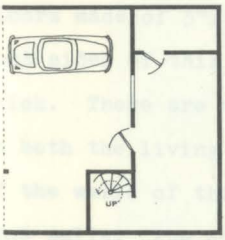
ATTIC



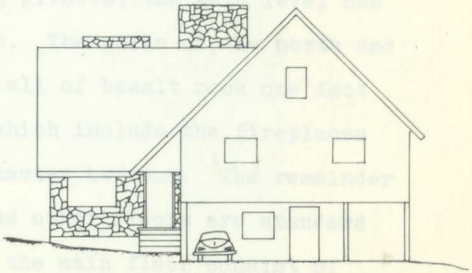
cost $11,500
square feet 3,500
cost/sq.ft. $3.30



MAIN FLOOR



GROUND FLOOR



WEST ELEVATION

33.

Description -

This three story house was built almost entirely from the remains of an old saw mill, locally quarried basalt rock, and locally cut cedar logs. The ground floor, consisting of carport and storage areas, has a slab floor and concrete stem walls which support the western half of the floors above. The main floor, which contains all the living space of the house, is in two levels. The lower level living room has floors made of 4"x12" timbers laid flat and spiked to supporting girders; the main level has floors made of 3"x12" timbers. The walls of the north and east sides of this floor are all of basalt rock one foot thick. These are the walls which include the fireplaces in both the living room and master bedroom. The remainder of the walls of this floor and other floors are standard stud walls. The ceilings of the main floor consist of

2"x12" planks laid flat and covered with tarpaper. The ceiling and walls of this floor are insulated as this is the only floor which is heated. Each room is provided with its own electric hide-away heater with an individual thermostat. The floor of the attic consists of 2"x4" joists 16" on center covered with 3/4" plywood. The ceiling of the attic, which is the roof of the building, is made of 2"x8" tongue and groove decking covered on the outside with hand-split cedar shakes. All three floors are connected by means of a circular steel staircase. Water is from a well. Sewage flows into a septic system.

Comments -

This is a truly remarkable house. It is impressive for its size, for its low cost, for the massiveness of its construction, and especially for the effort that went into

34.

building it. Slim is a lawyer, a big man who says he "gets his jollies" from hard physical work. When you see the house he built in 2½years during his spare time, it is apparent he was a very happy man. To start with, he bought a section of an abandoned lumber mill for $400. He dismantled this and hauled the huge timbers and other lumber to the building site. He estimates that he got 50,000 board feet of lumber from the old mill, enough for 90% of the lumber he needed to build the house with some left over. He hand placed about 100 tons of rock to build the exterior walls and the fireplaces. For the roof he bought $27 worth of cedar timber from the Bureau of Land Management. He logged the trees himself, cut them into bolts, and split them into shakes by hand using a froe and mallet. This $27 worth of BLM timber gave him enough shakes to cover his entire roof (35 squares) plus he had 10 squares extra and 100 ten foot posts.

Unfortunately Slim never got to finish his house. He was about 85% complete when he discovered

35.

traces of boron in his water supply. He decided to move because of this since he is very interested in his rhodydendron hybridization experiments, and boron is detrimental to these plants. He has bought some more land where he is starting to build another house.

Most of the owner-built houses I have seen have been built by inexperienced owner-builders who had never designed or built a house before. The advice, guidance and instructions which they needed to overcome their inexperience was obtained bit by bit as it was needed from friends, material suppliers, building inspectors, and how-to-do-it manuals. The inadequacy of this type of information retrieval is emphasized by the fundamental mistakes made by almost every owner-builder. I am convinced that these mistakes could be reduced significantly, that owner-built houses would be easier to build and more comfortable to live in, if access to the information needed by first-time owner-builders were made easier. Facilitating the process of information retrieval for owner-builders would be the most important contribution anyone could make toward improving the quality of owner-built houses.

The basic information needed to design a house is available in books to be found in almost every public library. The problem is that the inexperienced first-time owner-builder usually lacks the capability to integrate and coordinate the basic design concepts offered in these books with his preconceived visions of his future house. The amount of information which must be gathered and considered simultaneously to successfully design a house (especially a unique or experimental house) is

enough to overwhelm most inexperienced owner-builders to the point that basic concepts will be overlooked in the confusion. I have seen owner-built houses very comfortable and functional in other respects that become intolerably hot in the summer because of a bank of South-facing windows (see page 73), others that were almost impossible to heat in the winter because of high ceilings and poor insulation (see page 42). I have seen roofs designed for southern climates which have been translated to northern regions where the possibility of snow loads makes them extremely unsafe. I have seen a house where the owner-builder didn't realize until midway through construction that he had failed to provide any storage space. These are some of the most glaring examples of design mistakes made by owner-builders. A person accustomed to designing houses would never make such fundamental mistakes; but a first-time owner-builder, because he must make so many unfamiliar decisions based on information that is unfamiliar and often incomplete, is bound to make some errors in judgement. I see no solution to this problem short of providing owner-builders with access to an experienced house designer whose function would be to provide easier access to design concepts, insure their completeness, and assist owner-builders in the use of these concepts when assistance is requested.

Many of the problems encountered by owner-builders

as they attempt to discover how to construct their house stem from the fact that the vast number of answers they seek are scattered among inumerable sources. The process of retrieving this information is not only time consuming, inconvenient, and frustating, but the answers are often verbal which, especially to the first-time owner-builder unfamiliar with building terms, makes them confusing and easy to forget. A fully illustrated and annotated manual for owner-builders which explained the basic steps involved in the carpentry, plumbing, and wiring of a house would go furthest toward relieving the frustrations presently felt by owner-builders seeking this basic information. A manual of this sort would benefit not only owner-builders of the type included in this study who, as we have seen (page 19), employ proven techniques to build unusual houses, but would also benefit the greatest majority of owner-builders who build houses resembling professionally-built low-cost housing.

Information on codes is localized and reasonably accessable but nevertheless inadequate. The problem here is that the information is available mainly in verbal form. Of the three basic codes, building, plumbing, and electrical, only the building code is printed in a form designed to be comprehended by anyone other than a building official. Regulations of the plumbing and electrical codes pertaining to houses are buried in thick

volumes of regulations covering every size and type installation imaginable. The owner-builder is expected to be able to obtain over the telephone all the regulations of the plumbing and electrical codes which would pertain to his house.[4] The provision of a simple illustrated explanation of plumbing and wiring regulations available on request (or for a small fee) would go far toward reducing the confusion of owner-builders as well as reducing the time spent on the telephone by building officials.

It is current practice for each owner-builder to obtain his own information about design, construction, codes and materials. Each person makes his own discoveries, each his own mistakes. Collectively the understanding accumulated by owner-builders is substantial, but there is little opportunity to share this understanding. Easier access to this information and provisions for sharing it are sorely needed. It is my feeling that an agency or service created with the intention of assisting owner-builders obtain and share this information would be the most direct and efficient method of fulfilling this need. Such an agency as I am proposing here could be carved out of existing county building departments

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[4] Building, plumbing, and electrical inspectors all keep two office hours each day solely for the purpose of answering questions over the telephone.

without an increase in personnel[5], or it could be a county agency such as the Lane County Home Extension Service which provides information in the area of home economics to residents of Lane County, Oregon. Such an agency would contribute significantly toward making owner-built houses of all descriptions easier to build, safer, more durable, and more pleasant to live in.

[5]The time spent on the telephone by building officials explaining and re-explaining the codes to owner-builders could be better spent by one employee with the sole responsibility of helping owner-builders.

CHAPTER TWO

THE DESIGN PROCESS

The process of designing a house can be separated into three distinct phases -- the original considerations that are drawn into plans before construction begins, the alterations of and additions to the original plans that take place during the course of construction, and the continuous adjustments and changes that occur while the house is being used. Architects and professional designers have traditionally concentrated on the completion of the first of these three phases for the purpose of minimizing the other two. Owner-builders, on the other hand, do a large portion of their design work during the second and third phases. They are able to do this because, unlike architects, owner-builders are not saddled with the responsibility of communicating their ideas to a builder before construction begins. The owner-builder is responsible only to himself, and thus he is able to spread his design decisions over as long a period of time as he sees fit, changing his mind as often as he pleases.

Since it is quite rare that an owner-builder will have much experience in either the design or construction of a house, he will spend the bulk of the period before

construction begins gathering information. He will look for advice on the pros and cons of various construction methods, the costs of materials, the restrictions of the codes, and numerous other factors that will help him make decisions about the design of his house. Books are consulted, friends quizzed, building officials contacted, and building supply outlets pumped for prices and advice. Construction sites are visited and existing buildings are measured. Sometimes a practice project is taken on.

As the owner-builder is persuaded one way or the other by his newly found information, his image of the

36. The inside of this truck-house suggests the attention that must be paid to design detail when space is this limited. This is the fourth house built by this particular owner-builder.

house he wants to build will grow, sometimes slowly, sometimes rapidly, into a scheme that he will feel confident about beginning to build. This point of confidence is reached when the owner-builder has developed a firm conception of the shell of his house -- its size, shape, cost, and basic structural system. The shell design lacks the exact details and dimensions needed to build the house from the ground up, but it does include enough information to get started at the ground. It is a rough scheme expected to be refined as the house is being built.

Most owner-builders follow the pattern outlined above, but some take their design further before beginning construction and some do not go as far. The personality of the owner-builder and the nature of his project seem to determine the extent of the pre-construction design work. But no matter how much effort the owner-builder expends perfecting his design, it is always incomplete at the time he starts construction. In every case there are decisions that have been postponed.

The owner-builder has postponed these decisions for very practical reasons. So many decisions have to be made to draw a complete set of plans that owner-builders eventually find the alternative of starting to build, taking the problems as they come, unavoidable. The sheer quantity of information needed to make intelligent decisions tends to overwhelm the inexperienced owner-builder.

37. One of several smaller structures built on the fourth floor of the house seen in figure 2. The curved glass windows come from a dismantled house. The walls are covered with hand-split redwood shakes.

38. A detail of the small round house shown in figure 37, above. This structure illustrates the results of a design-as-you-build approach to design.

His difficulties in obtaining, digesting, and sorting out the appropriate information leads him to the simple conclusion that the longer he takes to gather the information, the more complete it will be, and the more well-founded his decisions will be. The easiest way to be sure he has thought of everything is to confront himself with everything. The longer he waits, the more he will think of.

Another reason owner-builders give for postponing decisions until the construction phase is that a person has more opportunity to learn about something he is actively involved with than something he is planning for. The owner-builder will easily learn more about plumbing, for example, when he is involved in the activities of buying materials, fitting the pieces together, and asking specific questions of the plumbing inspector than when he is planning for these activities before construction has begun. It makes sense for him to postpone any decisions he can since the firsthand experience of working with the materials will put him in a much better position to make decisions about how to arrange and install those materials.

The manner in which materials are purchased gives the owner-builder another reason for designing as he builds. Since the owner-builder can rarely afford the luxury of buying all his materials before construction begins, and since he usually wants to shop around

39. This owner-built house near Eugene, Oregon is well-built and well-designed in every respect except that the large bank of south-facing windows makes the space unbearably hot in the summer. This mistake was made because the inexperienced owner-builder designed his house in the winter.

40. The dining room of the house shown in figure 39, above, is the largest room in the house. The owner-builder runs a print workshop in the summer and needs a huge table to feed all his students.

to see what materials are available at what prices, he seldom knows, at the time he begins construction, exactly what materials he will be using. It is frequently the case that an owner-builder will want to begin construction before he has acquired all his windows, for example. It is therefore necessary for him to leave all his plans somewhat open-ended at the outset so he can incorporate these materials he doesn't yet know about into his house.

In the design-as-you-build process the owner-builder is forced to consider things in relation to one another while actually looking at the things being considered. The placement of windows is a typical example of how this situation can work to the advantage of the owner-builder. When he can see how the window will work in relation to the site and in relation to the rest of the building, that is the most opportune time for him to make the decision of how to place the window -- what shape, and what size he wants it to be. If an owl's nest is discovered atop a distant tree, a tiny window can be placed in its direction. If a view of the river is discovered to have a stronger effect than originally imagined, a window can be enlarged. The owner-builder is usually able to take advantage of this situation frequently as he designs and builds his house. The relationship of walls to one another, windows to walls, windows to the landscape, the way that light enters the space, the placement of elec-

trical lighting: all of these things can be best understood by actually seeing them in place.

Despite well-founded warnings against it, almost every owner-builder moves into his house long before it is "completed". If he is willing to put up with the inconveniences associated with this practice, he can take advantage of the situation. Since all the activities of daily living will be taking place in the spaces designed to accomodate them, the owner-builder is in a good position to see how he might change the design to make it more functional. New and better traffic patterns, for example, are often discovered after the house has been occupied.

41. This delightful owner-built house was designed by the wife and built by the husband. At the end of one summer's work, with the house as it appears in this photo, they decided to move in since they had been living in a travel trailer for almost two years.

By leaving out a section of wall or shifting the position of a cupboard the newly discovered pattern can be accomodated. By moving into his house before it is built the owner-builder is overlapping the second and third design phases. Many of the adjustments and changes normally made to a house after it has been built can be made by the owner-builder as he builds his house.

This design-as-you-build method is not without its drawbacks. The owner-builder who lives in the house he is building faces the problem that his design decisions will be influenced by the temptation to take short cuts in order to hasten the improvement of his living conditions. He will be tempted to choose the fastest method whereas, had he not been living in the house, he would have chosen the best. Hand-made French doors are replaced by aluminum sliders, tile floors by indoor-outdoor carpet, wooden bathtubs by porcelain. These design decisions are usually regretted after the house has been "completed."

Another major problem is that the design-as-you-build method involves a linear decision making process. Each design decision made in the process of building will affect another later decision. The consequences of the first decision on the second cannot be known until the time at which the second is being considered. By this time, the first decision has already been translated into reality. So the second decision relies on the first

but not the first on the second. This problem is more crucial when the designer is a novice. Ron (see page 42), for example, decided to put a huge window in the gable wall adjacent to his loft. This was his first decision. The second decision was approached when he realized a vent pipe had to run through this same area. The second decision, could it have been made independent of the first, would have been to run the vent through the same gable wall -- clearly the best route. But now the presence of the window in the wall prevented the vent from passing; the first decision had stymied the second. The owner-builder who calls his house "the temple of accumulated error" is not just talking through his hat.

CHAPTER THREE

THE CONSTRUCTION PROCESS

Owner-builders are probably the only people in the world who start construction on their houses without plans and without the skills to build them. While there are examples in primitive societies of people who build houses without plans, these houses are based on a traditional model that has been developed through experience over a long period of time. The materials, the construction techniques,

42. Experimental owner-builders sometimes encounter tasks for which no tool exists. This man is patching his dome using a heat sealer fashioned from a light bulb, two lenses, an orange juice can, and a vacuum cleaner.

and the traditional model are all familiar to these primitive owner-builders before construction begins. The owner-builder of today, however, has nothing to compensate for his lack of complete plans -- he has no traditional model, he often doesn't know what materials he will use, and he seldom has any building skills. Yet many owner-builders manage to build houses that are both aesthetically and functionally successful. How are they able to do this?

First, it should be emphasised that building a house involves no tasks which require special skills or previous construction experience. Successful first-time owner-builders have been proving this for years. In southern California a group of Mexican-Americans, a group we would not expect to be experienced in the methods of house construction used in this country, have successfully employed these methods to build more than 1000 houses for their families.[1] Their success has been possible because the thrust behind the development of building methods in this country has favored methods and materials that allow houses to be built quickly and easily. The greatest achievement in this direction occured over 100 years ago when George Washington Snow invented the Balloon Frame system of building. At that time it was proclaimed that,

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[1] Self Help Enterprises, Inc., Visalia, California.

"A man and a boy can now (1865) attain the same results, with ease, that twenty men could on an old-fashioned frame."[2] Since that time there have been many developments that have made the construction of houses even easier. The framing system has been simplified further, power tools have been introduced, and materials such as plywood and plastics have been developed. Plumbing and electrical systems, introduced to the house around 1900, have been simplified to the extent that almost no tools are needed to install them. Today it is possible to plumb an entire house without using a pipe wrench.[3] Plastic pipes are cut with a hand saw and glued together. The installation of electrical systems is equally easy. The appearance of electrical wiring supplies in supermarkets indicates the degree of simplification achieved in this area.

These simplified methods and materials are being used by most of today's owner-builders. Owner-builders experimenting with new construction methods such as domes use the most advanced materials (plywood, plastics, etc.) in an attempt to simplify house construction even further. Indeed, owner-builders are almost unanimous in their agreement that modern house construction methods

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[2] G.E.Woodward, Woodward's Country Homes, (New York, 1869), p. 156.

[3] Local antiquated building codes prevent this in some areas.

43. This owner-built shower is an example of what can be built by someone with no construction experience. The roof is plexiglass, the walls are brick covered with plaster, and the floor, which doubles as a sunken tub, is poured concrete. Note the bizarre plumbing detail.

have been simplified to the point that no experience is required to be able to build a successful house. The owner-builders I interviewed could say this with conviction since almost none of them had been previously involved with house construction prior to starting their own projects. One owner-builder put it this way; "Take a hammer and a board and a 16-penny nail; if you can get the nail into the board without bending it, you can build a house."

The owner-builder can overcome some of his deficiencies in the area of experience even before construction begins by reading construction manuals, consulting people, and studying existing buildings. But despite all his best

efforts at preparation he will lack some knowledge about how to construct his house when he finally decides it is time to begin. This is inevitable. The knowledge is so vast that it couldn't possibly be obtained entirely from books or from friends. Also, since the house hasn't been designed in detail, there are problems that the owner-builder will not even encounter until construction is in progress. What the owner-builder must realize at this point is that he need not know everything about how to build his house before he begins. When this has been realized, it is only important that he begin.

The owner-builder will often build a practice building to help himself overcome any lack of confidence caused by his inexperience. This practice building usually takes the form of a barn, storage shed, or work-shop to be associated with the house as an out-building. This is a highly recommended practice especially if the form of the out-building resembles the proposed form of the future house. By doing this, the owner-builder can acquaint himself with many of the procedures he will eventually use in the construction of his house. Difficulties will be encountered before the house is started, and the experience will help in planning the construction of the house. One owner-builder I interviewed went so far as to build a speculative tract house for practice. He said, "If you're going to blow it, it's nice to blow

it on someone else's house."

Building a house is essentially a series of repetitive tasks. Once the inexperienced owner-builder masters the basic principles of each task, he need only repeat the operation ten, a hundred, sometimes thousands of times. These operations are so elementary that they can usually be mastered on the first or second attempt, but when problems persist the experience acquired during the first attempts can be applied to each successive try until the operation is finally mastered. An owner-builder constructing a foundation wall of concrete block, for example, will have to learn to mix mortar and to set each block in the mortar so that it is in line, level, and plumb. Setting the first block will probably be quite difficult, but the experience of setting this block will make the second block easier to set. After several blocks have been set, the owner-builder will have reached a level of competence that will carry him through to the completion of the foundation wall. This mechanism of learning by repetition is encountered in almost every phase of house construction - building a stud wall, shingling, installing windows, plumbing, wiring, putting struts on a dome, etc.. It is through this mechanism that the first-time owner-builder is able to overcome his lack of experience.

The first-time owner-builder should not let his inexperience discourage him from building a house, but

44. Many owner-builders, when they see that professional builders can build a house in six weeks, expect to be able to build their own house during a summer. For a variety of reasons their expectations are seldom fulfilled. This owner-built house is in a typical state of completion as the end of the summer approaches.

he should realize that his project will take him many more hours than it would a professional. He will have to spend time discovering how to do things, and where to get the materials to do them. He will make mistakes that will have to be corrected. He will be unaware of short cuts. He will be using inadequate tools, and he will pay attention to detail where it is not needed. In general, his entire project will take him twice as long as he originally estimated.

There is a single most efficient procedure for constructing every house. This procedure is usually fairly obvious as it involves the common sense layering of materials, one over the other, in a specific sequence.

Contractors, who must pay for labor, are very aware of the importance of sequence, and direct a great part of their efforts toward controlling the sequence of work on a building. A sequence that permits all workers to work continuously without doing anything twice and without stumbling over other workers or over materials or equipment must be adhered to. The owner-builder is also concerned with minimizing the time and effort needed to build his house, and is therefore concerned with sequence. It is not as easy as merely choosing the most efficient sequence because, for the owner-builder, there are influences other than efficiency which affect the sequence of construction. It is extremely important for the owner-builder to recognize these other influences if he is to avoid wasting time, energy, and materials because all these influences tend to direct him away from that ideal sequence requiring the least work.

Design Influences - Since the design of his house is incomplete, the owner-builder must be very careful not to complete construction that will limit the possibilities of design decisions to be made in the future. If an owner-builder hasn't decided on the position of windows, for example, it is most logical for him to erect walls before they have been sheathed so that he can see through the wall to the view he will eventually want the window to frame. He must do this even though it is much easier to

nail the sheathing to the walls before they are erected. The incompleteness of the design has the effect of delaying construction in order to keep alternatives open.

It has also been noted (page 72) that the owner-builder often delays decisions in order to collect as much information as possible. The result of this practice is that the parts of the house requiring the most information to design such as plumbing and wiring systems are put off until the last possible moment. The contrast between the effort needed to do a job in its proper sequence and the effort needed to do the same job later is sometimes as great as the difference between casting a hole in a foundation wall to pass a sewer pipe and knocking a hole for the same pipe later with a sledge hammer.

Psychological influences - There is a tendency among owner-builders to construct first those parts of the house which make the most observable visible change. There is a sense of accomplishment and excitement which accompanies a change which can be seen. This is one of the reasons why the installation of plumbing and wiring systems is often delayed so long by owner-builders.

The boredom that comes from doing repetitive tasks tends to make owner-builders want to move on to something new. This can lead to extra work later on. There is more than one example of an owner-builder who tired of

shingling his roof only to find himself later spending many hours sanding waterstained wood.

The influence of moving in early - Almost every owner-builder moves into his house before he has finished building it. Beside having the effect of cluttering the house with things which must be moved or worked around, early occupation has the added effect of altering the sequence of construction. This happens because there is an urgency to complete those aspects of the house which most affect the functions of daily living. The importance of such things as running water, counter space, lighting, privacy, and storage increases greatly when

45. This temporary kitchen was set up on a living room wall so that the owner-builders could move in early. Cooking was done on a temporary wood cook stove and water was carried for six months.

the house is occupied. In his drive to provide these things the owner-builder's understanding of the principles of sequence is most critical since all of a sudden he is faced with the task of simultaneously installing all of the most complicated systems of his house.

During the course of construction problems frequently arise which the owner-builder will solve spontaneously, using intuition and impulse as a guide. These are questions of "which way" to build something rather than "how" to build it; questions of choosing from among several alternatives rather than discovering a single alternative. It is in these situations that the design process and the construction process fuse to become simultaneous, making the process of building a house a dynamic and exciting event for the owner-builder.

Building one's own house, especially for the first time, is usually described as one of the most fulfilling and exciting events of one's life. The fulfillment of learning so many new things, the satisfaction of creating things with one's own hands, and the excitement of seeing the spaces evolve more than compensate for the long hours of hard work. The excitement of working on a house under construction is so compelling, in fact, that virtually every owner-builder can boast of the number of hours contributed by friends, relatives, and, in some cases, even people he did not know.

CHAPTER FOUR

THE OWNER-BUILDER AND THE BUILDING CODES

Every man who builds his own house is naturally interested in building a house that will provide for the health, safety, and comfort of himself and his family. These are instinctive concerns which have been shared by all owner-builders throughout history. It is only when a house is built by someone other than the owner himself -- by a professional builder -- that this natural interest in building a healthful, safe, and comfortable house can be lost. The professional builder does not share the owner-builder's keen interest in these matters because he will not be living in the house he builds; he is simply building the house to earn money.

In order to insure that professional builders build good houses, it has become necessary to impose minimum standards or codes that must be followed. The earliest known building code is contained in the code of Hammurabi, the ruler of Babylon in the 18th century B.C.. Hammurabi's code dealt with the strength of buildings, making the professional builder responsible for his own work. If a house fell down killing its occupant, the builder of the house was to be slain.

The first building code in this country was enacted in Plymouth Colony in the year 1629.[1] This code was aimed at lowering the risk of fire by prohibiting the construction of thatched roofs in the city. Other colonies followed this example, and many codes aimed at lowering fire risk were adopted; but it was not until over 200 years later, in the year 1850, that the first building code relating to health was proposed. In that year the Sanitary Commission of Massachusetts recommended that local Boards of Health "endeavor to prevent or mitigate the sanitary evils arising from over-crowded lodging houses and cellar-dwellings."[2] Seventeen years later (1867) these recommendations were embodied in the first Tenement House Act of the State of New York. This law provided for the health and safety of tenement and lodging-house dwellers by requiring that; 1.) sleeping rooms be ventilated, 2.) a water closet be provided for every twenty occupants, 3.) the dwelling be kept clean to the satisfaction of the Board of Health, and 4.) stairways be equipped with banisters. The concern for the health and safety of dwellers expressed in this, the first of the American building codes, is still embodied

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[1] U.S. Public Health Service, Basic Housing Inspection, (National Center for Urban and Industrial Health, 1968)

[2] L. Shattuck, Report of the Sanitary Commission of Massachusetts, 1850, (Harvard University Press, 1948)

46. An owner-built house on Bainbridge Island near Seattle, Wash.

in the building codes of today. The preface to the currently most widely used building code states that, "The standards of safe construction that are set out in the Uniform Building Code are primarily founded upon health and safety..."[3]

Protection of the public health and safety from unscrupulous and unknowledgeable building practices is a noble objective, and one that has become increasingly important in recent years. Improved transportation and rapid population growth have put people (and houses)

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[3]International Conference of Building Officials, Uniform Building Code, vol. vi, Dwelling House Construction, (Pasadena, 1970), preface.

in such close proximity to each other that public health regulations are more vital today than ever before. Hardly a building site remains where improperly treated sewage wouldn't affect a neighbor's water supply. The need for regulations of public safety has also intensified as electricity and its accompanying technological advances have increased the danger of fire and introduced a new danger, electrical shock. An awareness of the increased need for regulations to protect the public from these and other hazards has resulted in four separate classes of codes which apply to building a house:

Building Codes - There are four building codes used in this country, but all four are almost identical in their major requirements.[4] The Uniform Building Code, written by the International Conference of Building Officials, is the most widely used of the four and used almost exclusively here on the west coast. All large cities and most heavily populated counties on the west coast have adopted this code.

Sanitary Codes - These locally controlled codes are more widespread than the building codes. As applied to house building, they are generally concerned with insuring adequate disposal of human waste. In outlying areas where there are no sewers, sanitary inspectors determine the feasibility of installing an acceptable

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[4]Eric W. Mood, "The Development, Objective, and Adequacy of Current Housing Code Standards", Housing Code Standards, Three Critical Studies, a report prepared for the National Commission on Urban Problems, (Washington, D.C., 1969), pp. 21-27, 45-59.

sewage disposal system. In areas where building permits are required, a septic permit is usually a prerequisite for obtaining a building permit.

Electric Codes - The National Electric Code, written by electrical inspectors, underwriters, power company employees, and electrical equipment manufacturers is virtually a national code. Power companies will not connect electricity to a house unless there is proof of compliance with the National Electric Code.

Plumbing Codes - There is a National Plumbing Code but it is usually only enforced in areas requiring a building permit. The code sets standards for types of materials used, their dimension, and their arrangement.

If these codes are to be effective in their function as a protector of the public health and safety, every house must come under their jurisdiction. Even owner-built houses, whose owners fully intend to build a safe and healthful house, must be subject to the regulations of the codes because, despite their good intentions, owner-builders are often uninformed. Just because an owner-builder wants to build a safe chimney doesn't mean that he will be able to. If an owner-built house catches fire because of a faulty chimney or faulty electrical system, firemen are called to risk their lives just the same as for any other fire. Neighboring houses and adjoining forests catch fire just as readily from a flaming owner-built house as from a professionally-built house. Public streams and waterways can be contaminated from faulty owner-built sewage systems as easily as from any faulty

47. This little house was started with the intention that it would become a chicken coop. As the experience of building it reminded the owner-builder how much time and work was involved, he changed his plans and made it into a house. He buys his eggs in town.

sewage system. And even if an owner-builder contaminates only his own water system, his resulting sickness becomes a public problem. The need to treat owner-builders the same as any builder in regard to the protection of the public health and safety should be clear from these examples. The argument is even more convincing, however, when we consider that there can be no guarantee that the owner-builder will not sell his house thereby putting himself in the same position as the professional builder for whom the codes were originally intended.

Despite the apparent soundness of this reasoning, a large percentage of owner-builders resent the restrictions of the codes. These people want nothing to do with the

codes, and they will go to almost any extreme to avoid being governed by them.[5] The reasons given for their reluctance to be governed by the codes go beyond the money saved on the cost of a permit to the codes themselves whose regulations tend to extend beyond the areas of health and safety.

The following illustration (fig. 48) shows a plan of the smallest, most minimal house allowed by the Uniform Building Code. It has the least floor space and as few conveniences as the code will allow. Although I am sure no one would ever want to, this tiny house could be built almost anywhere on the west coast - in the largest cities or in the most remote backwoods. Although most people would prefer more than the minimal conveniences required by the code, some of these requirements clearly extend beyond the realm of health and safety into the area of comfort. We can be sure that the requirement for a water closet (toilet), for example, is a question of comfort and not of health since latrines (outhouses) can be found in practically every State and National Park. Of course, latrines should not be allowed in heavily populated areas, but this is no reason to deny everyone

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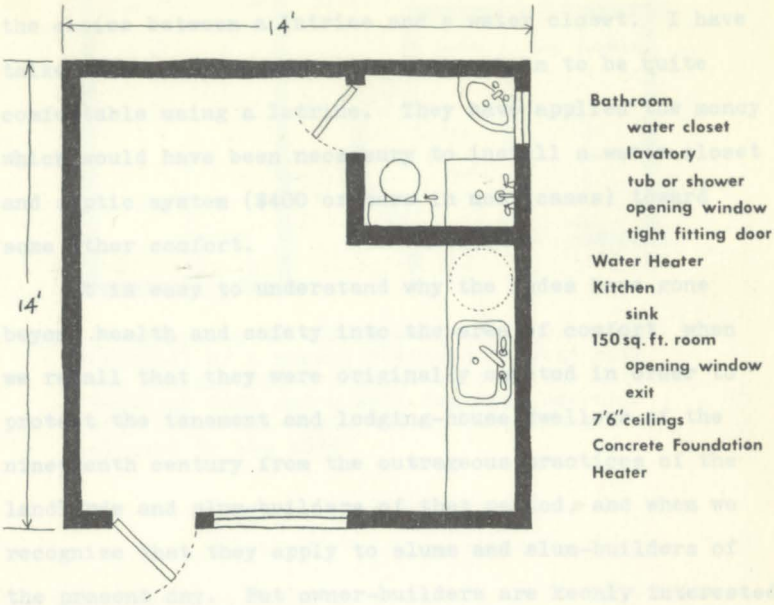
[5]Owner-builders on an extremely restricted budget and owner-builders employing unconventional means or materials to build their house are the ones who usually fall into this category.



48. The figure above is a plan of the smallest and most minimal house allowed by the Uniform Building Code. It has the least floor space and as few conveniences as the code will allow. Below are the specific requirements as stated in the code.

Sec. 1405. (a) Light and Ventilation. All . . . habitable rooms within a dwelling unit shall be provided with natural light by means of windows or skylights with an area of not less than one-tenth of the floor area of such rooms. All bathrooms . . . shall be provided with natural ventilation by means of windows or skylights with an area of a minimum of 3 feet.

Not less than one-half of the required window or skylight area shall be openable to provide natural ventilation.

(b) Sanitation. A room in which a water closet is located shall be separated from food preparation or storage rooms by a tight-fitting door.

Every dwelling unit shall be provided with a kitchen equipped with a kitchen sink and with bathroom facilities consisting of a water closet, lavatory and either a bathtub or shower. Plumbing fixtures shall be provided with running water necessary for their operation.

Sec. 1407. (a) Ceiling Heights. Habitable rooms . . . shall have a ceiling height of not less than 7 feet 6 inches.

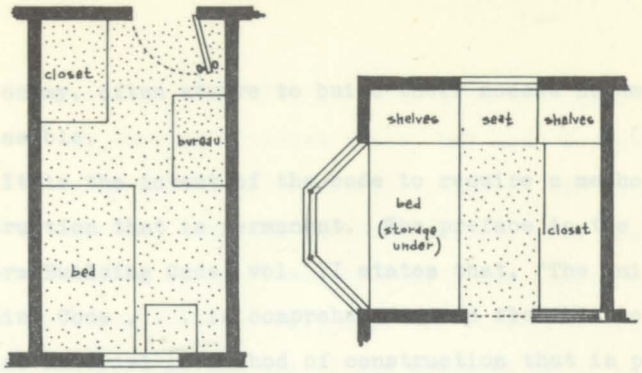
(b) Superficial Floor Area. Every dwelling unit shall have at least one room which shall have not less than 120 square feet of superficial floor area. Every room which is used for both cooking and living or both living and sleeping purposes shall have not less than 150 square feet of superficial floor area . . . exclusive of fixed or built-in cabinets or appliances.

Sec. 1410. Every dwelling unit and guest room shall be provided with heating facilities capable of maintaining a room temperature of 70°F at a point 3 feet above the floor in all habitable rooms.

the choice between a latrine and a water closet. I have talked with many owner-builders who claim to be quite comfortable using a latrine. They have applied the money which would have been necessary to install a water closet and septic system ($400 or more in most cases) toward some other comfort.

It is easy to understand why the codes have gone beyond health and safety into the area of comfort when we recall that they were originally enacted in order to protect the tenement and lodging-house dwellers of the nineteenth century from the outrageous practices of the landlords and slum-builders of that period, and when we recognize that they apply to slums and slum-builders of the present day. But owner-builders are keenly interested in their own comfort and are the ones who know best what they will find comfortable. There is no need to regulate comfort for owner-builders. The codes, by attempting to do this, are only working to defeat their own purpose of protecting the public health and safety by alienating owner-builders who might otherwise not connive to avoid the codes altogether.

Another complaint I have heard from owner-builders is that the code must be strong enough to include the very worst solution within the set of acceptable solutions. In order to allow for the worst design and sloppiest craftsmanship, the code must set minimum standards above



49. A comparison of the superficial floor areas (shaded) of a poorly designed bedroom with the minimum floor area allowed by the Uniform Building Code and a well designed bedroom with about one sixth the minimum floor area allowed by the code.

the standards that would be acceptable with good design or good craftsmanship. As a result good work doesn't count; good design must still meet the requirements of bad design. The code requires, for example, that each habitable room have 90 square feet of superficial floor area with no dimension less than 7 feet. If the smallest room allowed by the code (7 feet by 13 feet) were used for a bedroom, we would have trouble fitting in the furniture. A bedroom with a built-in bed and built-in storage and seating, however, could be easily designed with only 15 square feet of superficial floor area. (see fig. 49) But the code requires 90 square feet! Regulations like this tend to irritate owner-builders who, for reasons

of economy, often strive to build their houses as small as possible.

It is the intent of the code to require a method of construction that is permanent. The preface to the Uniform Building Code, vol. VI states that, "The Uniform Building Code . . . is comprehensive and flexible so that no material or method of construction that is permanent and safe is excluded."[6] Again, it is easy to see the reasoning behind this requirement when we think of the terribly dilapidated slum housing existing today in the cities, but this purpose is in conflict with the desires of those owner-builders who want to build and inhabit a house temporarily. Sometimes owner-builders want to live in a temporary house while designing and building a more permanent dwelling. Sometimes they have plans for moving on. Whatever the reason they have for choosing to build a temporary house, the code regulations requiring permanent construction seems quite arbitrary to these owner-builders. In these times of rapid change, it is possible that what is needed is less permanence and more temporary experimentation. Can you imagine what the land would look like now if all the Indians had been required to put a continous concrete foundation under their houses?

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[6] International Conference of Building Officials, Op. cit.

The owner-builder will shy away from the codes not only for the reasons outlined above, but also because of the lengthy and troublesome experience he can expect as he attempts to obtain a building permit. The building code is based on standard two-by-four frame construction, and, even though the provisions of the code "are not intended to prevent the use of any material or method of construction not specifically prescribed by this Code",[7] the owner-builder planning to build anything but a frame (or masonry) house will most likely have difficulty obtaining a permit. It is encumbent upon the owner who uses unorthodox methods or materials to prove that his work will be "at least the equivalent of that prescribed in the Code in quality, strength, effectiveness, fire resistance, durability, and safety."[8] The prospect of proving all this to the satisfaction of a building official has seemed so unlikely to most owner-builders using unorthodox methods or materials that they have (wisely) chosen not to try. It took three months for one pair of dome-builders applying for a building permit under the Uniform Building Code to convince the local building officials that they should be issued a permit.

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[7] Uniform Building Code, 1970 Edition, vol. 1, Sec. 106, p. 23.

[8] Ibid.

Throughout this chapter I have been arguing that the codes ought to restrict the owner-builder only when his actions might endanger the public health or safety. I argue that the owner-builder deserves special consideration under the codes since, unlike the professional builder, he is naturally interested in the comfort of the future occupants of the house (his own family), and he is therefore naturally interested in the quality of his house. He is in the special position of being able to directly translate his own needs, desires, and capabilities into the making of his house. Even though the codes themselves do not recognize this special relationship, owner-builders who choose to follow the codes usually find special considerations given them indirectly through the enforcement of the codes.

It is clear that, in order to obtain a building permit, the building department needs to be convinced that the regulations of the code will be followed in every detail. Once the permit has been issued, however, the owner-builder finds that he need not follow the code as closely as he said he would. He finds that the building inspector is a different person in the field than in the office. Inspectors in the field are free to use their own discretion in matters of compliance with the code. They are at once the interpreters and enforcers of the code. This is where the owner-builder will receive

50. Building inspectors will also make allowances for the amount of time owner-builders take to build their houses. 18 months ago a building permit was issued for this dome on the basis of plans showing a kitchen, a full bathroom, and a septic system. Today there is only a cold water tap in the kitchen and a latrine.

special consideration. It is refreshing for an inspector, who spends most of his day inspecting industrial buildings and tract houses, to see an owner-built house. He can appreciate the effort involved in building a house, and realizes that owner-builders are not accustomed to building techniques nor are they accustomed to the regulations of the code. Consequently the inspector will frequently make allowances for this that he would never make to the professional builder. These allowances are usually slight; the codes are stretched rather than ignored. You don't see inspectors waiving the requirement for a bathroom, but rather extending the distance a beam can span or allowing a wire to be slightly closer to a roof than

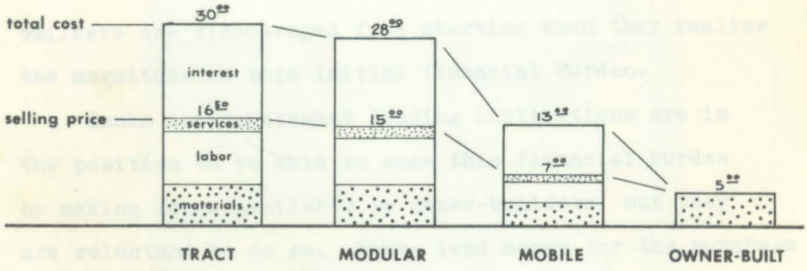
the distance specified in the code. These concessions are almost always made after the work has been completed, because it is more difficult for an inspector to tell an owner-builder to change his work than to tell him to change his plans. The owner-builder has cause to be grateful for the special consideration he recieves, but it is regretable that this consideration is not more far-reaching and that it must come, as it does, through the back door via the personal judgement of each inspector.

In a sense it is quite unfortunate that most experimental house builders have chosen to evade the building codes. By evading the codes they also evade the fundamental question of whether a person has a right to build a house for himself in any way he sees fit as long as he doesn't endanger the public health or safety. If this question is ever to be answered, or if future owner-builders are ever to know which "methods and materials" are acceptable under the codes, there must be confrontations in a court of law between experimental builders and building officials. One such confrontation is under way at the present time as Monte (page 51) has decided to go to court. Hopefully the outcome of this and other test cases will result in laws that will allow owner-builders to design and build their houses without unnecessary harassment.

CHAPTER FIVE

THE ECONOMICS OF THE OWNER-BUILT HOUSE

Owner-built housing can be built less expensively than any other type of low-cost housing currently available in this country, i.e. tract housing, modular housing, and mobile homes. The reason for this is that the owner-builder does not have to pay for labor, services, or interest. (see fig. 51) He must pay only for materials, trading his own time for the money he would otherwise



51. Cost per square foot comparing the least expensive of each type of low-cost housing with an owner-built house of comparable caliber. Figures are based on a survey of low-cost housing conducted December, 1972 by the author. Interest figures are based on a 20 year FHA loan at 7%.

have had to pay other people.[1]

Despite the lower cost of the owner-built house, the owner-builder frequently has a difficult time paying for his house. This is because he must pay the entire cost of his house within a relatively short period of time. The tract-house buyer and the mobile home buyer pay considerably more in the long run, but they pay in small installments spread over a long period of time -- a small down payment followed by monthly payments usually lasting 20 to 30 years. The owner-builder, even though his house costs much less, often finds himself in a financial predicament because he must scrape together the entire cost of his house before it can even be finished. I feel certain that many prospective owner-builders are discouraged from starting when they realize the magnitude of this initial financial burden.

Banks and government lending institutions are in the position to be able to ease this financial burden by making loans available to owner-builders, but they are reluctant to do so. Banks lend money for the purchase of building materials only when assurances have been made that the house assembled from those materials can

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[1]This is a slight simplification since the owner-builder must usually buy some tools, and must pay for permits. For all practical purposes, however, materials are the owner-builder's only expense since these other costs rarely total more than 2-3% of the total cost.

52. A family of five has lived in this 24 foot plydome for two years while trying to save enough money to build a more permanent house.

53. The mother of the family says, "I'm tired of hearing how spiritual it is to live in a dome. People are always talking about the Indians. I'd really like to have electricity so I could have a vacuum cleaner."

be easily sold on the open market. This requirement assures the bank that the loaned money could be recovered in the event that the borrower should default. Unfortunately for the owner-builder the requirement conflicts with his approach to building at almost every turn. His penchant for personalizing his house, his untested craftsmanship, and his tendency to leave things unfinished all contribute to making his argument that his house could be easily sold on the open market less convincing. The owner-builder simply does not fit the bank's definition of "good risk". Rather than change his program so that he might fit this definition, the owner-builder will almost always prefer to find his own means of financing his project.[2] Since he must work with his own limited funds, the realization of his project will depend on his ability to keep the initial cost of construction as low as possible and/or his ability to spread the cost over a long period of time.

Of paramount importance in keeping construction costs low is the owner-builder's ability to find and utilize inexpensive materials. In this pursuit the owner-builder has one great advantage over the contractor. That advantage is time. The owner-builder has time to scrounge

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[2]Owner-builders who cannot build without borrowing money are usually able to find a relative or friend who is able to help them.

for materials, sometimes finding them for free. He has time to shop at salvage yards and auctions for used materials -- windows, fixtures, etc.. He has time to shop around for new materials, picking up bargains when they appear, buying materials at their seasonal low prices. Since most owner-builders start with a very limited knowledge of building materials and their costs, the more time they have to consider the alternatives, the better the decision will be, and the more money they will save. The importance of time as a money-saving factor for the owner-builder cannot be overstressed. Used materials not only take more time to obtain than new materials, they are also more time consuming to install. Free materials are free because it takes so much time to make them useful. The owner-builder must exchange his time and labor for economy of expenditures.

The owner-builder rejoices when he finds a source of free materials. There are always free materials available in the form of materials taken directly from nature -- soil, rocks, timber; but it takes so much time and energy to put these materials into useful form that they are rarely used. Of much more interest to the owner-builder are free materials that can be used directly, with little or no alteration -- materials such as lumber, windows, fixtures, pipes, wiring, and bricks. These are materials found in old buildings such as barns,

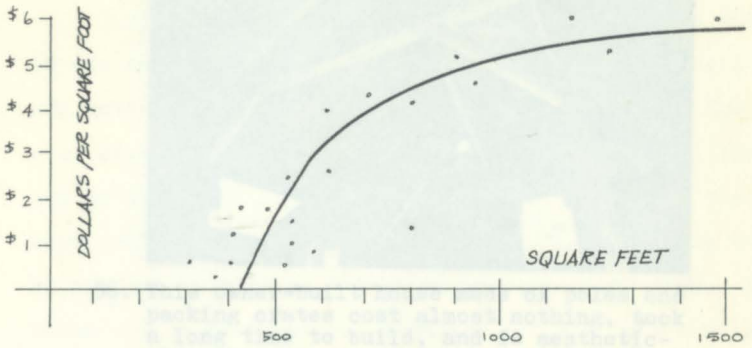
54. Members of a commune disassemble a church in exchange for all salvageable materials.

warehouses, churches, and houses. The materials from these old buildings are sometimes acquired merely for the asking. The owner will give them to anyone willing to tear down the building and haul the materials away. In northern Washington the rural fire departments have lists of farmers wanting their old unused barns and farm buildings burned for tax purposes. Owner-builders in that area have been fortunate in being able to obtain the names of these farmers who would usually just as soon have their old building torn down and hauled away as have it burned. Free materials are so precious to the owner-builder that he will usually collect them even if he has no idea of how to utilize them. I have seen

many piles of free materials surrounding owner-builders who are trying to think of some way to put them to good use.

When purchasing materials for his house, it is to the owner-builder's great advantage that he is shopping for himself. Unlike the contractor, he need not be concerned with satisfying the prevailing public taste. The owner-builder is free to buy whatever pleases him no matter how marred or strange it may look to the next person. This freedom, although it seems quite obvious, should not be underestimated in its importance to the owner-builder since it allows him to buy used, damaged, discontinued, and low-grade materials that the contractor cannot.

Aside from finding inexpensive materials, one of the easiest ways for the owner-builder to minimize the initial cost of his house is to make the house as small as possible. The smaller the house, the fewer materials will be needed, and therefore the less it will cost to build. The owner-builder will usually take advantage of this relationship, designing his house to the minimum size that will accomodate his immediate needs. Almost every house in this study includes fewer than 1000 square feet of floor area. The smaller the budget of the owner-builder, the smaller he will generally make his house.



55. Each dot represents an owner-built house. The average of these instances as represented by the curved line shows the trend that owner-builders who spend less per square foot also tend to build smaller houses.

If care is not taken, this effort to economize by minimizing the size of the house can easily result in a house that is too small. 29% of all the owner-builders I interviewed felt that they had designed their house too small.

Of course, the cost of a house is not directly proportional to its size since the cost of water, power, and heating systems are not related so much to the size of the house as to the complexity of the system itself. By simplifying these systems the owner-builder can make substantial savings in the initial cost of construction. The cost of a wood stove, for example, is so much lower than the cost of conventional electric or forced air

56. This owner-built house made of poles and packing crates cost almost nothing, took a long time to build, and is aesthetically pleasing to its owner.

heating systems that 47% of the owner-builders I interviewed had chosen wood heat as their primary heating source.[3] Of course, the decision to substitute a cheaper simplified system for the standard system is generally made at the expense of convenience to the owner-builder. Wood heaters and wood cook-stoves are cheaper to install than their standard counterparts, but they require more human energy to operate. A latrine is certainly less expensive to build than a flush toilet with its accompanying septic system but hardly as convenient on a

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[3]These owner-builders save not only on the initial installation of a heating source but also facilitate long-range savings by virtue of having chosen a fuel which they can collect themselves.

rainy night.

Finding inexpensive materials, minimizing the size of the house, and simplifying the heating, the power, and the water systems all help the owner-builder keep the cost of his house to a minimum. But the financial burden can be eased even further if he is able to spread the cost over a long period of time, building his house bit by bit and completing things as he can afford them. This turns out to be a natural strategy for the owner-builder since he usually will take a long time to build his house regardless of his financial situation. On the average the owner-builder will take about two years to build his house. The usual pattern is to build the shell of the house first, move in, complete the heating, power, and water systems as soon as possible, and leave the finish work till the last. This already lengthy construction period can usually be easily extended to accomadate a lack of funds. Dale and his family (page 46) lived in their unfinished house for six years before the flush toilet was installed. Despite the inconvenience involved, this strategy can be particularly important to the owner-builder with limited funds since it allows him to design his house around his long-range needs rather than around his immediate financial means.

The typical owner-builder is notorious for underestimating the cost of his house. The finished house

57. The living room of an owner-built house built by an artist who traded paintings for many of his materials.

usually ends up costing 25-50% above his original estimate. This is mainly due to his inexperience at estimating the amount of materials needed and to his tendency to overlook materials whose need will only become apparent when he becomes involved in the construction of his house. I feel that the owner-builder could come a lot closer to estimating the true cost of his house if he were able to gauge his own estimate from examples of other owner-built houses. In the interest of providing such an example a complete cost breakdown of the owner-built house pictured on page 38 of this text is included in Appendix A.

APPENDIX A

The following is a complete cost breakdown of the house pictured on page 38 of the text. The house was built to code on a limited budget and includes all the standard conveniences. Standard construction methods and standard materials were used throughout. All materials were purchased new unless otherwise noted. The builder was extremely concerned with keeping the cost of the house as low as possible and so every opportunity was taken to find and use the most inexpensive materials.

Building permit for 926 sq.ft. house		$ 63.00
Foundation		$ 261.69
4 yds. readymix concrete (5 sack)	$ 81.20	
327 6"x8"x16" concrete blocks	98.30	
block cartage	15.60	
form lumber(a burn)	19.60	
materials for mortar	36.30	
anchor bolts	9.69	
	$261.69	
Framing lumber		$1,145.49
1700 board feet utility 2"x8" tongue and groove fir for subfloor	$158.01	
3040 board feet standard and better fir - 2"x4", 2"x6", 4"x4", 4"x6", and 4"x8"	582.48	
3000 board feet 2"x6" tongue and groove #200 hemlock for ceilings	405.00	
	$1145.49	
Exterior walls		$ 376.26
40 sheets 4'x8'x3/8" CDX plywood	$103.65	
13 squares #1 cedar shingles	272.61	
	$376.26	

Windows		$ 151.49
3 used wooden sash for bathroom	$ 10.50	
15 used wooden casement sash with hardware	38.00	
3 used industrial steel sash	12.00	
replacement glass, putty, clips, etc.	29.95	
finish lumber for frames	61.04	
	$151.49	
Doors		$ 58.32
2 used exterior doors with hardware	$ 24.50	
2 used interior doors with hardware	10.00	
finish lumber for frames	23.82	
	$ 58.32	
Roof		$ 267.59
6 squares 1" rigid insulation	$ 75.96	
7 squares composition shingles	80.15	
3½ squares #1 cedar shingles	70.00	
gutters, flashing, roof jacks, etc.	42.48	
	$267.59	
Heating system		$ 164.93
used wood heat stove	$ 80.00	
8"x33" metalbestos flue kit with roof jack and storm collar	45.59	
custom-made 8"x6' galvanized chimney with tie-downs: custom-made interior cover plate: 6" to 8" increaser	39.34	
	$ 84.93	
Electrical		$ 242.12
wire: 750' 12/2wg ($50.43), 45' 6/3wg ($22.05), misc. ($9.55)	$ 82.03	
47 receptacles, switches, and light sockets	45.83	
200 amp service entrance with wire, breakers, meter base, weatherhead	85.37	
miscellaneous rods, clamps, covers, nuts, etc.	18.89	
permits	10.00	
	$242.12	

Plumbing		$ 424.07
materials for ABS plastic drain, waste, vent system rough-in	$ 96.18	
materials for copper supply system rough-in	67.10	
55 gal. electric hot water heater and plumbing fittings	67.90	
flush toilet and fittings	37.48	
double stainless steel kitchen sink and fittings	50.14	
5' porcelain tub and fittings	68.36	
shower fittings	8.04	
crockery lavatory (used) and fittings	21.67	
outdoor faucets	7.50	
	$424.07	
Finish floor		$ 203.40
2200 board feet #3 (reject) 1"x4" tongue and groove fir flooring	$150.00	
rental of nailing machine (1 week)	7.00	
special non-split, toothed nails	25.90	
rental of floor sanders with paper	20.50	
	$203.40	
Interior walls		$ 302.97
9 rolls (630 sq. ft.) 3½" foil-backed wall insulation	$ 48.09	
29 sheets ⅜"x4'x8' sheetrock for living, dining and bedrooms	52.11	
labor for taping sheetrock	105.56	
310 board feet 1"x4" roughsawn cedar for halls and stairway walls	50.00	
210 board feet B & better beveled cedar siding in 3' lengths for kitchen	15.75	
233 board feet 1"x10" utility & better roughsawn cedar for bath	31.46	
	$302.97	
Finish lumber		$ 206.06
materials for cabinets	$ 83.00	
clear fir treads and risers for eight 36" wide stairs	35.16	
clear vertical grain fir for trim	83.60	
	$206.06	

Miscellaneous		$ 272.87
nails	$ 37.78	
15 pound felt	33.07	
caulk	13.33	
paint	83.18	
saw blade sharpening	19.95	
other	85.56	
	$272.87	
COST of HOUSE, exclusive of its attachments and supporting systems which are itemized in the following list		$4,140.26
Water supply system		$ 418.73
one horse shallow well pump with jet and 40 gal. pressure tank	$184.86	
450 gallon cylindrical storage tank home-made with cedar 2"x4"x6' boards bound with steel hoops	88.04	
pump house and pump mount with slab floor, cedar walls, shingle roof	28.80	
fittings and valves	28.24	
200 feet 1¼" 125 lb. plastic pipe	46.72	
200 feet 10/2wg underground wire, 20 amp breaker, electrical boxes	42.07	
	$418.73	
Septic system		$ 375.00
contracted system with 140' field, 30' tight line, 1000 gal. tank	$370.00	
septic permit	5.00	
	$375.00	
Outside deck		$ 142.99
900 board feet used 2"x12" and 4"x8" fir	$ 83.00	
17 12"x12" pier blocks	16.50	
bolts, nuts, washers	33.49	
50 lbs. 8" grooved deck spikes	10.00	
	$142.99	

Driveway		$ 61.50
26 tons 3" no minus crushed rock	$ 36.50	
10 tons 1½" minus crushed rock delivered	35.00	
	$ 61.50	
SUBTOTAL of supporting systems		$ 998.22
GRAND TOTAL		$5,138.48

APPENDIX B

Following are the questions asked of owner-builders by the author. These questions were asked both in personal interviews and by means of questionaires sent through the mail. The sample answers shown here came through the mail from a "Dynadome" builder in northern Washington.

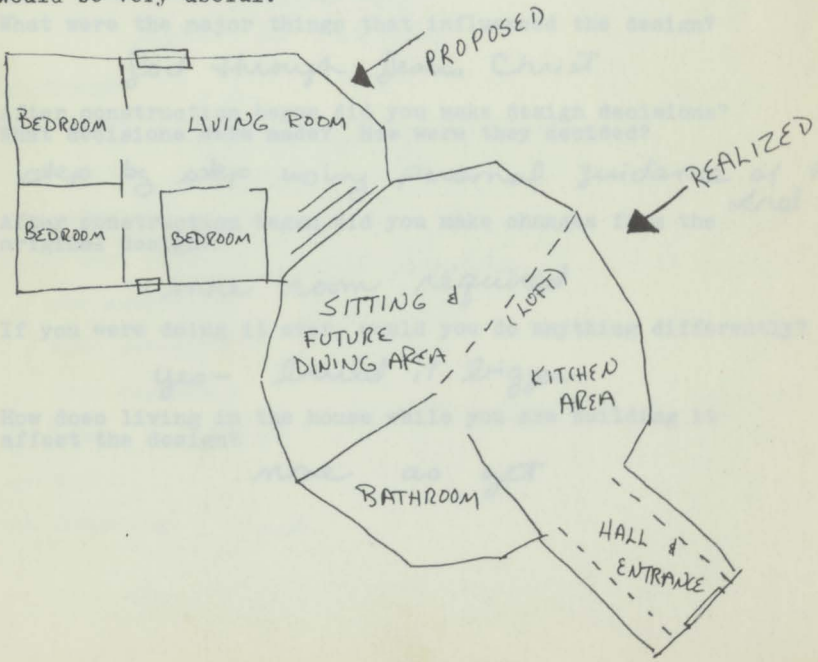
General Questions

date: June 28, 1972

name: John W. Stewart

occupation: none

A plan of your house sketched on this page (or elsewhere) would be very useful.



What made you decide to build your house? I had inherited a large sum of money & felt moved to purchase some acreage & build a house.

Where have you lived before?

In rented houses in cities

Do you have plans about how long you're going to stay?

no plans to ever move (as yet)

Design Process

Do you have any previous design experience?

none

Before construction began did you consult any books?

no

Did you consult any people? Who? friends

What were the major things that influenced the design?

God through Jesus Christ

After construction began did you make design decisions? What decisions were made? How were they decided?

step by step using personal guidance of the Lord

After construction began did you make changes from the original design?

more room required

If you were doing it over, would you do anything differently?

yes- build it bigger

How does living in the house while you are building it affect the design?

none as yet

Building Process

Do you have any previous building experience?

none

Do you have recommendations of the skills necessary to build a house?

What skills did you learn as you were building your house? How were they learned?

basic carpentry - learned through experiencing

What tools did you use?

hand tools & skill saw (chain saw on some big timbers)

Did you have any skilled help?

none profesional - some pretty good non-pros, though.

Did you have any unskilled help?

lots of friends

Economics

land size: 22.6 acres

land cost: $16,500

financing: paid cash

house cost (total): (still building)

- new materials: 2000.00 ?
- used materials:
- free materials:
- labor: none
- tools:
- financing: cash

Building Codes and Permits

	Building-Plumbing	Electrical	Other
cost of permit			
What did you need to do to obtain a permit?			
Were the requirements of the code made clear at the time you got the permit?			
Were the requirements accessable after you got the permit?			
Were there any requirements you were unwilling or unable to meet? What happened?			
What was the inspector looking for?			
Do you have hints for others dealing with codes?			

I didn't get any type of building permit because I'm situated in the country and as far as I know none is required.

I do have to have my elec. wiring inspected and have found the code in the little book easy to read & the help from the inspector(s) has been real fine.

I hope this will help you, Rob, stop in again if you're up this way... God bless you.

John S.

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