AN EVALUATION AND COMPARISON OF THE LIVABILITY OF PROTOTYPICAL AND CONVENTIONAL HOUSE TYPES: THE DEVELOPMENT AND TESTING OF A METHODOLOGY

by

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ABSTRACT

The purpose of the study was to develop a methodology for evaluating the livability of single-family houses and to test it on conventional and prototypical house types. The House Plan Evaluation Checklist and the Housing Satisfaction Scale were developed and analyzed for content validity using the responses of randomly selected housing professionals. Once the instruments were revised they were used to evaluate the Benchmark house type (FmHA plan no. H5-41) and the Solar Attic house type (Cooperative Extension Plan Service experimental plan no. 7220). A randomly selected sample of 32 housing professionals evaluated the plans of these houses using the House Plan Evaluation Checklist. They rated the Solar Attic plan significantly higher on five of ten subscales. All of the subscales of the House Plan Evaluation Checklist had high inter-rater reliability when used by the housing professionals to rate the Benchmark house and the majority

of the subscales also had high inter-rater reliability when used to rate the Solar Attic plan.

The Housing Satisfaction Scale and an interview schedule were used with samples of 15 Benchmark and 15 Solar Attic residents to obtain information about their housing satisfaction and demographic, housing, and energy characteristics. The Solar Attic residents rated their satisfaction with their housing significantly higher than the Benchmark residents on five of 13 Housing Satisfaction subscales. The Benchmark residents had significantly more female heads of households, less educated heads of households, and lower income households. Their housing was older, smaller and the residents had lived there longer. They used more electrical energy, although their housing had many of the same energy-saving features as the Solar Attic houses. The subscales of the Housing Satisfaction Scale had inconsistent inter-rater reliability when used by the residents of both house types to rate their satisfaction, but they had high internal consistency reliability ratings on all but the Cost subscale.

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CHAPTER I

INTRODUCTION

As conventional energy supplies continue to dwindle, and housing costs continue to soar, alternative energy sources and innovative technologies are being incorporated into more and more house designs. Prototypical houses or model units of original design have been built by researchers in order to study and demonstrate the effectiveness of these innovative housing systems in actual use. Prototypes have incorporated active solar systems, passive solar design, earth sheltering, and hybrid systems that combine these technologies. Researchers have also developed prototypical houses to demonstrate innovative framing, flooring, and panel systems in housing construction. Research studies have been conducted to investigate the building cost, energy use, and system efficiency of these innovations (Hurst & Zettersten, 1976; Newman, 1976; Zornig & Godbey, 1980). Few studies have reported empirical results concerning residents' satisfaction with the livability of prototypical houses.

Many prototypical houses have unique designs that may require some adaptation by the residents living in them.

It is possible that the prototypical structures have not been designed in a way that is acceptable to the average consumer. Balcomb (1978) reported that many solar homes were not designed to function well as living units. She recommended that for alternate-energy-use homes to be accepted by the public they must meet the same criteria that are used to judge the functionality and livability of conventional houses. Livability refers to the capability of a residential space to meet the daily living needs of a family or household through its design, arrangement, and construction. To be livable the dwelling should be safe, functional, and useable. It should be flexible enough to satisfy the variety of users that might occupy the dwelling. If designers of innovative and prototypical houses are to plan structures that are livable, a comprehensive method for evaluating the livability of houses needs to be established and tested.

A standardized method of evaluation that encompasses the social and behavioral responses of residents living in prototypical houses does not exist. Researchers associated with the Southern Regional Housing Research Project "Housing for Low- and Moderate-Income Families" (S-141) recognized the need to establish a user-oriented evaluation and to apply it to the prototypical houses they developed. The S-141 project was undertaken by research personnel of the agricultural experiment stations in seven southern states, and of certain units of the U.S. Department of Agriculture, the Tennessee Valley Authority, and the Appalachian Regional Commission. A specific objective of the regional project was to "provide innovative designs and research assistance for the construction of prototype housing systems and sub-systems...and review and evaluate them by interdisciplinary teams" (S-141 Cooperative Regional Project Outline, 1979, p. 3). As a result of detailed discussion of the objective, it was suggested that questionnaires be developed to examine the social, behavioral, psychological, and aesthetic responses of families living in the prototypical houses and that comparisons be made between the responses of residents living in prototypical and conventional houses. The evaluation procedures developed for this comparison study could then be used to evaluate other prototypical houses. The S-141 project outline designated that the Solar Attic house be used as the prototypical model in this comparison and that the Benchmark house (one of the Farmers Home Administration's [FmHA] most used plans) be used as the conventional model.

The recommendations in the S-141 project outline were an outgrowth of the preceding regional research project

(S-95). In the S-95 Southern Regional Housing Research Project, "Quality Housing Environments for Low-Income Families," a subcommittee was established to evaluate prototypical houses developed by researchers involved in the regional project. The five member multidisciplinary team suggested that the following topics be considered in the evaluation of prototypical houses: acceptability, safety, maintenance, energy conservation, appearance, economy, flexibility, materials, equipment, durability, and suitability (S-95 Participants, 1974). Later, the subcommittee decided to use a conventional house as a "yardstick" for comparison. The FmHA Benchmark house (plan no. HS-41a) was selected as the "yardstick" because of its wide use throughout the United States. Zornig (1976) stated that the examination of the Benchmark house would allow the subcommittee to develop "weighted" criteria to evaluate prototypical houses. Residents of Benchmark houses in Maryland were interviewed by VanDongen and Fish (1978) using an interview schedule from another component of the S-95 project. Based on the findings of this investigation, S-95 researchers improved on the Benchmark house when they designed the Solar Attic house. The overall size of the house was increased and a garage and an outdoor storage space were included in the plan. Fish (1978) indicated that the Benchmark interviews would be used as a basis of comparison for the Solar Attic house. She explained that

> by determining the satisfaction of the residents of the Solar Attic houses and comparing their criticisms with those of the residents of the Benchmark houses we will be able to "determine the acceptability of innovations in housing" (Fish, 1978, p.8).

She recommended that the houses be compared on utility costs, percentage of household income spent on housing, and housing quality indicators, as well as residents' satisfaction. The Maryland Benchmark interviews did not include specific evaluation items and there is no evidence that "weighted" criteria were developed.

Members of the S-141 committee currently have plans to evaluate the Benchmark house by analyzing the amount and composition of building materials and equipment required in its mechanical and framing systems. The "yardstick" measurements developed from this analysis will be used by the researchers to evaluate the materials and equipment required for these systems in prototypical houses (S-141 Technical Committee "A" Subcommittee Report, 1981).

Conceptual Framework for Evaluation Studies

In recent years social scientists and designers have been working together in an attempt to make the built environment more responsive to the needs of people. This has resulted in the field of study referred to as man-environment relations, the theory of how buildings and people influence one another (Rubin & Elder, 1980). One of the primary purposes behind this collaboration has been to provide scientifically gathered information about the actual or potential users of environments so that the environments can be planned to provide for user needs and to enhance user satisfaction with the completed design. Much of this research has been design-oriented and has been performed to provide guidelines for designers.

Generally there are two types of design-oriented research studies, programming and evaluation. Programming studies are used in the predesign process to provide criteria for the design. They also specify performance characteristics that will be tested in later evaluation studies (Lang, Burnette, Moleski, & Vachon 1974). Studies conducted after the design is completed, occupied, and used for a reasonable length of time are referred to as evaluation studies, post-occupancy studies, or post-construction studies. The basic purpose of evaluation studies is to provide programmatic information to the designers (Cooper & Sims, 1979). The Environmental Research and Development Foundation (1977) defined post-occupancy evaluations as research studies that examine the environment after it has been occupied, by collecting data primarily from its occupants, and by focusing on the functional-behavioral aspects of the environment. Lang et al. (1974) explained that the "purpose of evaluation is to investigate whether or not the design has satisfactorily solved the environmental problem" (p. 231). Evaluation studies usually compare the intended use with the actual use of the structure. They examine the "level of user's comfort and adaptation, the frustration of a user's desired activities and the recognizability of the intended environmental image" (Lang et al., 1974 p. 231).

Post-occupancy evaluation studies provide feedback to the designer and detect design criteria that can be implemented in future designs. The results of the post-occupancy evaluation can serve as programmatic inputs which allow designers to systematically improve the design of development types that are frequently repeated with only slight variations (Cooper & Sims, 1979). This type of feedback can be crucial to engineers and architects designing prototypes. Malpass (1976) stated that architecture often is in need of small prototypical designs that can be evaluated and revised instead of large structures that are constructed and assumed to be satisfactory. The development of the second generation of a prototypical unit gives the designer the opportunity to improve the quality and efficiency of the system and to redesign the dwelling so that it better meets the needs of users.

In post-occupancy studies a variety of methods have been used to evaluate residential structures. Evaluation techniques include: interviews and questionnaires administered to residents, managers, and architects; non-obtrusive observations of public areas; building checklists; photography; diaries; furniture maps; and inventories of household objects. Through the various methods researchers try to assess how the structure or complex is actually being used, how it satisfies users' needs, and how the structure or complex meets already established design guidelines.

Researchers conducting post-occupancy studies have relied on research designs that incorporate an actual setting. Laboratory and experimental research designs have not been appropriate. In experimental research, the investigator is attempting to determine the effect that one variable (treatment) has on another variable (outcome). In this type of research, other factors that might also affect the outcome (e.g. sex and age of respondents) can be controlled through the selection of respondents or by matching respondents in the experimental and control groups on these factors. Margulis (1981) established a research design for post-occupancy studies that incorporated the use of matched samples with survey methodology, so that many of the factors affecting the outcome of the findings could be identified and controlled similar to an experimental design. In order to evaluate the prototypical industrialized housing developed through Operation Breakthrough, post-occupancy studies were conducted to determine residents' satisfaction and acceptance of these housing units and comparisons were made with residents living in conventional housing. (Operation Breakthrough was a federally sponsored housing program, established in 1968 to demonstrate mechanisms for the large-scale production of housing that would reduce housing costs. The program encouraged industrialization through prefabrication and assembly-line construction techniques.) Margulis established an experimental group (the Operation Breakthrough residents) and a control group (the residents of conventional housing) in order to isolate the effects of industrialized construction on the residents' responses. These groups were matched on several physical, economic, and social factors that might have affected the respondents' level of satisfaction and acceptance. Because of this research design, the major difference between the two groups was the industrialized construction of the housing and the effect of this on residents' satisfaction. Thus acceptance could be determined more accurately.

Several researchers have analyzed the methodologies of post-occupancy studies and have recommended that multiple methods or a combination of techniques should be used so that more comprehensive and accurate data can be collected (Lozar, 1974; Ostrander, 1974). Multi-method evaluations can also encourage the verification and validation of findings and recommendations (Patterson & Passini, 1974). Margulis (1981) indicated that a research design that controls external factors by using matched samples should be incorporated in post-occupancy studies to improve the validity of the evaluation conclusions.

Statement of the Problem

Prototypical houses have been scientifically evaluated to determine the efficiency, reliability, and costs of their construction and operation. Many of these houses have innovative technologies that affect the size, arrangement, appearance, and features of the dwelling. Often the total structure is unique. These structures need to be evaluated so that the residents' responses can be determined. The following questions need to be answered: How can livability in single-family residences be evaluated? Is the livability of a prototypical house similar to a conventional house? Are prototypical and conventional houses meeting design guidelines? Are the residents satisfied with their housing? Have the residents made alterations or do they plan to make alterations to make their housing more livable? What factors are associated with the residents' housing satisfaction? Is house type associated with satisfaction? Are demographic, economic, and alteration factors associated with satisfaction? A comprehensive post-occupancy evaluation methodology that is suited to single-family residences was needed in order to answer these and other questions.

Purposes of the Study

The purposes of the study were to develop and to test a methodology for evaluating the livability of single-family houses. The instruments to be used in the methodology were developed, analyzed for content validity, and revised. The livability of the Benchmark and the Solar Attic houses was evaluated to test the appropriateness and usefulness of the methodology and to provide feedback on the design of the two house types. The methodology included a house plan evaluation by housing professionals and an assessment of residents' satisfaction with their housing. The researcher developed a profile of the residents of the houses and compared the two houses on the following: design, residents' satisfaction and demographic characteristics, the physical and economic characteristics of the houses, and housing alterations. The relationship between housing satisfaction and the demographic characteristics of the residents and the physical and economic characteristics of the houses were also investigated.

Objectives

The study was conducted in two phases. The specific objectives of Phase I were:

1) to develop an instrument to evaluate the livability of house floor plans, determine its content validity, and revise the instrument.

2) to develop an instrument to measure resident' satisfaction with their dwelling units, determine the content validity, and revise the instrument.

The specific objectives of Phase II were:

1) to use the house plan evaluation instrument with housing professionals to evaluate the design of the Benchmark house plan (Farmers Home Administration

plan no. H5-41) and the Solar Attic house plan (Cooperative Extension Plan Service experimental plan no. 7220).

2) to use the satisfaction instrument to determine the housing satisfaction of residents living in the Benchmark houses and the Solar Attic houses. Specific items related to residents' satisfaction with solar attic features were obtained when appropriate.

3) to use a house plan diagram to record any alterations or additions that had been made to the respondents' houses that were different from the original house plans.

4) to examine the relationship between housing satisfaction and housing alterations, selected housing characteristics, and selected demographic characteristics of the residents.

5) to compare the Benchmark and Solar Attic houses on the following:

a. house plan evaluation
b. residents' demographic characteristics
c. housing characteristics
d. energy characteristics
e. housing alterations
f. residents' housing satisfaction

Definition of Terms

For purposes of this study the following definitions of terms were used:

Benchmark house: Farmers Home Administration house plan no H5-41, one of three most used plans distributed by the Farmers Home Administration between 1968 and 1973.

Energy characteristics: A variety of energy and utility-related factors. Specifically refers to type of utilities used, amount of electricity used, energy saving features in the home, and changes to reduce utility costs.

Family life cycle: Stages of family development that refer to the changes in the family composition over time (Lindamood & Hanna, 1978). The stages used in this study have been adapted from Oppenheim (1976):

1. Single Person - One person households.
2. Beginning Couple - Two people establishing themselves in a joint household.
3. Expanding Family - Families with children at home.
4. Contracting or Older Family - Families or single parents with children no longer at home.

House Plan Evaluation Checklist: A checklist housing professional used to evaluate floor plan features. Subscales of the checklist were: Zoning, Circulation, Storage, Living Areas, Dining Areas, Kitchen, Bedrooms, Bathroom, Laundry, and Service and Facilities.

Household: A group of related or unrelated people sharing the same housing unit (Morris and Winter, 1978).

Housing alterations: Structural and mechanical changes to a house that increase or rearrange the living area.

Housing characteristics: A variety of housing-related factors. Specifically refers to the age of the dwelling, size of the dwelling, housing costs, location of the house, and the household's length of residency.

Housing professionals: Persons employed or interested in housing as a field of study. The samples of housing professionals were selected from a complete list of state housing specialist in the Cooperative Extension Service (CES), and from a modified list of the 1982 members of the American Association of Housing Educators (AAHE).

Housing Satisfaction Scale: A scale rating residents' satisfaction with their actual dwelling unit. Subscales of the instrument were: Layout of Floor Plan, Storage, Living Areas, Dining, Kitchen, Bedrooms, Bathroom, Laundry, Appearance, Exterior, Systems, Structure and Materials, and Costs.

Livability: The capability of a residential space to meet the daily living needs of a household through its size, design, arrangement, and construction.

<u>Solar Attic house</u>: The solar attic system was designed by engineers and architects associated with the Rural Housing Research Unit in Clemson, South Carolina, as part of the S-95 Southern Regional Housing Research Project, "Quality Housing Environments for Low-Income Families." Prototypical houses were constructed and over 300 plans were distributed through the Rural Housing Research Unit and the Cooperative Extension Plan Service (experimental plan no. 7220).

<u>Utilities</u>: Sources of energy and water used by the households. Specific categories of energy sources include electricity, natural and bottled gas, oil, wood, and kerosene.

<u>Zoning</u>: The division of the house into different areas that provide for living, working, and sleeping activities. Rooms should be arranged so that similar activities can occur in the same general location.

CHAPTER II

REVIEW OF HOUSING EVALUATION METHODOLOGIES

A post-occupancy methodology to evaluate single-family residences was developed in this study. Several different research methods were used to complete evaluations of conventional and prototypical house types. Important components include: a measure to indicate how well house plans meet with single-family housing design standards; an assessment of residents' satisfaction with specific features of their housing; and an assessment of the residential alterations that the families have completed or hope to complete in the future. This information and other information related to housing characteristics and household demographics were analyzed to determine the overall livability of the houses under study and to examine the factors related to the residents' satisfaction with their housing.

A great deal of research has dealt with the various aspects of housing outlined above. Only the most pertinent studies will be discussed. A general review of post-occupancy studies will be discussed first and brief reviews of the methodology components will follow.

Residential Post-Occupancy Studies

Researchers have examined the methodologies used in man-environment studies and have characterized them in several ways. Lozar (1974) classified techniques on their ability to collect data on covert or overt behavior and further categorized them as self-report and non-self-report techniques. Self-report methods were survey attitude instruments (Likert scales, semantic differentials, simulation mechanisms) and interview techniques (unstructured, structured, participant interviews). Non-self-report methods were instrumented observations (videotaping, still photography, time-lapse film), direct observations (behavior settings, time sampling, mapping), sensory stimuli observations (lighting, noise, thermal comfort) and other indirect methods (tracks, records). Ostrander (1974) saw a similar classification. He arranged data collection techniques along a continuum from obtrusiveness to unobtrusiveness in terms of the subject's awareness of his or her involvement. A similar continuum from intervention to nonintervention by researchers ran parallel to this continuum. Both researchers recommended a combination of techniques so that more comprehensive and accurate data could be collected. However, Lozar recognized that combining techniques creates problems in research design and in analysis of data.

Data collection techniques in man-environment studies have usually been implemented to examine dependent variables that are either behavioral, attitudinal, or demographic (Patterson & Passini, 1974). The research study that incorporates only behavioral or attitudinal measuring techniques may have validity problems. Attitudinal measures are usually self-report and are generally "reactive." They allow the respondent to assume a role and are subject to invalidity caused by a "response set." Behavioral measures may give a truer picture of the building in use, but they are also subject to inaccuracy and lack generalizability. Again, a multi-method approach was suggested to verify and validate results (Patterson & Passini, 1974).

The survey is a common method used in both evaluation and theory-oriented research. Questionnaires or interview schedules are used to obtain information from residents. Ravetz (1971) had other criticisms that pointed out experimental laxness in much of the research that involved the use of buildings. These included the use of jargon, the use of small nonrandom samples, and the faulty and biased training of observers. He also suggested that many researchers have conducted studies that lack statistical analysis and have not considered the wide range of variables operating in field settings. He pointed out that most of the researchers implementing these types of studies have examined interactions and have not identified dependent and independent variables and therefore have not determined causality.

Design-oriented evaluation studies often lack a relative contribution to theory development in housing or man-environment relations. Cooper and Sims (1979) viewed the lack of emphasis on theory as an asset.

> The major strength of post-occupancy evaluation as a source of programmatic information for designers is its basis in holistically assessing the performance of real settings as opposed to predictions derived from theory. Even in those rare instances where we have "good" theory it inevitably deals with only a small portion of the entire range of concerns that the designer of an environmental setting must consider. Looking at the overall performance of a real setting, on the other hand, provides one with a comprehensive and concrete list of attributes that work and do not work for particular client groups in particular situations. Given the spotty and faddish nature of environment/behavior theory, this holistic and non-theoretical stance is probably the major strength of this approach to generating design guidelines. (Cooper and Sims, 1979, p. 141)

Theory-oriented research and evaluation studies have been distinguished from one another in several different ways. Coleman (cited in Bernstein, 1975) stated that discipline research (theory-oriented) and policy research (design-oriented) are directed at different audiences, have problems that are formulated differently, and are conducted under different guidelines and criteria. Discipline research is directed at the scientific community and in it, problems are formulated based on the dependent variable. Policy research is directed at a specific audience (often client sponsored) and problems are formed around the independent variable.

In their discussion of research methods for behaviorally oriented design, Lang et al. (1974) classified these two types of studies as conceptually oriented and programmatic. Conceptual studies investigate general classes of phenomena and provide information that may be applicable across many specific settings and activities. Through these theory-oriented studies, researchers seek to understand and predict a wide range of environmental occurances. The programmatic studies (programming and evaluation) are solution oriented and are directed at providing a solution for a specific problem.

In a recent review and analysis of post-occupancy residential studies, Beamish (1981) compared theory-oriented and design-oriented (evaluation) studies on sample size, instrumentation, and statistical analysis. The studies in the analysis were categorized according to purpose and contribution to theory. Beamish found that design-oriented studies were conducted to evaluate a specific facility in terms of residents' satisfaction or to document residents' experiences in their housing. Theory-oriented studies were undertaken to examine relationships between people and their residences. Both types of studies included conceptual frameworks to link past research and theories with their stated objectives. Through their findings and conclusions, researchers conducting theory-oriented studies made contributions to the frameworks and attempted to verify the accuracy of the theories. Researchers of design-oriented studies did not present their findings this way, but offered design recommendations. Multiple methods for collecting data were used in both the design-oriented evaluation studies and the theory-oriented studies and interview schedules and self-administered questionnaires were the most frequently used techniques. Larger sample sizes and more inferential statistical analyses were used in the theory-oriented studies than in the design-oriented studies.

Theory-oriented and design-oriented studies have different objectives and can be implemented differently. However, there can be commonalities in their methods. Lang et al. (1974) pointed out that theory-oriented and design-oriented studies are not always mutually exclusive, "for basic research can offer information useful in solving everyday problems, and applied research can produce insights into theoretical issues" (p.224).

Design Guidelines for Single-Family Housing

There are a variety of house planning principles and design guidelines that serve the interests of different segments of the housing process. Researchers have investigated space requirements to determine the space needs of families for various work, living, and sleeping areas of the home. Guidelines that incorporate some of these findings have been written to aid consumers in their house building or purchase decisions. Recognized standards have been developed to guide builders and developers in the planning and construction of housing units. Some of these standards have been adopted and enforced by local, state, or federal governments in order to assure some level of housing quality or livability for the public. These research findings, guidelines, and standards are not always consistent; though, they often include the same subject areas and some similar items.

Research Studies

Research investigators have undertaken the determination of space requirements and the location of various household activities so that recommendations concerning housing design could be made based on users' needs. Many of these writers have analyzed space needs in relation to the physical requirements of the worker and the principles of time-motion economy.

The U.S. Department of Agriculture (USDA), through the Institute of Home Economics and the state agricultural experiment stations, has provided a great deal of insight into space requirements for many household activities. A series of planning guides were published by each of the regional Cooperative Agricultural Experiment Stations based on research performed in each of the USDA-Cooperative Research regions. In Planning Guides for Southern Rural Homes (Southern Regional Housing Research Technical Committee, S-8, 1958), space guidelines for several major household activities were suggested. Specific recommendations were made for kitchen area arrangements, kitchen storage units, food preservation areas, dining areas, laundry areas, sewing areas, and indoor play areas for preschool children.

In the Farmhouse Planning Guides (Northeastern Farm Housing Technical Committee, 1959) researchers analyzed the space requirements for food preparation, dining, food preservation, laundry activities, farm and home business activities, personal hygiene, sleeping and dressing, leisure activities, sewing activities, and cleaning activities. These activities were analyzed according to the kind and extent of the activities, the facilities and equipment needed, the space requirements for the activities, the space requirements for storage, the location of the activities, and the arrangement of work centers.

Many of the same activities were analyzed by researchers in the Western Region in their publications _Space Standards for Home Planners_ (1960). These standards included space recommendations for furnishings, equipment, activity, and circulation. Individual brochures were published for each activity area.

Farmhouse Requirements (North Central Regional Research Technical Committee, 1965) had a broader scope than the other regional publications. It was a compilation of research studies in which housing needs and preferences were reported, and house planning guides were presented. It contained summaries of articles about the design of specific areas of the house, including kitchen arrangements, laundry centers, bathrooms, and household storage, and suggested plans for building or remodeling farmhouses. The report also summarized the article _Space Standards for Household Activities_ (McCullough, Philson, Smith, Wood, & Woolrich, 1962) which established clearances for the satisfactory performance of several activities based on the observation of a sample of 230 women and 20 men who performed 40 different activities.

The Small Homes Council - Building Research Council of the University of Illinois was also instrumental in developing and distributing design guidelines and space requirements. The Council issued a Circular Series of bulletins dealing with various aspects of housing including kitchen and bedroom planning, indoor storage, and laundry areas. Several of the Circulars (C5.1, C5.31, C5.32, C5.33, and C5.4) were based on research sponsored in conjunction with the Illinois Agricultural Experiment Station (McCullough, 1949; 1953; 1957; McCullough and Schoeppel, 1956; and Ranney, 1949).

Consumer Guidelines

Design guidelines based on research reports and standards have been frequently cited in popular publications and in publications designed to educate the consumer (Cooper, 1975; Craig & Rush, 1966; "Evaluating Floor Plan," no date; Faulkner & Faulkner, 1975; Harrison, 1976; Lindamood & Hanna, 1979; Midwest Plan Service, 1978; Wedin & Nygren, 1976). These guidelines have been useful in combining recommendations and in translating the criteria into easily understood checklists. The guidelines have been organized in various ways, however common components can be identified. The guidelines usually suggest specific space requirements for activities, such as food preparation and storage, and specify the arrangement and integration of these spaces in the home.

Standards

Design guidelines that have been sanctioned by a specific organization or by a government agency have an important impact in determining housing design. The American Public Health Association (APHA) is one influential organization that has identified standard space requirements for specific activities. The original standards were established in 1950 and reported optimum space requirements for various activities and household sizes (APHA, 1950). In 1971 the APHA published minimum requirements in Recommended Housing Maintenance and Occupancy Ordinances (APHA, 1971). These standards have served as a prototype for many of the housing codes adopted by local communities (Morris & Winter, 1978).

Minimum Property Standards. Perhaps the most influential standards impacting housing design have been the Minimum Property Standards (MPS) that were established when the National Housing Act of 1934 empowered the Federal Housing Administration (FHA) to provide mortgage insurance for single-family houses. The standards were established in 1935 to assure that insured property met the minimum requirements that FHA considered necessary for the property to be an economically sound security ("The Evolution of HUD's Minimum Property Standards," 1971). As the mortgage insurance programs expanded, MPS were established for housing for the elderly and handicapped, multi-family housing, nursing homes, urban renewal rehabilitation, and swimming pools. A separate set of standards was established to guide the developers of public housing and other federally sponsored low-income housing. These space standards were not the same as the MPS for property covered by mortgage insurance.

The Housing and Urban Development Act of 1968 called for improved architectural design in federal housing programs. As a result of this, revised standards were developed by the U. S. Department of Housing and Urban Development (HUD). A review draft document entitled <u>Design and Construction Standards: Housing</u> (HUD, 1969) was written in response to this decree. The document declared that HUD's design and construction activities should result in environments that have an uplifting effect on people's lives. The specific purposes of the standards were to combine previous standards for private (FHA) and public housing; to develop standards based on performance criteria; and to encourage design and technological innovations that would improve the quality or reduce the cost of housing (HUD, 1969).

The Design and Construction Standards included guidelines for site design, building design, unit design, and construction. The section on unit design listed the activities and furniture requirements for living, dining, kitchen, laundry, bedroom, and bathroom areas. Clearances for furniture use were indicated and floor plan diagrams illustrated room arrangements that incorporated these furniture pieces and clearances. The section on unit design was almost identical to the evaluation criteria established for Operation Breakthrough in 1970 (Pfrang, 1970). Both documents cited the same thirteen references including: Circular Series (Small Homes Council, no date); Design Criteria for Space in Dwellings (Small Homes Council, 1953); Space Standards for Household Activities (McCullough et al., 1962); and Household Storage Study (Federal Housing Administration, 1963).

In 1973 the Minimum Property Standards were revised and the various standards were combined into three volumes that included single-family housing, multi-family housing, and care-type facilities. There were no longer separate standards for low-income public housing. A Manual of Acceptable Practices (MAP) accompanied these three volumes. It was a supplementary document that provided information to aid in the use and interpretation of the mandatory MPS (HUD, 1973). According to the MPS the general guide for building design is that the unit should:

> provide for a safe, secure, healthful, and attractive living facility and environment suited to the needs of family life and individual family members. It shall provide for ease of circulation and housekeeping; visual and auditory privacy; appropriate light and ventilation; fire and accident protection; economy in maintenance and use of space; accessory services, and sanitation facilities. (HUD. 1979, p. 4-1)

The _Minimum Property Standards for One- and Two-Family Dwellings_ and the MAP had content similar to the previously issued draft _Design and Construction Standards: Housing_. For example, the MPS also identified activities and furniture requirements for different living areas and furniture clearances and floor plan diagrams were in the MAP. However, there were several differences in the two standards. The MPS identified minimum square footage requirements for living areas, dining areas, and bedrooms based on the number of bedrooms in the dwelling unit. The _Design and Construction Standards_ did not recommend specific room sizes. Some of the other differences between the MPS and the _Design and Construction Standards_ that reduced the recommended room sizes in the MPS included: the elimination of studying, reading, clothes storage, and housekeeping as activities performed in the bedroom; the elimination of a table in the furniture list for the primary bedroom; the elimination of a desk or storage chest from the furniture list for the secondary bedroom; the ability to combine kitchen counter areas without adding 6" to the total counter frontage; the ability to continue counter areas around corners without considering a minimum frontage on both sides.

Housing research and the MPS. It is evident that the Design and Construction Standards, which have a basis in research, were instrumental in formulating the content of the 1973 revision of the MPS. However, changes were made in the space standards cited in the two documents that resulted in the MPS being less liberal than the Design and Construction Standards. This reduction in space requirements for certain areas discredits the idea that the MPS were based on the research of actual user needs and research references to justify space and planning standards were not cited in the MPS.

Stubbs and Pike (1980) reviewed the Cooperative Agricultural Experiment Station regional research publications that examined space requirements and suggested room size requirements based on the findings of these studies. Space requirements for the living area, dining area, and for three bedrooms as suggested in their article and in the MPS are presented in Table 1. The dining area is the only area where the "moderate" space is less than the "minimum space requirements of the MPS.

Morris and Winter (1978) examined a variety of space standards and were critical of the usefulness of the standards established in the MPS. They recognized that the MPS have dictated the size of millions of dwellings in the United States, but they questioned how clearly the MPS reflect the cultural norms of this society. They believed that families react more to the number of rooms of various types and have only a vague idea of actual room size standards. A deficient number of rooms is more likely to cause a housing adjustment than a sufficient number of rooms each of a deficient size.

The fit between the design recommendations of the MPS and actual user needs was examined by Zeisel and Welsh (1981) who categorized the findings of several environment-behavior research studies and applied them to the MPS and the MAP. In many instances Zeisel and Welsh indicated that the MPS and the MAP did not accurately describe activities that were occurring in certain rooms. For example, the MPS described the bedroom as a space devoted to sleeping, dressing, and personal care. According to Zeisel and Welsh, some larger families also

Table 1

Space Requirements for a Three Bedroom Living Unit as Presented by Stubbs and Pike* and by the Minimum Property Standards

Room	Stubbs & Pike	MPS
Living area	196	170
Dining area	80	95
Bedroom (master or primary)	143	120
Bedroom (secondary)	122	80
Bedroom (tertiary)	102	80

*Stubbs and Pike designated their space requirements as adequate space for a moderate size house with a standard family unit of 4 (Stubbs and Pike, 1980, p. 81).

used the bedrooms as children's play or study areas. The activities of the living area were more varied than the MPS indicated and, in fact, many families enjoyed a second informal living area which the MPS did not recognize. The MPS also encouraged combined living areas because this reduces the square footage required for these areas. The way in which the MPS presented the space requirements placed the incentive first on combining living, dining, and kitchen areas, second, on combining living and dining areas, and last, on combining dining and kitchen areas. Research has indicated that families often use an eating area in a kitchen as an area for informal activities; therefore, this combination should have had a higher priority than the MPS gave it. Zeisel and Welsh also noted that although the MPS emphasized the need for space to adequately house basic pieces of furniture, the need for flexibility had not been considered. They noted that a room should be designed so that the occupant can rearrrange furniture and furnish it for different uses.

<u>Policy and industry views of the MPS</u>. A different perspective of the problems of the MPS has been presented by a variety of government policy and building industry groups. The 1978 Task Force on Housing Costs found that there was a widespread belief that the MPS design requirements were excessive or inflexible. "A housing

unit which is structurally and mechanically sound and which conserves energy, can be more basic in terms of space and amenities than current MPS allow" (HUD, 1978, p. 40). The Task Force recommended that the MPS be revised to allow more flexible design and construction techniques.

The Task Force was also critical of the differences and conflicts between the MPS and the model building codes. Although HUD officials have disclaimed that the MPS is a building code, it has been adopted as such in some jurisdictions and is in conflict with model codes in the jurisdictions that have adopted these codes. The Task Force recommended that the MPS be revised so that it would be consistent with the <u>One and Two Family Dwelling Code</u> and with requirements of a multifamily dwelling code that has not been developed (HUD, 1978).

The <u>One and Two Family Dwelling Code</u> (1975) is published by and is in agreement with the following nationally recognized associations: Basic Building Code - Building Officials and Code Administrators; National Building Code - American Insurance Association; Standard Building Code - Southern Building Code Congress International; Uniform Building Code - International Conference of Building Officials. Specific design criteria can be found under the following headings in the building design chapter of the One and Two Family Dwelling Code (1975): location on lot, light and ventilation, room sizes, ceiling heights, sanitation, toilet, bath and shower compartments, glazing, private garages, exits, doors and hallways, landings, stairways, handrails and guardrails, and smoke detectors.

The Reagan Administration's emphasis on government deregulation of private industries has been influential in justifying revisions to the MPS for One- and Two-Family Dwellings. Both the Regulatory Analysis Review Group of the Council of Wage and Price Stability and the Presidential Task Force on Regulatory Relief suggested that extensive changes in the MPS may be warranted since there are other government programs and market forces (such as building codes and homebuilders' warranties) that may achieve the same purposes as the MPS (HUD, 1982). The National Institute of Building Sciences (NIBS) has gone one step further suggesting that HUD should phase out the MPS and rely only on the nationally recognized building codes and the state and/or local authorities that enforce them (HUD, 1982). The President's Commission on Housing has also recommended elimination of the MPS and suggested that in the absence of a locally enforced building code, the One and Two Family Dwelling Code should be used (HUD, 1982).

<u>1982 revisions to the MPS</u>. The Department of Housing and Urban Development is currently in the process of preparing a proposed rule that would replace the MPS with reliance upon local building codes. Pending adoption of that recommendation, HUD has issued revisions to the <u>MPS for One- and Two-Family Dwellings</u>. The intent of the revisions were:

> (1) to incorporate appropriate portions of the current Model One- and Two-Family Dwelling code, (2) remove criteria that do not bear directly on health, life safety, legislative requirements or durability (i.e. remove "livability" and "marketability" criteria), and (3) reduce the bulk of the standards and update and relocate criteria as appropriate. (HUD, 1982, p.34335).

The revisions remove many of the livability and marketability criteria that were presented in Chapters 3 and 4 of the MPS. These chapters were related to site and building design. The building design changes include the removal of the following: provisions of bathroom accessories; room sizes (except kitchens); ceiling heights; provisions of bedroom, coat, linen and general storage closets; bedroom to bathroom access without passage through other habitable rooms; dimensions of doors, halls, and stairs; and artificial and natural lighting requirements (HUD, 1982).

The Valuation Analysis used in the underwriting process will continue to weigh the marketability and livability criteria that have been eliminated from the _MPS for One- and Two-Family Dwellings_ (HUD, 1982). The MPS are used to determine if a property is acceptable for mortgage insurance, but it is the underwriting process that determines the amount of the insured mortgage. According to personnel in the Construction Standards Division at HUD (1983), the determination of livability and marketability is based on the judgement of the evaluators in the district offices and there are no written guidelines to assist in making this judgement.

Some of the livability and marketability criteria are also health and safety criteria, such as requirements for hall, door, room, and stair size and natural and artificial light.

> The Department [of Housing and Urban Development] recognizes the health and safety aspects of these standards but believes that these design features are sufficiently obvious to the prospective homeowner to permit reliance upon informed consumer choice (HUD, 1982, p. 34335).

The criteria for many of these features is presented in the _One and Two Family Dwelling Code_, though the revisions to the MPS do not specify that the code must be adhered to in regard to these criteria. However, if a model code is in effect in a state or locality these criteria for building design would be in effect.

The 1982 revisions to the _Minimum Property Standards for One- and Two-Family Dwellings_ respond to many of the criticisms directed toward the standards resulting in less conflict between MPS and nationally recognized building codes. By eliminating most of the building design requirements, there is freedom to design unusual and innovative structures that do not conform to the previously established standards. There is also the freedom to design and build structures that have space and design features below the previous minimum standards. Zeisel and Welsh (1981) noted that several previous minimum standards did not meet housing design recommendations made by behavioral science researchers. By relying on consumer choice and evaluators' judgements to assure housing livability and marketability, HUD has removed official sanctions on single-family housing design. The impact of this decision on housing design has not been determined.

Guidelines in Post-Occupancy Studies

In only a few post-occupancy studies have design guidelines or standards been used as a means to evaluate residential structures. Design guidelines for housing the elderly were used by Lawton and Nahemow (1979) to determine if specific features were present in federally funded housing complexes for the elderly. Francescato, Weideman, Anderson, and Chenoweth (1979) used a Site Information Measure and a Physical Attributes Recording System to record information about the physical measurements and characteristics of the residential structures under study. Both of these checklists were used in conjunction with other methodologies. They were primarily used by researchers who observed the dwelling of the interviewees. The information was used to support data obtained through other sources. Most of the standards and guidelines in the literature are used by builders and inspectors prior to and during construction and by consumers prior to the construction or purchase of a dwelling.

Housing Satisfaction

Housing satisfaction has been explored in many research studies. It has been used as a predictor of future housing decisions and as an evaluation measurement of current housing conditions. Housing satisfaction has been defined in several ways. Lindamood (1980) described housing satisfaction as a subjective measure of the quality of the housing unit. It is one means of determining how well housing is serving residents and it elicits input from the residents on how well the unit is fulfilling perceived needs. McCray and Day (1977) stated that housing satisfaction "refers to the amount of contentment experienced by an individual or family relative to [the] current housing situation" (p.245). Morris and Winter (1978) also defined housing satisfaction in terms of the level of contentment associated with current housing conditions.

Measurements of Housing Satisfaction

Several different techniques for measuring housing satisfaction have been used by various researchers. These techniques have been used alone or in combination depending on the objectives of the study. In one method, one overall question was used to assess this factor. Typically the respondent was asked how satisfied he was with his housing and responded on a four-point scale from very satisfied to very dissatisfied (Barr, 1975; Bross, 1975). A general question of this nature has tended to underreport satisfaction and it has not given any indication of the factors that might have been the sources of dissatisfaction or satisfaction (Morris & Winter, 1978).

Specific feedback on the causes of satisfaction and dissatisfaction was sought by a second method that asked respondents to list the "most liked" and "least liked" features of their housing. Degmore, Feldman, Hilton, Love, and Shearer (1979) used this method in a post-occupancy study of Phipps Plaza West, an apartment complex in New York. The researchers categorized responses from 52 residents to questions about the best and least liked aspects of living in the apartment units. These categories were: apartment layout, angled walls, space and size, balcony, view, window features, light from windows, noise level, kitchen features, bathrooms, closet space, wood floors, maintenance, monetary issues, heating units, and feelings about oneself. Similar categories were developed for items so that information about what residents liked most and least about living in the housing complex could be determined.

In post-occupancy studies housing satisfaction has been used as a measure of the fit between the housing design and the user's needs. A series of specific questions related to different housing features has been used to evaluate residents' responses. Becker (1974) used a self-administered questionnaire and personal interviews to obtain information related to the housing satisfaction of 989 residents living in seven New York Urban Development Corporation housing complexes. The respondents to the questionnaire evaluated housing features by determining if the features were excellent, satisfactory, in need of minor improvement, or in need of major improvement. The residents were asked about 49 different aspects of housing, including items about the individual unit, the complex facilities, and the neighborhood. Interview items probed for further information concerned with these same areas. The data were presented in frequency tables showing the percentage of respondents satisfied with each feature. Each feature was comprehensively evaluated and design recommendations were made based on the residents' ratings, their interview comments, and on observations of the complexes.

Housing satisfaction scales. A housing satisfaction scale or index has been another technique used by researchers to assess residents' overall satisfaction with their housing. Respondents usually ranked their satisfaction with a series of housing features and their scores on the items were added together to form a total housing satisfaction score. Many of these scales or indices have been tried in order to reduce the data into common components, which were then used as variables in theory-oriented research.

Rossi (1955) used indices to identify components that were sources of residential dissatisfaction. Respondents were asked if they were satisfied, dissatisfied, or indifferent to fourteen housing and neighborhood conditions. Six Complaint Indexes were developed from these items. Conditions that were highly intercorrelated were grouped together in the indices. The six indices were: (1) dwelling unit space, (2) utilities, (3) physical environment, (4) social environment, (5) distance, and (6) housing costs. Rossi related the Complaint Indexes to residential mobility and the propensity to move.

Stewart and McKown (1977) used a similar procedure to develop five scales of housing satisfaction. In their study, housing satisfaction was a measure of the adequacy of the respondent's present housing for meeting the family's housing needs. Respondents rated 24 housing characteristics on a scale of one to nine with one indicating that the characteristic was not at all like the family wanted and nine indicating that it was just like the family wanted. The five scales were developed based on the correlations of the items. The scales were: (1) space and arrangement; (2) type, structural quality, and appearance; (3) storage and outdoor space; (4) housing/utility costs and services; and (5) location, fire and police protection. Stewart and McKown used the scales to predict desire to move and viewed housing satisfaction as an intervening variable acting between family and housing characteristics and the propensity to move.

Francescato et al. (1979) also used indices to identify different components of housing satisfaction. The researchers obtained information from 1907 residents in 37 multifamily federally assisted housing complexes. Principal component analysis was used to reduce the number of variables by grouping them into common factors. These components were used to explain and predict the residents' satisfaction with the units. Overall satisfaction with "living there" was determined by a general question that asked respondents to rate their satisfaction on a five-point scale. The components that explained the most variance in satisfaction were perceived economic value, appearance, and neighbors.

Specific housing satisfaction scales. The use of a specific satisfaction scale has been another technique that has been used in housing research. Rather than derive factors or components from a series of satisfaction items, all items on the scale relate to one component. This technique has been used in a manner similar to the housing satisfaction scales or indices, but it permits the researcher to concentrate on only one aspect of housing satisfaction.

Yockey (1976) used a housing space satisfaction scale that included the following items: satisfaction with total number of rooms, and satisfaction with total number of bedrooms, satisfaction with the size of bedrooms. She also asked an overall housing satisfaction question. Each item was rated on a four-point scale. Yockey used the scale to investigate the relationship between space norms and space satisfaction among 455 Fort Dodge, Iowa, households. She found no relationship between overall satisfaction and the lack of normatively prescribed bedroom space for low-income families, though there were relationships present for higher income families. The relationships between specific space satisfaction items and the presence of bedroom deficits were stronger than the relationship between overall satisfaction and these deficits.

Harris (1976) compared the housing quality and satisfaction with housing quality among 455 Fort Dodge, Iowa, households. The scale for satisfaction with housing quality was developed by combining items about satisfaction with floor plan, physical condition of the house, house comfort, house style, house image, landscape, and number of bathrooms. An overall housing satisfaction item was also used. Each item was rated on a four-point scale. Harris found that housing quality did affect overall satisfaction and housing quality satisfaction, but it was only a small component of overall satisfaction.

Problems in Assessing Housing Satisfaction

One criticism with the practice of combining items into scales has been that this method assumes that each item is equally important to the respondent in determining his satisfaction or dissatisfaction (Lindamood, 1980). The use of a weighted satisfaction measure allows the respondent to indicate which factors are important as well as indicating the level of satisfaction. Morris (1976) developed an overall measure of satisfaction that included quality, quantity, ownership, and structure-type satisfactions. In this study and the Harris (1976) and Yockey (1976) studies a set of paired items were used. A question about satisfaction with a characteristic was paired with a question on the respondent's assessment of its importance to the family. A four-point rating scale for both satisfaction and importance was used in all of these studies.

Goss (1982) adapted the Morris (1976) method of weighting satisfaction ratings with a measure of importance. She used a six-point rating scale for both factors and combined them into a Satisfaction-Importance Scale. She explored the housing conditions, aspirations, and satisfactions of 438 Appalachian coal miners in McDowell County, West Virginia, and used the

Satisfaction-Importance Scale to examine the miners' satisfaction with seven community variables and nine dwelling variables. A housing satisfaction index was created from the weighted scores of these combined items and was used to determine the relationship between housing satisfaction and several demographic variables and housing characteristics.

Several other criticisms have been made regarding the use of a measure of residents' satisfaction with their housing. Lindamood (1980) reported that there may be a problem with the accuracy of reporting satisfaction. She remarked that it is culturally "better" to be satisfied and not to be a complainer. Morris and Winter (1978) stated that it is reasonable to assume that respondents are able to accurately report their feelings of satisfaction with their housing. An exception might be the ability to report extreme levels of dissatisfaction. Yockey (1976) found that feelings of apathy or powerlessness may have reduced some low-income families' sensitivity to deficits and therefore reduced their tendency to be dissatisfied.

Housing Satisfaction in Theory

It is evident from the above discussion that satisfaction with housing has been measured in many different ways and that it has been used in various types of analyses. It has been viewed as a dependent variable, as an independent variable, and as an intervening variable. In post-occupancy studies housing satisfaction has been viewed as an indication of how well a design has met the needs of the users and researchers have attempted to discover the causes of satisfaction. In other types of research, housing satisfaction has been used as a predictor of residents' propensity to move or alter their housing. More complex models of housing adjustment behavior have viewed housing satisfaction as a response to housing deficits which in turn affect residents' propensity to move or to alter their dwellings.

Morris and Winter (1978) have developed a theoretical model to explain housing adjustment behavior. According to this theory, families consciously evaluate their housing and neighborhood conditions against specific criteria that are established through cultural norms. Normative standards have been set related to space, tenure (own or rent), quality, expenditures, structure type, and neighborhood. Deficits exist when there is a gap between the actual housing conditions of the family and their normative standards. Certain demographic and socioeconomic characteristics have been found to be predictors of these deficits. These include stage in the family life cycle, income, occupation, education, and family structure. When there are deficits present the familymembers become dissatisfied and reduced satisfaction causes them to move to a new dwelling, to alter the one in which they currently live, or to make family adjustments. This would presumably bring the family's housing more closely in line with their norms. Families with constraints to the achievement of these norms must adapt the family by lowering expectations or by actually altering their family composition. In the housing adjustment theory, satisfaction is a measure of how well housing meets the family's expectations of normative housing. It is also a predictor of the family's propensity to alter their dwelling or to move. Stewart and McKown (1977), Harris (1976), Yockey (1976), and numerous other authors have supported this theoretical model of satisfaction and housing adjustment behavior.

Housing Alterations

Residential alterations and additions have been defined as increases in the amount of space or number of rooms in a dwelling and improvements in the quality of the dwelling (Morris & Winter, 1978). In the housing adjustment theory, housing alterations and additions are viewed as responses to residents' dissatisfaction with their housing. In this theory, residents who perceive deficits in their housing are dissatisfied and their dissatisfaction leads them to move or alter their housing or adapt their family's expectation or structure. Moving offers the family the opportunity to overcome several housing deficits. They can change their tenure, structure type, neighborhood, space, and quality. Altering housing is a more limited alternative for it can only be used in overcoming space and quality deficits (Morris & Winter, 1978).

Morris and Winter (1978) reported that research related to housing alterations showed a weak relationship or no relationship between satisfaction and plans to alter. They suggested that there may be a curvilinear relationship between the two variables. Residents who are dissatisfied with their dwelling may make home improvements to either overcome a deficit or to improve the resale value of the house. Persons who are satisfied with their housing may also want to make home improvements because of their love of the dwelling and the desire to see it improved.

Summary of Applicable Methods

Most post-occupancy studies have been evaluation or design-oriented studies. They have been limited to a particular setting and have been sponsored by a client or performed by the designer to determine what aspects of the design have been successful and what aspects need to be improved in the next design. This type of research is applicable to the investigation of prototypical housing that is innovative and possibly in need of revision so that it will be acceptable to the general public.

Researchers conducting post-occupancy studies are capable of making a contribution to theory and actually testing theory under certain conditions. By planning the study to collect appropriate information and analyzing it statistically, the researcher performing design-oriented studies can provide insights into theoretical issues.

Although the use of house plan evaluations has not been common in post-occupancy evaluation studies, they have been used in programming or pre-construction evaluations by designers, builders, financiers, and consumers. Many of the guidelines developed through research and residential design standards have been based on the study of man-environment relations and the fulfillment of users' needs in housing design. These standards and guidelines have impacted the design of residential spaces and have affected residents' expectations for housing.

Residents' satisfaction with various aspects of their housing has been an important component of post-occupancy studies. Satisfaction has been measured in several different ways, but the use of a weighted score that combines satisfaction and importance (Morris, 1976; Goss, 1982) seems most accurate and encompassing. Housing satisfaction is an important concept in Morris and Winter's (1978) housing adjustment theory because it is a measure of how well the family's expectations of normative housing is being met. It is also a predictor of the family's propensity to alter their dwelling or to move. Altering housing to bring the dwelling in line with the family's expectation of normative housing is also an important concept in the housing adjustment theory. Very little research has been conducted to explore the relationship of past alterations on housing satisfaction or the role that housing alterations may play in the family's evaluation of the dwelling unit.

CHAPTER III

BACKGROUND INFORMATION ON THE BENCHMARK AND SOLAR ATTIC HOUSES

The evaluation of prototypical houses developed by researchers involved in the S-141 Southern Regional Housing Research Project was proposed in the project outline (S-141 Cooperative Regional Project Outline, 1979). Primary emphasis in past research has been on the building cost and energy efficiency of the units. The authors of the project outline suggested that researchers would evaluate the structures using social, behavioral, psychological, and aesthetic criteria. An evaluation of this type could provide information about the livability of these structures. Zornig (1976) called for the evaluation of prototypical housing designs and suggested that prototypes be compared with a specific conventional house. The S-141 project outline specified that a comparison should be made between the prototypical Solar Attic house and the conventionally built Farmers Home Administration Benchmark house. In this chapter, the physical characteristics of the two house types will be described and research related to the Benchmark and Solar Attic houses will be reviewed.

Benchmark House

Description

The Farmers Home Administration house plan no. H5-41 was designated as the Benchmark house by the S-141 Technical Committee in March 1982 (S-141 Objective "A" Subcommittee, 1982). Prior to that time, the plan or similar plans had been used as a "yardstick" house for one survey and for determining structural and mechanical material calculations (S-141 Technical Committee "A" Subcommittee Report, 1982; Zornig, 1976). The house was designated as a benchmark because its size and design were typical of low-to-moderate priced housing and because it was built throughout the United States in nonmetropolitan areas (Fish, 1978).

The house plan (Appendix A) is 40' x 24' and includes an L-shaped living-dining area, a corridor kitchen, three bedrooms, one bath, a utility alcove, and seven closets. FmHA provided plans of this house that indicated it could be built on foundation (H5-41), over a basement (H5-41a), and on slab (H5-41b). The floor plan for H5-41a was slightly different from the H5-41 plan in that the utility closet and hall storage were eliminated and the bathroom was rearranged to allow room for stairs to the basement. The H5-41 plan was approved for financing by the FmHA under the Section 502 program established by the Housing Act of 1949. It was available to prospective borrowers and builders from 1968 to 1973. Plans similar to it have been adapted by builders and used since 1973.

Review of Research

VanDongen and Fish (1978) investigated the satisfaction of owners of Benchmark houses in Maryland. Most of these houses had the H5-41a house plan. The plan had been designated by the S-95 Southern Regional Housing Research Technical Committee as the "yardstick" house that would be used by the researchers to compare future housing prototypes (Zornig, 1976). The researchers used the interview schedule developed for the S-95 study, "Quality Housing Environments for Low-Income Families," and interviewed 173 families. The information from this study was to be used in the evaluation of the prototypical houses (S-141 Cooperative Regional Project Outline, 1979). However, the information obtained in the study was not developed into evaluation criteria.

VanDongen and Fish (1978) found that the homes were of sound construction and had complete electricity, heat, and plumbing. The residents of these houses were satisfied with the location of their houses because they lived in quiet settings that were private and near relatives. They were satisfied with the actual dwelling unit because of the cost, ease in caring for the unit, number of rooms, and its comfort and privacy. The only major change that was desired by the residents was to build an addition to the house. Leaky basements and decaying door and window frames were the only major defects in the houses. The structures had been new when the residents had moved in and they estimated that the value of their houses had appreciated by $10,000.

Fish (1978) compared the Maryland Benchmark houses with a national sample of rural nonfarm houses on physical conditions and crowding. The national sample was based on a study conducted by Goedart and Goodman (1977). The two studies had comparable information on ten indicators of physical deficiencies. The incidence of physical deficiencies in the Benchmark houses was lower than that of the national sample of households at the same income level except for cracks or holes in the walls, ceilings, or floor coverings, and the lack of air conditioning. Only 6.5 percent of the Benchmark residents with incomes below twice the poverty level experienced crowding as measured by more than 1.01 persons per room. For this same segment in the national sample, crowding was experienced by 12 percent. For those in the national sample with incomes below the poverty level, 18 percent experienced crowding.

In this study Fish also examined the housing cost of the Benchmark residents. According to the Birch (1973), households spending more than 25 percent of their incomes on housing are depriving themselves of other necessities. Seventy-eight percent of the Benchmark residents with incomes below twice the poverty level were paying more than 25 percent of their income for housing. For those with incomes two to four times the poverty level, 26 percent were paying 25 percent of their income for housing. Comparable information was not presented for the national rural nonfarm sample.

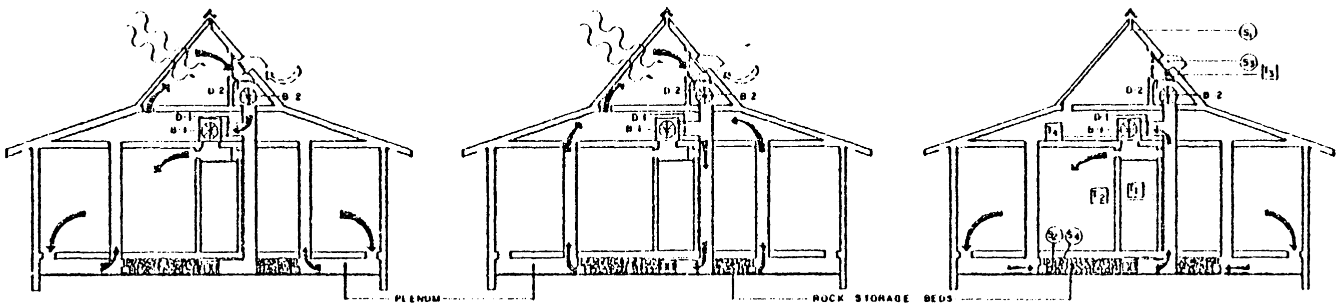
Fish (1981) completed further analysis of the Maryland FmHA homes by comparing their structural quality to other FmHA financed homes in the Southern region. She also compared the quality of the regional sample of FmHA financed homes with a regional sample of non-FmHA financed homes that were of similar size and tenure. This information was available as part of the S-95 study. The quality factors included residents' reports of the presence or absence of leaky roofs; cracks in the walls and ceilings; minor and major decay of door frames, window frames, porches, and outside steps; broken or missing materials in the outer walls or foundations; uneven outside steps; uneven floors; sags or bulges in the walls or ceilings; peeling paint on the inside and outside walls; broken or missing window panes; rodent or insect damage; and water problems in the last six months. The chi-square test for significant differences in the percentages of deficiencies between the FmHA financed homes and non-FmHA financed homes in the Southern region indicated that the FmHA financed homes had more rodent or insect damage, but were not significantly different on any other quality factor. However, the Maryland sample of FmHA financed homes had significantly more deficiencies on five of the quality factors when compared to the non-FmHA financed homes in the South and on five of the quality factors when compared to the regional sample of FmHA financed homes. Fish concluded that the quality factor deficiencies in the Maryland sample were related to construction materials and/or processes. She also noted that the FmHA program requirements resulted in approximately the same income dispersion in all states; therefore income differences would not be present in the Maryland and Southern region samples of FmHA financed homes and would not account for the differences in deficiencies on quality factors between the two groups.

Solar Attic House

Description

The Solar Attic heating and cooling system was designed by researchers at the Rural Housing Research Unit (RHRU) at Clemson, South Carolina. The system was adaptable to many house plans, however the Cooperative Extension Plan Service Experimental Plan no. 7220 was designated as the Solar Attic house for the purposes of this study. The design of the plan was influenced by the previous study of the Benchmark house (Fish, 1978). The overall size of the Solar Attic house was made larger than the Benchmark house and a garage and outdoor storage were added to the plan.

The solar attic system as designed by RHRU used an insulated attic area with glass roofing on the south as a solar collector. The heat absorber in the attic was plywood painted black. The heat gained in the attic area was transferred directly to the interior of the house or to rock storage beneath the house where it was stored for later use (Figure 1). An air distribution fan circulated the heated air from the attic or from the rock storage to the entire house. The original system was designed so that it could be used to cool the house during the summer



HEATING - ATTIC TO HOUSE
COOLING - OUTSIDE AIR TO HOUSE (OPTIONAL)

HEATING - ATTIC TO STORAGE
COOLING - OUTSIDE AIR TO STORAGE (OPTIONAL)

HEATING - STORAGE TO HOUSE/CONVENTIONAL FORCED AIR HEATING
COOLING - STORAGE TO HOUSE/CONVENTIONAL FORCED AIR COOLING

AIR FLOW DIAGRAMS FOR SIX OPERATING MODES & CONTROL LOCATIONS

T_1 AND T_2 - 24V HEATING-COOLING THERMOSTATS, HEAT-OFF-COOL SELECTION

HONEYWELL - T87F AND Q539A SUBBASE
DAYTON - 2E186 AND 2E191 SUBBASE
PENN CONTROLS - T 51ACU-1 AND Y 51C0-1 SUBBASE
WHITE ROGERS - 1F 56-310 AND 520-1 SUBBASE

T_3 - TWO SPEED BLOWER THERMOSTAT, SPDT LINE VOLTAGE, 1/2 HP RATED. SET FOR 100°F, 2° TO 7°F DIFFERENTIAL AMBIENT TEMPERATURE RANGE UP TO 150°F.

PENN CONTROLS A19BAC-1
DAYTON - 2E216
HONEYWELL - T631C1103A

T_4 - FAN AND LIMIT CONTROL SUPPLIED WITH FURNACE. USE FURNACE MANUFACTURERS SUGGESTED SETTINGS.

DM 1 AND DM 2 - SPRING RETURN DAMPER MOTOR 2-POSITION (OPEN-CLOSE) POWER OPEN, SPRING RETURN. 115V CONTROL VOLTAGE.

BARBER COLMAN MA 405
HONEYWELL - M436A1116
PENN CONTROLS - M81ACB-1 & 24V TRANSFORMER

D_1 AND D2 DAMPERS 12" x 20" SPECIFY END AND BLADE SEALS, FULL OPEN & FULL CLOSED USE.

JOHNSON SERVICE CO. D-1300
AMERICAN WARMING & VENTILATING - DAA P-10
LOUVERS & DAMPERS, INC. - CD 500
SOLAR CONTROL CORP.

SDT-1 - DIFFERENTIAL THERMOSTAT AND SENSORS FOR WINTER SOLAR HEATING. SPECIFY 20°F TURN ON DIFFERENTIAL AND 5 1°F TURN OFF DIFFERENTIAL, RATED 1/2 HP 115 V
SOLAR CONTROL CORP.
RHO SIGMA
HELIO & ROFE GENERAL
DEKO LABS
SOLAR ENERGY RESEARCH CORP.

SDT 2 - DIFFERENTIAL THERMOSTAT AND SENSORS FOR SUMMER NOCTURNAL COOLING OF ROCK STORAGE. SPECIFY 5 1°F TURN ON DIFFERENTIAL AND 3 1°F TURN OFF DIFFERENTIAL, RATED 1/2 HP 115 V (OPTIONAL, PRIMARILY FOR DRY CLIMATE AREAS)
SOLAR ENERGY RESEARCH CORP.
RHO SIGMA
HELIO & ROFE GENERAL
DEKO LABS
SOLAR CONTROL CORP.

B 2 - COLLECTION BLOWER: 115V 60 CYCLE MULTI OR TWO SPEED, PERMANENT SPLIT CAPACITOR TYPE. THESE ARE 40% TO 50% MORE EFFICIENT THAN SHADED POLE MOTORS. LOW SPEED BLOWER OUTPUT 2 TO 3 CFM/FT² OF COLLECTOR SURFACE AT 3/8" INCHES WATER COLUMN. HIGH SPEED OUTPUT SHOULD BE 4 TO 5 CFM/FT² OF COLLECTOR SURFACE AT 3/8 INCHES WATER COLUMN. SIMILAR TO DAYTON 4C058.

B 1 - FURNACE BLOWER: 115V 60 CYCLE, ONE CFM/FT² OF FLOOR AREA, 1/2" WATER COLUMN. SUGGEST PERMANENT SPLIT CAPACITOR MOTOR.

TWO STANDARD HEAT COOL THERMOSTATS LOCATED IN HALLWAY CONTROL ELECTRIC FURNACE OR HEAT PUMP. T_1 - CONTROLLING BLOWER (B 1) IS SET AT 68°F WINTER & 75°F SUMMER. T_2 - CONTROLLING AUX HEAT OR COOL IS SET AT 65°F WINTER & 78°F SUMMER.

DAMPER MOTOR DM 1 IS ENERGIZED WHEN BLOWER (B 1) IS ON & OPENS DAMPER (D 1). BLOWER (B 1) IS TURNED OFF WHEN DAMPER MOTOR (DM 2) IS ENERGIZED. WHEN BOTH DAMPERS ARE OPEN COLLECTION BLOWER HEATS OR COOLS HOUSE.

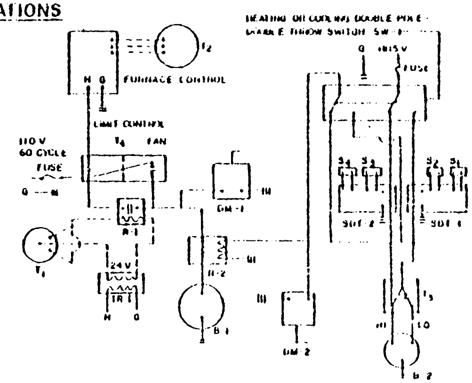
TWO DIFFERENTIAL THERMOSTATS CONTROL COLLECTION BLOWER (B 2). SDT-1 CONTROLS BLOWER DURING SOLAR HEAT CYCLE. SENSOR (S_1) IS LOCATED IN ATTIC NEAR RIDGE & SHADED. SENSOR (S_2) IS CENTERED IN ROCK ONE FOOT IN ON COOL SIDE. WHEN S_1 IS 15°F HOTTER THAN S2 BLOWER STARTS AT LOW SPEED. BLOWER 2-SPEED THERMOSTAT (T_3) SET AT 100°F FOR HI SPEED BLOWER OPERATION. SDT-2 CONTROLS BLOWER (B 2) DURING COOLING. SENSOR (S_3) IS LOCATED WITHIN ATTIC INTAKE VENT & (S_4) IS LOCATED NEAR (S_2) IN ROCK. WHEN S_3 IS 7°F COOLER THAN S_4 COLLECTION BLOWER (B_2) CIRCULATES COOL AIR THROUGH ROCK OR HOUSE. BOTH DIFFERENTIAL THERMOSTATS AND HEAT COOL SWITCH ARE LOCATED ON OR IN HOUSING FOR COLLECTION BLOWER.

MANUAL CHANGE OVER FROM SOLAR HEAT TO COOLING.

(1) OPEN RIDGE VENT.
(2) OPEN ROOF VENT TO BLOWER (B 2) & CLOSE OFF ATTIC TO BLOWER.
(3) SWITCH TO COOLING THERMOSTAT (SDT 2) WITH SWITCH SW 1.
(4) CHANGE BOTH HOUSE THERMOSTATS TO COOL.
(5) OPEN ALL SOFFIT VENTS.

TO CHANGE FROM COOLING TO SOLAR HEAT REVERSE ABOVE CHANGE OVER.

NOTE AUXILIARY FURNACE OR HEAT PUMP SHOULD BE SIZED BY LOCAL SUPPLIER.



SW 1 - ON OFF SWITCH, DPDT, RATED 1/2 HP AT 115 V.

R-1 - SPDT RELAY, 24V COIL, RATED 1/2 HP AT 115 V

R 2 - SPDT RELAY, 115 V COIL, RATED 1/2 HP AT 115 V

TR 1 - 24V TRANSFORMER

NOTE

MENTION OF PROPRIETARY ITEMS DOES NOT IMPLY USDA GUARANTEE OR WARRANTY AND IS NOT INTENDED TO EXCLUDE OTHER SUITABLE PRODUCTS.

COOPERATIVE EXTENSION WORK IN AGRICULTURE AND HOME ECONOMICS
STATE OF SOUTH CAROLINA
CLEMSON UNIVERSITY
AND
UNITED STATES DEPARTMENT OF AGRICULTURE COOPERATING

SOLAR HOUSE
EXPERIMENTAL

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Figure 1

months by circulating night air through the rock storage to provide thermal capacity for daytime cooling.

Two Solar Attic prototypes were built by the Rural Housing Research Unit, one in Clemson, South Carolina, and one in Athens, Georgia. Several houses with the solar attic system were built by local builders in other locations and were financed through the U.S. Department of Housing and Urban Development Cycle 1, 2, 3, and 4 Grant Programs. A house incorporating the solar attic system and built by Helio-thermics, Inc. in Greenville, South Carolina, received one of the First Passive Solar Home Awards presented by the U.S. Department of Housing and Urban Development in 1979 (Franklin Research Center, 1979). Helio-thermics, Inc. was the company that built the original solar attic system for RHRU (Zornig, Godbey and Bond, 1976). The system has been marketed commercially by several firms and has been publicized at the 1982 Worlds Fair and in popular publications, such as Mother Earth News ("Helio-thermics," 1976), Popular Science (Stepler, 1979), and House Beautiful Building Manual ("Build It Yourself," 1983).

The house plan (Appendix A) is 52' x 28' and includes a living-dining area, a U-shaped kitchen, entrance hall with airlock entry, three bedrooms, one bathroom with laundry facilities, five closets, and a single car garage with storage space. Alternate plans with the same square footage and number of rooms were available from the developers.

Review of Research

The Solar Attic house has been studied primarily by researchers who have been concerned with the energy savings of the unit and with the performance of the building materials and construction techniques used in actual structures. The first prototype of the solar attic system was designed by the Rural Housing Research Unit (RHRU) and was incorporated into a house built in Greenville, South Carolina, in 1975. The original system included an "insulated attic, unvented in winter and vented in summer, with translucent fiberglass roofing facing south" (Zornig et al., 1976). Painted black plywood served as the heat absorber in the attic collector and loose rock under the floor provided a heat sink for the excess collected solar energy. During the summer night air would be circulated through the rock storage to provide thermal capacity for daytime cooling. A distribution fan with motorized dampers and metal ducts provided eight different modes of operation. Zornig et al. (1976) reported on this installation and the data that were collected during part of the first year of operation. During a five day test period the solar collection efficiency ranged from 10 percent on cloudy days to 59 percent on clear days and it was estimated that the system would operate at an average 40 percent efficiency. The researchers also reported that about 10 percent of the total cost of the unit was due to the cost of the solar attic system and that the estimated cost of the solar energy for space heating was 6.7 cents/kWh.

A second solar attic prototype built in Athens, Georgia, was also designed by the Rural Housing Research Unit (Zornig and Godbey, 1980). Several changes were made in this unit that were not present in the first unit. These included the use of glass for the collector glazing, and different controls and air distribution fans. The RHRU researchers found that 10-20 percent more solar energy was transmitted through the glass glazing and the different controls and fans simplified the distribution system into three modes of operation. In the second prototype a solar water heater also was integrated into the attic collector area. The family living in the unit used 5,338 kWh during a 5-1/2 month period in the first year. They used an electric resistance heater during part of this time to raise the temperature of their house to 75 degrees Fahrenheit. Zornig and Godbey (1980) calculated that the average solar operating cost was about 30 cents per day (based on electric rates averaging 3-1/2 cents/kWh) if the house was heated to 70 degrees Fahrenheit and that the annual heating bill would be 85 percent less than it would be with the electric space heat alone.

Several houses with the solar attic system were built in other locations and were financed through the U.S. Department of Housing and Urban Development Cycle Grant programs. Through these programs a large number of solar demonstration projects were supported and have provided builders and developers with an opportunity to gain experience with solar installations (Real Estate Research Corporation, 1980). A market survey of a sample of houses built under Cycles 1, 2, and 3 provided information about the builders, the local government officials, and the purchasers involved with these solar homes. The typical purchasers of the solar homes in the South had a 36.3 year old head of household who had completed 16.6 years of schooling and was likely to be in a professional or managerial occupation (72%). The average household size of the southern sample was 2.8 and the average annual household income was $36,300. The solar home was liked or liked very much by 94 percent of the homeowners. Sixty-one percent of these purchasers were satisfied with their solar system. For those not satisfied with the system, the major complaints were lower than expected utility cost savings, poorer than expected temperature control, and frequent repair and service problems (Real Estate Research Corporation, 1980).

Summary

The development of a housing evaluation methodology and its use with the Benchmark and Solar Attic houses was included as an objective of the S-141 project outline. Both of these house types are small single-family units with three bedrooms and similar living and working areas. Past research has been focused on the quality of the Benchmark house structure and the energy efficiency of the Solar Attic house. There has not been any previous research that evaluated the design of the units or compared the two house types on livability features.

CHAPTER IV

OVERVIEW OF METHODOLOGY

The main objectives of the study were to develop and revise a methodology to evaluate single-family houses and to test this methodology by using it to assess a conventional house type and a prototypical house type. In order to accomplish these objectives, several separate investigations were conducted and have been organized into two phases (see Table 2). During Phase I two evaluation instruments were developed, analyzed for content validity, and revised. During Phase II the revised evaluation instruments were used in separate investigations in order to determine their reliability and to evaluate and compare the Benchmark and Solar Attic house types. The general procedures for these investigations are presented below. Specific procedures and findings are presented in Chapters 5, 6 and 7.

Phase I

Procedures

The Phase I investigations were completed in order to determine the content validity of the House Plan

Table 2

Phases in the Research Study

Instruments	Phase I Instrument Development	Phase II Testing of Instruments in Evaluation of House Types
	Phase I-A	Phase II-A
House Plan Evaluation Checklist	Developed by investigator Tested for content validity (questionnaire sent to first set of housing professionals) Revised by investigator	Mailed to third set of housing professionals Determined inter-rater reliability Compared house types
	Phase I-B	Phase II-B
Housing Satisfaction Scale	Developed by investigator Tested for content validity (questionnaire sent to second set of housing professionals Revised by invesitgator	Mailed to residents prior to interview Determined inter-rater and internal consistency reliability Compared house types Examined influences of demographic and housing characteristics
Housing Livability Interview Schedule		Developed by S-141 Committee Used with residents as part of interview Compared demographic and housing characteristics
House Plan Diagram		Developed by investigator Used with residents as part of interview Analyzed housing alterations

NOTE: Phase I completed prior to Phase II.

Evaluation Checklist and the Housing Satisfaction Scale which were developed by the investigator. Independent investigations were conducted by surveying housing professionals to determine the content validity of these instruments. For each investigation 40 randomly selected housing professionals contacted through a mailed questionnaire, were asked to rate on a scale of 0 (Should not be included) to 4 (Excellent) the appropriateness of each item on the particular instrument. Respondents were also asked to make comments about the items and to suggest new items.

Mean scores for the items were calculated and all items with mean scores of 2.5 or below were omitted from the revised instruments. The comments and suggestions were tabulated, categorized, and used as a basis for revising, expanding, combining, and/or adding items.

Scope of study. This phase of the study was based on the assumption that housing professionals were capable of judging the content validity of a house plan evaluation checklist and a housing satisfaction scale. The researcher also assumed that the professionals would be willing to participate in the study and would be able to understand the questionnaires. Their inability to do so would affect the interpretation of the findings. The items on the two instruments were related to the housing design of single-family residences. No hypotheses were tested or inferential statistical analyses were conducted in this phase of the study. The complete procedures and findings of the surveys and the revision process for both instruments are reported in Chapter 5, Sections A and B.

Phase II

During Phase II the two instruments that were developed in Phase I were used to collect data in order to determine the reliability of the instruments in actual use and to evaluate and compare the Benchmark and Solar Attic house types. The two instruments were used in separate investigations, but information that would assist in evaluating and comparing the Benchmark and Solar Attic house types was sought in both.

Phase II-A

Procedures. During the Phase II-A investigation, the House Plan Evaluation Checklist was used by a sample of housing professionals to evaluate the Benchmark and Solar Attic house plans. The investigation was undertaken so that the reliability of the instruments could be determined and so that the plans could be compared on the checklist items.

Two checklists and the Benchmark and Solar Attic house plans were mailed to 41 housing professionals who rated each plan on the checklist items. The items on the revised checklist were organized into ten subscales. The scores on the checklist were analyzed to determine the inter-rater reliability of the subscale ratings for each plan. Further analysis was undertaken to test the hypothesis stated below.

Scope of study. This phase of the study was based on the assumption that housing professionals were capable of evaluating house plans using a house plan evaluation checklist. The researcher also assumed that the professionals were willing to complete the evaluations and were able to understand the checklist and the floor plans. Their inability to do so would limit the interpretation of the findings. The professionals were asked to evaluate only the Benchmark and Solar Attic house plans, which should be considered when making generalizations about the use of the checklist with other house types.

Hypothesis. The following hypothesis was tested in this phase of the study:

Ho 1: There is no difference in the mean scores received by the Benchmark and Solar Attic house plans on the following subscales of the House Plan Evaluation Checklist:

a. Zoning
b. Circulation
c. Storage
d. Living Area
e. Dining Area
f. Kitchen
g. Bedrooms
h. Bathroom
i. Laundry
j. Service and Facilities

Plan of analysis. The paired samples t test procedure was used to compare the differences in the mean scores received by the two houses for each item and to test the hypothesis. The complete procedures and findings of this investigation are reported in Chapter 6.

Phase II-B

Procedures. During the Phase II-B investigation residents living in Benchmark and Solar Attic houses were interviewed so that users' responses to living in these two house types would be recorded. The instruments used in this phase of the study were the Housing Satisfaction Scale and the Housing Livability Interview Schedule, which was developed by S-141 Technical Committee members and based on an interview schedule used in Objective C of the S-141 project. The interview schedule also included a House Plan Diagram that permitted the interviewer to record the actual plan of the respondent's home. The investigation was undertaken so that the reliability of the Housing Satisfaction Scale could be determined, and so that residents' evaluations of the two house types could be determined, analyzed, and compared.

Benchmark and Solar Attic residents were identified in the following southern states: Georgia, Kentucky, North Carolina, Tennessee, Virginia, and West Virginia. First, the Solar Attic houses were identified through contacts with the Rural Housing Research Unit, the U.S. Department of Housing and Urban Development, builders, and suppliers of the solar attic system. Once these houses were located, Benchmark houses in the same geographic areas were identified through contacts with local builders and the state and local Farmers Home Administration offices. Residents were contacted by a letter that explained the research study and by a telephone call to arrange appointments. The Housing Satisfaction Scale was mailed to the residents and was retrieved by interviewers who completed the Housing Livability Interview Schedule with the residents and photographed the houses.

The responses of residents living in houses with identical house plans were used to determine the inter-rater reliability of the 15 subscale ratings on the Housing Satisfaction Scale. All responses were used to determine the internal consistency reliability of these subscales. Descriptive statistics were used to describe the housing and demographic characteristics of the samples. Inferential statistical analyses were undertaken to test the hypotheses.

Scope of study. This phase of the study was based on the following assumptions:

a. Housing satisfaction is determined by the extent to which a resident perceives that his or her housing needs are met. It is an indication of the fit between the house design and the users' needs.

b. Residents' satisfaction with their housing can be measured and the residents of the houses under study were able to analyze their housing satisfaction and were able to verbalize their satisfaction. Their inability to analyze or verbalize their satisfaction could affect the interpretation of the findings.

The study included 30 residents in Benchmark and Solar Attic houses in six southern states. These were single-family house types in a limited geographic area. The sample included available Solar Attic residents in the six states and selected Benchmark residents. These factors should be taken into account when considering the generalizability of the findings of this phase of the study.

Hypotheses. The following hypotheses were tested in this phase of the study:

Ho 2: There is no difference between the residents in Benchmark and Solar Attic houses on the following demographic characteristics:

a. household size
b. sex of household head
c. race
d. age of household head
e. stage in the family life cycle
f. years of education of household head
g. occupation of household head
h. household income

Ho 3: There is no difference in Benchmark and Solar Attic house types on the following housing characteristics:

a. age of dwelling
b. respondents length of residence
c. size of dwelling
d. relative amount of income spent on housing

Ho 4: There is no differnce in the Benchmark and Solar Attic houses on the following housing alterations:

a. number of past housing alterations
b. number of planned housing alterations, improvements, and repairs

Ho 5: There is no difference between the Benchmark and Solar Attic house types on the following energy characteristics:

a. amount of electricity used
b. the presence of energy saving features
c. changes to reduce utility costs

Ho 6: There is no difference between the Benchmark and Solar Attic house types on the following:

a. respondents' reasons for selecting their housing
b. respondents' overall housing satisfaction
c. respondents' desire to move

Ho 7: There is no difference in the mean scores the Benchmark and Solar Attic residents assigned to the following subscales of the Housing Satisfaction Scale:

a. Layout of Floor Plan
b. Storage
c. Living Areas
d. Dining
e. Kitchen
f. Bedrooms
g. Bathroom
h. Laundry
i. Appearance
j. Exterior
k. Systems
l. Structure and Materials
m. Costs

Ho 8: There is no difference in the mean Housing Satisfaction Scale scores of households:

a. in different locations
b. in different stages of the family life cycle
c. whose heads have different occupations

Ho 9: There is no relationship between the Housing Satisfaction Scale scores and:

a. household income
b. household size
c. years of education for household head
d. respondents' length of residence
e. relative amount of income spent on housing
f. amount of electricity used
g. age of dwelling
h. size of dwelling
i. number of past alterations
j. number of planned alterations, improvements, and repairs

Plan of analysis. The following analyses were performed to test these hypotheses:

Hypothesis 2. A Students *t* test was used to determine if there were significant differences in the means of residents in the Benchmark and Solar Attic houses regarding: household size, years of education of household head, and household income. The Fisher's Exact test (two-tailed) was used to determine if the residents differed significantly on sex, race, and occupation of household head. The chi-square test statistic was used to determine if the residents differed significantly in percentage distribution on the variable stage in the family life cycle.

Hypothesis 3. The Student's *t* test was used to determine if there were significant differences in the means of the two house types on the variables age of dwelling, respondents' length of residence, size of dwelling, and relative amount of income spent on housing.

Hypothesis 4. The Student's *t* test was used to determine if the mean number of past alterations and number of planned alterations, improvements, and repairs differed between the two house types.

Hypothesis 5. The Student's *t* test was used to determine if the mean amount of electricity used by the two house types was significantly different. The Fisher's Exact test was used to determine if the two house types differed significantly in the presence of energy saving features and in changes to reduce utility costs.

Hypothesis 6. Fisher's Exact test was used to determine if the respondents of the two house types differed in their reasons for selecting their houses and in their desire to move. The Student's *t* test was used to determine if the mean scores on the overall housing satisfaction variable differed significantly.

Hypothesis 7. The Student's *t* tests was used to determine if there were significant differences in the means of residents in the Benchmark and Solar Attic houses on the 15 subscales of the Housing Satisfaction Scale.

Hypothesis 8. The one-way analysis of variance was used to test the equality of Housing Satisfaction Scale mean scores regarding location of dwelling, stage in the family life cycle, and occupation of household head.

Hypothesis 9. The Pearson Product Moment Correlation was used to measure the association between housing satisfaction and household income, household size, education of household head, respondents' length of residence, relative amount of income paid for housing, amount of electricity used, age of dwelling, size of dwelling, and number of past and planned alterations. The correlations were tested for their significant difference from zero.

The complete procedures, description of the samples, and findings of the investigations are reported in Chapter 6.

CHAPTER V

PHASE I

DEVELOPMENT OF THE INSTRUMENTS AND TESTING FOR CONTENT VALIDITY

During Phase I the House Plan Evaluation Checklist and the Housing Satisfaction Scale were developed by the investigator, analyzed by housing professionals for content validity, and revised by the investigator. In the process of determining the content validity of an instrument, judges (other than the investigator) evaluated items on how well they represented the content universe of the concepts in the study. The independent judgements were pooled to assess the content validity of the instruments (Kerlinger, 1973). The judgements of housing professionals were used to determine the content validity of the items on the House Plan Evaluation Checklist and the items on the Housing Satisfaction Scale.

A. House Plan Evaluation Checklist

Description of the Instrument

The original items on the House Plan Evaluation Checklist were developed and compiled by the investigator based on a review of available published guidelines and standards. Once the checklist was revised, it was to be used by housing professionals to evaluate the livability of single-family house plans. The original checklist included architectural features and structural guidelines under the following headings: Zoning, Circulation, Storage, Living Area, Dining Area, Kitchen, Bedrooms, and Service and Facilities.

The items on the original House Plan Evaluation Checklist were incorporated into a questionnaire format that permitted housing professionals to rate each item (Appendix B). The instrument included: a description of the purpose and use of the House Plan Evaluation Checklist; a rating scale for the items on the original House Plan Evaluation Checklist; sections for suggesting item improvements; and a section for suggesting new items and making general comments. The following ratings were used to evaluate the appropriateness and quality of the items and to determine those items that were to be used on the revised House Plan Evaluation Checklist: 0--Should not be included, 1--Poor item, 2--Fair item, 3--Good item, 4--Excellent item.

Participants in the Study

A sample of housing professionals were selected from a complete list of state housing specialists in the Cooperative Extension Service (CES), and from a modified list of 1982 members of the American Association of Housing Educators (AAHE). Only AAHE members who identified an interest in family housing or interior design on their application form were included on the modified membership list. There were 111 AAHE members with such an interest and 97 CES housing specialists. Dissertation committee members and S-141 Technical Committee members were not eligible to participate. All persons with addresses outside the United States were deleted from the population. When all deletions were made and duplications were removed from the lists there was a total population of 189. Three-digit random numbers were generated on a Monroe calculator and the first 40 numbers between 001 and 189 constituted the sample of housing professionals in this phase of the study. Large sample sizes were not required in the phases of the research study that relied on the identified population of housing professionals because they represented a homogeneous group with similar interests in housing design and it was expected that there would be limited variability in their responses.

Procedure for Data Collection

Dillman's (1978) procedure for collecting data through mailed questionnaires was modified and used in Phase I-A. All housing professionals selected were mailed a copy of the instrument on July 1, 1982. A stamped, self-addressed envelope and a cover letter describing the study and requesting assistance accompanied the instrument. A postcard reminder was sent two weeks later. A third mailing that included a second copy of the instrument, a cover letter and an envelope was sent to all nonrespondents on July 27, 1982. A copy of the correspondence for this investigation is in Appendix C. Thirty-four of the 40 sample members returned the questionnaire by August 20, 1982. The rate of return was 85 percent.

Analyses of the Data and Revision of the Instrument

The House Plan Evaluation Checklist was revised on the basis of the selected professionals' rating of each item, their comments about each item, and their general suggestions and comments. The respondents' rating of each item was coded, transferred to computer cards, and verified for accuracy. The mean score and standard deviation was determined for each item (Table 3). The mean scores ranged from 2.06 to 3.88. It was anticipated that

Table 3

Mean Scores and Standard Deviations for
Content Validation of House Plan Evaluation Checklist

Variable Number	Number of Responses	Mean Score	Standard Deviation	Variable Number	Number of Responses	Mean Score	Standard Deviation
HPEC 1	33	3.45	0.90	HPEC 34	32	3.44	0.84
HPEC 2	32	3.19	1.06	HPEC 35	32	3.53	0.80
HPEC 3	34	3.24	0.99	HPEC 36	33	3.36	0.82
HPEC 4	34	2.94	1.20	HPEC 37	32	3.78	0.55
HPEC 5	34	2.94	1.20	HPEC 38	32	3.47	0.95
HPEC 6	32	3.22	1.13	HPEC 39	31	3.48	0.77
HPEC 7	33	3.33	0.96	HPEC 40	32	3.56	0.56
HPEC 8	33	3.39	0.79	HPEC 41	31	3.58	0.67
HPEC 9	34	2.88	1.07	HPEC 42	32	3.63	0.71
HPEC 10	32	2.94	1.13	HPEC 43	31	3.61	0.67
HPEC 11	32	2.69	1.15	HPEC 44	31	3.52	1.09
HPEC 12	34	*2.15	1.40	HPEC 45	31	3.71	0.64
HPEC 13	33	*2.48	1.46	HPEC 46	30	3.07	1.14
HPEC 14	34	2.94	1.35	HPEC 47	33	3.48	0.91
HPEC 15	34	3.64	0.95	HPEC 48	33	2.97	1.13
HPEC 16	33	3.62	0.49	HPEC 49	33	3.48	0.87
HPEC 17	34	3.65	0.60	HPEC 50	34	3.00	1.07
HPEC 18	34	3.44	0.93	HPEC 51	34	3.44	0.96
HPEC 19	34	3.59	0.86	HPEC 52	34	3.76	0.50
HPEC 20	33	3.30	0.98	HPEC 53	34	3.88	0.33
HPEC 21	33	3.52	0.83	HPEC 54	33	3.21	1.19
HPEC 22	34	3.32	0.88	HPEC 55	34	3.67	0.53
HPEC 23	33	3.09	1.16	HPEC 56	33	2.79	1.29
HPEC 24	34	3.26	0.75	HPEC 57	34	*2.05	1.43
HPEC 25	33	3.67	0.70	HPEC 58	32	3.31	1.00
HPEC 26	34	3.76	0.50	HPEC 59	34	3.85	0.36
HPEC 27	34	3.26	1.24	HPEC 60	34	3.56	0.66
HPEC 28	34	*2.32	1.36	HPEC 61	33	3.58	0.75
HPEC 29	33	3.48	1.00	HPEC 62	33	3.79	0.42
HPEC 30	33	2.94	1.34	HPEC 63	34	2.94	1.37
HPEC 31	32	3.25	0.84	HPEC 64	33	3.21	0.94
HPEC 32	32	3.88	0.34	HPEC 65	33	3.21	1.14
HPEC 33	31	3.35	1.02	HPEC 66	34	3.15	1.23

* Items with mean scores of 2.50 or below were eliminated from the revised checklist.

items with mean scores of 2.5 or below would be eliminated from a revised instrument. This would eliminate items rated "Poor" and "Fair" by the professionals. Four items on the original House PLan Evaluation Checklist had mean scores of 2.5 or below and were subsequently eliminated.

The comments made by the professionals about each item and about the checklist in general were useful in identifying items that could be combined and in determining new items that should be included. General comments and suggestions have been categorized and combined where possible and are in Appendix D.

Comments by the professionals prompted the following revisions in the House Plan Evaluation Checklist:

1. Three items were expanded into six items.
2. Two items were added.
3. Nine items were combined to form four items.
4. Twenty items were reworded.

The five items that were added or expanded were concerned with the bedroom and bathroom areas. Two items related to bedrooms were expanded to allow separate evaluation of the master bedroom and other bedrooms. One item under the Bathroom section was divided so that size of bathroom could be evaluated separately from arrangement of bathroom space. An item related to bathroom storage was added based on specific comments and in order to achieve a degree of consistency with the Housing Satisfaction Scale. An item related to the visual privacy of the bedroom-bathroom area was added to the checklist because it was suggested by several respondents.

The nine items that were combined on the checklist were based on specific item suggestions. Two items were combined to form one item about the separation of quiet and noisy areas of the house. Three items were combined to form an item about connections between front entry and living areas. A new item about space for furnishings in living areas was formed from combining two items and an item on kitchen work center flow was created from two items on the original checklist.

The major portion of the rewording involved changing the statements to exclude verb phrases and to eliminate the terms "adequate" and "minimum." These terms were frequently questioned in specific comments about each item. Statements were simplified so that the professionals using the checklist would be able to use a rating to determine the adequacy of a feature. For example, rather than rating the floor plan on "adequate number of bathrooms for number of bedrooms," the revised item would rate the plan on the "number of bathrooms." This permitted the housing professionals using the checklist to determine if the number of bathrooms was "excellent," "good," "fair" or "poor" without defining an adequate number. Adequate and minimum amounts of spaces have been determined by various sources and to some degree conflict with one another. To provide some type of guideline using the checklist to rate a house plan, the Federal Housing Administration (FHA) Minimum Property Standards for One- and Two-Family Dwellings (HUD, 1979) were identified along with appropriate items. The FHA Minimum Property Standards were selected because of their previous national uniform application and their former representation of formal legal sanctions in housing design. The Small Homes Council standards for minimum amounts of base and wall cabinets were also identified in a similar manner. These measures are not identified in the FHA Minimum Property Standards.

Several suggested items could not be accommodated into the House Plan Evaluation Checklist. Although the items could be useful in evaluating a specific house that had already been constructed, they would be difficult to use when studying a house plan. Items and comments categorized under the following headings were determined not to be within the content universe of the House Plan Evaluation Checklist: energy features, orientation, lighting and electrical features, heating and cooling systems, and construction features. Two suggested items were already incorporated into the original checklist (window and door location and bath convenient to outside areas). Other items were mentioned by only one person and were not included in the revised checklist. There were five general comments related to the belief that houses would be smaller in the future and that the checklist might be too traditional to be useful for smaller houses. These comments were considered by the investigator but were not specifically included in the revised checklist. Three professionals suggested that a housing evaluation instrument should be based on the family that would live in the house. Since the checklist would be used to evaluate a plan without knowledge of the family that might live in the house, these comments were not used to revise the instrument.

Once the House Plan Evaluation Checklist was revised using the information provided by surveying housing professionals it was examined and approved by the five dissertation committee members for clarity and content. One item was reworded after this examination. The final examination of the checklist was made by three faculty and two graduate students in the Housing, Interior Design and Resource Management Department of Virginia Polytechnic Institute and State University. These persons who had expertise in housing and/or interior design pilot-tested the checklist by examining and rating a house plan. Based on their comments an item related to laundry space was expanded into two items prompting reorganization of the instrument to include a Laundry section. In addition, several items were reordered within the Kitchen section of the checklist. Their comments were also useful in identifying features necessary for clarity on the house plans. Table 4 contains a summary of all item revisions and additions.

Summary

The House Plan Evaluation Checklist was revised based on the ratings and comments of a randomly selected sample of housing professionals and on the comments and suggestions of several specifically selected housing and interior design faculty and graduate students. Of the 66 original items, four items were eliminated, five items were combined with other items, six items were expanded or added, and 21 items were reworded. A total of 63 items were included in the revised House Plan Evaluation Checklist (Appendix E).

Table 4

Summary of Revisions to the Houuse Plan Evaluation Checklist

Original Items *	Revised Items
	EXPANDED ITEMS
OHPEC 19 Adequate bedroom closet storage (minimum of 24" depth)	RHPEC 15 Closet space in master bedroom (MPS - 2' x 5') RHPEC 16 Closet space in other bedrooms (MPS - 2' x 3')
OHPEC 51 (Bedroom) Large enough to contain appropriate furniture	RHPEC 46 Master bedroom of sufficient size to accomodate bedroom furniture (MPS specifies 2 twin beds, 1 dresser, 1 chair, 1 crib) RHPEC 47 Other bedrooms of sufficient size to accomodate bedroom furniture (MPS specifies 1 double bed, 1 dresser, 1 chair)
OHPEC 58 (Bathroom) Space adequate and arranged for convenient and private use	RHPEC 53 Space arranged for convenient and private use RHPEC 55 Size of bathroom (MPS specifies tub, lavatory, water closet
OHPEC 62 Space for washer and dryer	RHPEC 56 Space for washer RHPEC 57 Space for dryer
	ADDITIONAL ITEMS
	RHPEC 4 Visual privacy of bedroom-bathroom area RHPEC 22 Storage in bathroom
	COMBINED ITEMS
OHPEC 1 Quiet areas separated from noisy areas OHPEC 2 Living, working, sleeping areas separated from each other	RHPEC 1 Separation of quiet (private) areas from noisy (public areas of the house
OHPEC 10 Front entry with direct connection to living area OHPEC 11 Short access from front entry to family room or recreation room OHPEC 14 Front door located to prevent direct view of any room	RHPEC 10 Connection between front entry and living areas

Table 4 -- continued

Original Items *		Revised Items	
		COMBINED ITEMS -- continued	
OHPEC 25	Adequate floor and wall space for a sofa and other large pieces of furniture	RHPEC 23	Floor and wall space for living room furnishings (MPS specifies 1 couch, 2 easy chairs, 1 desk, 1 desk chair, 1 television set, 1 table)
OHPEC 27	At least one wall uninterrupted by windows and long enough to accomodate a sofa		
OHPEC 38	Work ceenters flow from sink, mix to range	RHPEC 41	Work centers flow from refrigerator, mix, sink to range
OHPEC 44	Kitchen layout iss functional - range, sink, and refrigerator within easy reach of each other		
		REWORDED ITEMS	
OHPEC 3	Bedrooms separated from living zone by change in floor level, other rooms, or sound isolation	RHPEC 2	Separation of bedrooms from living areas using closets, quiet rooms, or sound insulation
OHPEC 4	Rooms related to each other in a convenient manner, entry to living room, dining room to kitchen, bedrooms to bath	RHPEC 3	Relation of rooms to each other, i.e. entry next to living area, dining area next to kitchen, bedrooms close to bathrooms
OHPEC 5	Doors locaated near corner of rooms	RHPEC 5	Location of door near adjacent corner of rooms
OHPEC 7	Traffic pattern away from areas of activity	RHPEC 7	Width of major traffic paths (MPS specifies 3' wide halls)
OHPEC 9	Limited hall space	RHPEC 9	Length of hall
OHPEC 15	Direct access from service entry to kitchen	RHPEC 11	Access from service entry to kitchen
OHPEC 16	Easy and short access to bath, lavatory or mud room from service area	RHPEC 12	Access from service area to bath, lavatory or mud room
OHPEC 17	Easy access from service entry to other rooms in house without passing through kitchen work triangle	RHPEC 13	Access from service entry to other rooms without interference with kitchen work triangle
OHPEC 18	Traffic pattern does not pass through conversation areas	RHPEC 14	Relation of traffic pattern to conversation areas
OHPEC 20	Adequate closet space for out-of-season clothes	RHPEC 17	Closet space for storing out-of season clothes

Table 4 -- continued

Original Items *		Revised Items	
		REWORDED ITEMS -- continued	
OHPEC 21	Adequate storage for household linens; located close to bedrooms and baths	RHPEC 18	Storage for household linens (MPS - 15 sq.ft. shelf area
OHPEC 22	Adequate storage for cleaning equipment and supplies	RHPEC 19	Storage for cleaning equipment and supplies
OHPEC 23	Adequate storage for yard and lawn equipment	RHPEC 20	Storage for yard and lawn equipment
OHPEC 24	Coat closet within six feet of front door	RHPEC 21	Closet space convenient to front entry (MPS - 2' x 2')
OHPEC 29	Room large enough to allow for seating family and guests	RHPEC 25	Size of living areas
OHPEC 30	Proportion of room adequate for comfortable conversation distances	RHPEC 26	Size and shape of living area allows for furniture to be arranged for conversation
OHPEC 31	Direct access to living area	RHPEC 27	Access to living areas
OHPEC 32	Direct access to kitchen	RHPEC 28	Access to kitchen
OHPEC 33	Separate room or sufficient space in dual-purpose room to permit arrangement of appropriate furnishings	RHPEC 29	Space for dining furniture (MPS specifies dining table and dining chairs for six people
OHPEC 34	Convenient to outdoor living areas	RHPEC 30	Convenience to outdoor living areas
OHPEC 35	Next to or near garage or carport	RHPEC 31	Convenience to garage, carport or drive

* Original Items OHPEC 12, 13, 28, and 57 were eliminated from the House Plan Evaluation Checklist because their mean scores were 2.5 or below; Original Items OHPEC 6, 8, 26, 36, 37, 39, 40, 41, 42, 43, 45, 46, 47, 48, 49, 50, 52, 53, 54, 55, 56, 57, 59, 60, 61, 63, 64, 65, and 66 were revised.

B. Housing Satisfaction Scale

Description of the Instrument

Items for the original Housing Satisfaction Scale were developed and compiled by the investigator based on a review of housing satisfaction scales and instruments used in previous research and post-occupancy studies. The Housing Satisfaction Scale was designed to be used by residents of Benchmark and Solar Attic houses to rate their relative satisfaction with specific features in their housing unit.

The items on the original Housing Satisfaction Scale were incorporated into a questionnaire format that permitted housing professionals to rate each item (Appendix F). The instrument included: a description of the purpose and use of the Housing Satisfaction Scale, a rating scale for the items, sections for suggesting item improvements, and a section for general comments and suggestions for creating new items. The following ratings were used to evaluate the appropriateness and quality of the items and to determine those items that were to be used on the revised Housing Satisfaction Scale: 0--Should not be included, 1--Poor item, 2--Fair item, 3--Good item, 4--Excellent item.

Participants in the Study

A second sample of housing professionals was selected from the population that was identified in Phase I-A. The population consisted of Cooperative Extension Service housing specialists in all 50 states and of 1982 members of the American Association of Housing Educators who had identified interests in family housing or interior design. Three-digit random numbers were generated on a Monroe calculator and the second 40 numbers between 001 and 189 constituted the sample of housing professionals in this phase of the study. (The first 40 numbers were used to identify the sample in Phase I-A of the study.)

Procedure for Data Collection

The same procedure used for collecting data in Phase I-A was used in Phase I-B. The instrument was mailed to housing professionals on July 1, 1982. A postcard reminder was sent two weeks later. A third mailing that included a copy of the instrument, cover letter, and return envelope was sent to nonrespondents on July 27, 1982. A copy of correspondence for this investigation is in Appendix G. Thirty-one of the 40 sample members returned the instrument for a return rate of 77.5 percent.

Analyses of the Data and Revision of the Instrument

The Housing Satisfaction Scale was revised on the basis of the rating of each item by the housing professionals, their comments about each item, their general suggestions and comments, and the investigator's analysis of the Housing Satisfaction Scale in relation to the House Plan Evaluation Checklist. The respondents' rating of each item was coded, transferred to computer cards, and verified for accuracy. The mean score and standard deviation were determined for each item (Table 5). The mean scores ranged from 1.68 to 3.71. It was anticipated that items with a mean score of 2.5 or below would be eliminated from a revised instrument. This would eliminate items rated "poor" and "fair" by the professionals. Seven items on the original Housing Satisfaction Scale had mean scores of 2.5 or below and were subsequently eliminated.

The comments made by the professionals about each item and about the scale in general were useful in identifying items that could be combined and in determining new items that should be included. The general comments and suggested items have been categorized and combined where possible and are in Appendix H.

Table 5

Mean Scores and Standard Deviations for
Content Validation of Housing Satisfaction Scale

Variable Number	Number of Responses	Mean Score	Standard Deviation	Variable Number	Number of Responses	Mean Score	Standard Deviation
HSS 1	30	3.23	0.82	HSS 31	31	2.90	1.08
HSS 2	31	3.58	0.56	HSS 32	30	3.37	1.00
HSS 3	31	3.61	0.56	HSS 33	31	3.06	0.96
HSS 4	31	3.58	0.62	HSS 34	31	2.68	1.08
HSS 5	31	3.00	0.87	HSS 35	31	2.94	0.96
HSS 6	31	3.52	0.81	HSS 36	30	3.00	1.23
HSS 7	31	3.19	0.87	HSS 37	31	3.06	1.12
HSS 8	31	3.32	0.70	HSS 38	31	3.13	0.96
HSS 9	30	3.10	0.99	HSS 39	31	3.06	1.06
HSS 10	31	*2.32	1.13	HSS 40	30	*2.50	1.14
HSS 11	31	3.71	0.46	HSS 41	30	*2.50	1.14
HSS 12	31	3.58	0.72	HSS 42	31	2.65	1.20
HSS 13	31	3.32	1.05	HSS 43	30	2.90	1.24
HSS 14	30	2.87	1.04	HSS 44	31	2.77	1.36
HSS 15	31	3.13	1.02	HSS 45	30	*2.17	1.44
HSS 16	31	3.00	1.10	HSS 46	31	*1.68	1.17
HSS 17	31	3.48	0.63	HSS 47	31	3.29	0.74
HSS 18	31	3.23	0.72	HSS 48	31	3.39	0.72
HSS 19	31	3.48	0.68	HSS 49	30	2.90	1.18
HSS 20	30	3.37	0.85	HSS 50	30	3.43	1.00
HSS 21	31	3.42	0.81	HSS 51	31	3.29	1.22
HSS 22	31	3.39	0.95	HSS 52	31	3.39	0.92
HSS 23	31	3.23	0.92	HSS 53	31	3.65	0.55
HSS 24	31	3.52	0.63	HSS 54	29	2.66	0.90
HSS 25	31	3.00	1.13	HSS 55	31	3.00	0.97
HSS 26	31	3.03	1.08	HSS 56	31	*2.23	1.26
HSS 27	31	3.06	0.85	HSS 57	30	3.63	1.07
HSS 28	31	2.84	1.10	HSS 58	30	3.60	1.10
HSS 29	31	*2.29	1.19	HSS 59	30	3.67	1.03
HSS 30	31	2.90	1.08				

* Items with mean scores of 2.50 or below were eliminated from the revised scale.

The comments by the professionals prompted the following revisions in the Housing Satisfaction Scale:

1. Five items were expanded into fifteen items.

2. Fifteen items were added.

3. Nineteen items were reworded.

Several of the original items were expanded into multiple items so that the items would be more specific. The item "size of rooms" was divided into five items related to specific rooms. The item "amount of indoor storage" was divided into four items that identified specific types of indoor storage. The items "amount of closet space in bedrooms" and "flexibility in arranging furniture in bedrooms" were both divided to allow for differences in master bedroom and other bedrooms. The item "arrangement for preparing food" was split into two items that asked about the arrangement of work space and storage space.

Eleven items were added to the scale based on the specific comments about each item and on the general suggestions for additional items. These included the following: "children's play area indoors," "children's play area outdoors," "security system," "energy efficiency of home," "flexibility of spaces for more than one use," "number, type, and location of windows," "number of levels in home," "arrangement of space for laundry," "types of rooms," "ability to arrange furniture for conversation," and "structural soundness of home."

After analyzing the contents of the Housing Satisfaction Scale and the House Plan Evaluation Checklist, it was determined that many of the features identified on each instrument should be consistent. Items related to the arrangement of bathroom fixtures; location of bedroom; location of dining areas; and number, type, and location of doors were added in order to improve consistency.

Nineteen items were reworded to increase the clarity and understanding of the concept. These were based on the specific comments made about each item and on the investigator's analysis of the consistency between the Housing Satisfaction Scale and the House Plan Evaluation Checklist.

Some of the items suggested by the professionals were not incorporated into the revised Housing Satisfaction Scale. Although several of the items could be useful in examining various aspects of housing satisfaction, these items would not be useful in evaluating specific features of the dwelling unit. Items that were categorized under the following headings were determined not to be within the content universe of the Housing Satisfaction Scale: community and neighborhood factors, utility services, demographic and family characteristics, and special features for the handicapped and elderly. Items related to outdoor storage, outdoor areas, and interior zoning were already included in the original Housing Satisfaction Scale. Other items mentioned by only one person were not included in the revised Housing Satisfaction Scale. Two general suggestions made about the scale included regrouping items under major headings and shortening the list of items. In the revised Housing Satisfaction Scale, items were regrouped under the following headings: Layout of Floor Plan, Storage, Living Areas, Dining, Kitchen, Bedrooms, Bathroom, Laundry, Appearance, Exterior, Systems, Structure and Materials, and Costs. Because of the many suggested items the scale was increased instead of decreased.

After revision based on the information provided by surveying housing professionals, the Housing Satisfaction Scale was examined and approved by the five dissertation committee members and by the S-141 Technical Committee. It was suggested that the item "kitchen finishes" be reworded. Table 6 contains a summary of all revisions and additions to the Housing Satisfaction Scale. In addition, items under the Living Areas section were duplicated so that residents could evaluate two living areas. This duplication resulted in the addition of four more items to the Housing Satisfaction Scale which are not on Table 6.

Summary

The Housing Satisfaction Scale was revised based on the ratings and comments of a randomly selected sample of housing professionals and on the comments and suggestions of dissertation and S-141 committee members. Of the 59 original items, seven items were eliminated, 29 items were added or expanded, and 20 items were reworded. A total of 81 items were included in the revised Housing Satisfaction Scale used in Phase II-B of the study (Appendix I).

Table 6

Summary of Revisions to the Housing Satisfaction Scale

Original Items *		Revised Items	
		EXPANDED ITEMS	
OHSS 1	Size of rooms	RHSS 23	Size of living rooms
		RHSS 29	Size of dining space
		RHSS 42	Size of master bedroom
		RHSS 43	Size of other bedrooms
		RHSS 48	Size of bathroom(s)
OHSS 4	Amount of closet space in bedroom	RHSS 12	Closet space in master bedroom
		RHSS 13	Closet space in other bedroom
OHSS 6	Amount of indoor storage	RHSS 14	Storage for out-of season clothes
		RHSS 15	Storage for household linens
		RHSS 16	Storage for cleaning equipment and supplies
		RHSS 18	Storage at entry
OHSS 14	Arrangement for preparing food	RHSS 34	Arrangement of work space in kitchen
		RHSS 35	Arrangement of storage space in kitchen
OHSS 16	Flexibility in arranging furniture in bedrooms	RHSS 40	Flexibility in arranging furniture in master bedroom
		RHSS 41	Flexibility in arranging furniture in
		ADDITIONAL ITEMS	
		RHSS 4	Children's play area indoors
		RHSS 5	Children's play area outdoors
		RHSS 9	Number of levels in home
		RHSS 10	Type of rooms
		RHSS 11	Flexibility of spaces for more than one use
		RHSS 24	Ability to arrange furniture for conversation
		RHSS 30	Location of dining area(s)
		RHSS 44	Location of bedrooms
		RHSS 49	Arrangement of bathroom fixtures
		RHSS 52	Arrangement of space for laundry
		RHSS 69	Energy efficiency of home

Table 6 -- continued

Summary of Revisions to the Housing Satisfaction Scale

Original Items *		Revised Items	
		ADDITIONAL ITEMS -- continued	
		RHSS 70	Security systems
		RHSS 76	Number, location and type of windows
		RHSS 77	Number, location and type of doors
		RHSS 78	Structural soundness of home
		REWORDED ITEMS	
OHSS 2	Amount of work space in kitchen	RHSS 32	Amount of counter or work space in kitchen
OHSS 7	Amount of outdoor storage	RHSS 17	Outdoor storage for lawn and yard equipment
OHSS 9	Amount of space for laundry	RHSS 51	Size of laundry area
OHSS 23	Privacy of family members from each other	RHSS 2	Privacy for family members
OHSS 24	Elimination of noise from outside	RHSS 56	Control of noise from outside
OHSS 25	Control of plumbing noise	RHSS 59	Control of plumbing noises in living areas
OHSS 28	Wall coverings	RHSS 72	Wall materials
OHSS 32	Electrical outlets	RHSS 62	Location and number of electrical outlets
OHSS 33	Lighting fixtures	RHSS 63	Lighting quality
OHSS 36	Plumbing	RHSS 61	Plumbing system
OHSS 37	Kitchen finishes	RHSS 38	Kitchen counter and cabinet finishes
OHSS 38	Comfortable temperature in living areas	RHSS 65	Control of interior space temperatures
OHSS 39	Comfortable humidity level	RHSS 64	Control of humidity
OHSS 42	Elimination of drafts	RHSS 68	Sbsence of drafts
OHSS 44	Natural outdoor ventilation effects	RHSS 67	Control of ventilation
OHSS 47	Amount of space for dining	RHSS 31	Number of dining areas
OHSS 48	Amount of living areas	RHSS 20	Number of living areas
OHSS 51	Direct access between different areas of the house	RHSS 7	Access between different areas of the house
OHSS 54	Backyard, front yard	RHSS 57	Private outdoor living areas
OHSS 55	Car storage	RHSS 58	Car storage and drive

* Original Items OHSS 1, 10, 29, 40, 41, 46, and 56 were eliminated from the Housing Satisfaction Scale because their mean scores were 2.5 or bbelow; Original Items OHSS 3, 5, 11, 12, 13, 15, 17, 18, 19, 20, 21, 22, 26, 27, 30, 31, 34, 43, 49, 50, 52, 53, 57, 58, and 59 were not revised.

CHAPTER VI

PHASE II-A

HOUSING PROFESSIONALS' EVALUATION OF THE BENCHMARK AND SOLAR ATTIC HOUSE PLANS

The second phase of the research study was conducted to evaluate the Benchmark house (FmHA plan no. H5-41) and the Solar Attic house (Cooperative Extension Plan Service experimental plan no. 7220). The instruments developed in Phase I were used in Phase II to provide feedback on the design and livability of the two house types and to assess their reliability in actual use.

During Phase II-A the Benchmark and Solar Attic house plans were sent to a sample of housing professionals who rated the plans using the revised House Plan Evaluation Checklist. Inter-rater reliability was determined and the mean ratings of the checklist items and subscales were compared for the two house types.

Description of the Instrument

The House Plan Evaluation Checklist used in Phase II-A of the study (Appendix E) was developed, tested for content validity, and revised in Phase I-A. The checklist contained 63 items categorized under the following headings: Zoning, Circulation, Storage, Living Area, Dining Area, Kitchen, Bedrooms, Bathroom, Laundry, and Service and Facilities. The checklist included instructions, the items, and a rating scale for each item. The following ratings were used to evaluate the livability of house plans: 0--Does not have, 1--Poor, 2--Fair, 3--Good, 4--Excellent.

Participants in the Study

The population for this phase of the study was the same as reported in Phase I-B. The population included state housing specialists with the Cooperative Extension Service and 1982 members of the American Association of Housing Educators who had an interest in family housing or interior design. Fifty random numbers between 001 and 189 were generated by computer. Nine of the numbers were included in the sample of respondents identified in Phase I-A. It was anticipated that their participation in evaluating the original instruments might have biased their responses to the revised instrument; therefore, these nine were eliminated and the final sample size was 41.

Procedure for Data Collection

Dillman's (1978) procedure for collecting data through mailed questionnaires was modified and used in this phase of the study. On November 1, 1982, a packet was mailed to all of the identified housing professionals. It contained two House Plan Evaluation Checklists, one copy each of the Benchmark house plan and the Solar Attic house plan (Appendix A), a cover letter, and a stamped self-addressed envelope. Two weeks after the first mailing a postcard reminder was sent to all participants who had not responded. Another complete packet was sent to nonrespondents in a third mailing on January 6, 1983. The third mailing was postponed from the second week in December until January to avoid the holiday season and the end of many academic sessions that might have affected negatively the return rate of the sample of housing professionals. A copy of the correspondence for this investigation is in Appendix J. Thirty-three of the 41 sample members returned the questionnaire by February 28, 1983, however one respondent returned only one of the checklists. The respondents' ratings of both plans were required in order to complete the appropriate statistical analyses, therefore this one checklist was not used in the study. The rate of return excluding this response was 78 percent.

Analyses of the Data

Responses to the items on the checklist were coded, transferred to the computer, and verified for accuracy. Inter-rater reliability was determined by a data transformation that organized the data so that the General Linear Model (SAS Institute, 1982) could be used to perform the appropriate analysis of variance procedure. Further analysis for the reliability procedure was performed with a calculator. A two-tailed paired samples *t* test, as specified in *SPSS*^{x} (SPSS, 1983), was used to test the significance of the differences between the items and subscale mean ratings for the Benchmark and Solar Attic house plans. Alpha was set at .05.

Description of the House Plan Ratings

The mean scores for the item ratings were rounded and grouped under the following categories to facilitate a description of the item ratings: Not Present -- < .4, Poor -- .5 - 1.4, Fair -- 1.5 - 2.4, Good -- 2.5 - 3.4, Excellent -- > 3.5.

Benchmark plan. The majority of the ratings the Benchmark received on the House Plan Evaluation Checklist were Fair to Good (Table 7). The plan received five Excellent ratings, 31 Good ratings, 23 Fair ratings, three Poor ratings, and one Not Present rating. The item "storage for yard and lawn equipment" received the only Not Present rating (not indicated on Table 7). The Benchmark plan did not indicate the presence of any outside storage. The items that received Poor ratings were also associated with features that were not indicated on the plan. These items were "storage in bathroom," "[kitchen] convenience to garage, carport or drive," and "space for dryer." Since the Benchmark plan did not indicate where a garage, carport, or drive might be, it was impossible to accurately evaluate the kitchen's convenience to such a space. The item was eliminated from item and subscale comparisons of the two plans.

The Excellent ratings received by the Benchmark plan were for the items "visual privacy of bedroom-bathroom area," "doors open into the room they serve," "[dining area] access to living area," "[dining area] access to kitchen," and "all bedrooms entered without going through another bedroom." The actual mean scores received by the Benchmark house ranged from .16 to 3.81.

<u>Solar Attic plan</u>. Almost two-thirds of the ratings that the Solar Attic house plan received on the House Plan Evaluation Checklist were Good (Table 7). The plan

Table 7

Ratings Received by Benchmark and Solar Attic House Plan Evaluation Checklist Items *

Checklist Items	Benchmark Poor	Benchmark Fair	Benchmark Good	Benchmark Excel-lent	Solar Attic Poor	Solar Attic Fair	Solar Attic Good	Solar Attic Excel-lent
ZONING								
Separation of quiet and noisy areas		2.44					2.88	
Separation of bedrooms from living areas		2.10					2.94	
Relation of rooms to each other			3.42				3.10	
Visual privacy of bedroom-bathroom areas				3.47			2.78	
CIRCULATION								
Location of door near adjacent corners of rooms			3.41					3.53
Doors open into rooms they serve				3.47				3.50
Width of major traffic paths			3.42				3.36	
Traffic pattern does not interfere with room activities			2.87				3.26	
Length of hall			2.56				3.16	
Connection between front entry and living areas			2.72				3.03	
Access from service entry to kitchen			3.14				3.07	
Access from service entry to bath		2.43				1.60		
Access from service entry to other rooms without interfering with kitchen work triangle			3.00				3.09	
Relation of traffic to conversation areas in living areas			2.77				2.93	
STORAGE								
Closet space in master bedroom		1.78					2.78	
Closet space in other bedrooms			2.69				3.38	
Closet space for out-of season clothes		1.97				1.58		
Storage for household linens			2.91			2.44		
Storage for cleaning equipment		2.16					2.47	
Closet convenient to front entry		2.17					2.55	
Storage in bathroom	0.53				0.91			

Table 7 -- Continued

Checklist Items	BENCHMARK Poor	Fair	Good	Excel-lent	SOLAR ATTIC Poor	Fair	Good	Excel-lent
LIVING AREA								
Space for furnishings			2.56				2.56	
Flexibility in furniture arrangement and room use		2.28				2.44		
Size of living area		2.16					2.50	
Arrange furniture for conversation			2.58				2.77	
DINING AREA								
Access to living area				3.50			3.22	
Access to kitchen				3.61			3.00	
Space for dining furniture			2.56				2.88	
KITCHEN								
Convenience to outdoor living areas			3.39			1.58		
Convenience to garage or drive	0.59						3.11	
Access to front or service entry			2.63				3.40	
Counter space on latch side of refrigerator		2.28						3.72
Counter space at mix center		1.88						3.56
Counter space on both sides of sink			3.13				3.22	
Counter space on both sides of range		1.94					2.69	
Amount of wall cabinet space			2.48					3.48
Amount of base cabinent space		2.06					3.06	
Work triangle			2.45					3.45
Traffic does not pass through work areas		1.94						3.72
Work center flow		2.21						3.76
Location of serving center			2.89				3.23	
BEDROOMS								
Closets on wall adjacent to bedroom door			3.29					3.48
Windows and doors located to permit flexible furniture arrangement			2.66					3.50
Wall area for two bed positions			2.93					3.57
Master bedroom sized to accomodate furniture		2.20					2.83	
Other bedroom sized to accomodate furniture			2.67				3.19	

Table 7 -- Continued

Checklist Items	BENCHMARK				SOLAR ATTIC			
	Poor	Fair	Good	Excel-lent	Poor	Fair	Good	Excel-lent
BEDROOMS -- continued								
Bathroom adjoining or accessible via hall			3.36				3.23	
Bedrooms entered without going through other bedrooms				3.81				3.88
BATHROOM								
Number of bathrooms		2.00				2.03		
Convenience to bedrooms			3.41				3.19	
Convenience to outside areas		2.36			1.43			
Arrangement of space		2.38					2.53	
Window or exhaust fan		2.34					2.66	
Size of bathroom			2.81				3.38	
LAUNDRY								
Space for washer			2.81				3.38	
Space for dryer	0.66						3.38	
Location of laundry		2.44					2.56	
SERVICE AND FACILITIES								
Centralized plumbing core			3.10		1.27			
Location of windows and doors for ventilation			2.97				2.48	
Provision for outdoor living areas		2.23					3.10	
Convenience of outdoor living areas to indoor living areas		2.16					3.00	

* Rating Categories: Not Present=<.4, Poor=.5-1.4, Fair=1.5-2.4 Good=2.5-3.4, Excellent=>3.5. Not Present category not included in table since there there were only two items in this category.

received 12 Excellent ratings, 39 Good ratings, seven Fair ratings, two Poor ratings, and one Not Present rating. The item "location of water heater" was the only item to receive a Not Present rating (not indicated on Table 7). The water heater was not identified on the Solar Attic house plan and this omission prevented an accurate evaluation of its location. The item was eliminated from the item and subscale comparisons of the two plans. The two items that received Poor ratings were "storage in bathroom" and "centralized plumbing core." The plan did not identify bathroom storage and the kitchen and bathroom areas were separated preventing centralized plumbing. The items that received Excellent ratings were related to door location and openings, kitchen counter and cabinet space, kitchen arrangement, bedroom furniture placement, and bedrooms entered without going through other bedrooms. The actual mean scores received by the Solar Attic house plans ranged from .31 to 3.88.

Inter-rater Reliability

The House Plan Evaluation Checklist is an evaluation instrument that permits the identification of good and poor design features in a single-family house plan. The appropriate measure of reliability should measure the consistency of the respondents' rating of the plan on the checklist items. Inter-rater reliability is a process of correlating ratings obtained from different raters in order to determine this type of consistency (Guilford, 1954). Ebel (1951) determined that if each rater had rated N persons (items) on some trait, then there is a possibility of obtaining intercorrelations of the ratings of the persons (items) from all possible pairs of raters. Ebel refers to "persons" being rated which is comparable to the items on the House Plan Evaluation Checklist. Intra-class correlations, a method for determining an average intercorrelation, is used to achieve inter-rater reliability. Ebel's formula for the reliability of all ratings for the items is:

$$r_{kk} = \frac{MS_i - MS_e}{MS_i}$$

where r_{kk} = reliability of ratings for k raters
MS_i = Mean square for items
MS_e = Mean square for error.

To obtain this information, the data set was transformed so that the respondent number, item number, and item score were on each record. "Item number" and "respondent number" were the variables used in an analysis of variance for each subscale as specified in the

Statistical Analysis System's General Linear Model (SAS Institute, 1982). This procedure provided information about the mean square for the items and for the error. Both of these factors were used in the calculation of Ebel's formula.

The inter-rater reliability of the checklist subscales by house type are presented in Table 8. All of the subscale reliability ratings for the Benchmark plan were .87 or above, and all but three of the subscale reliability ratings for the Solar Attic plan were .92 or above. The Solar Attic ratings below .92 were: .10 on the Zoning subscale, .49 on the Living Area subscale, and .61 on the Dining Area subscale. The low reliability of the Solar Attic plan's Zoning subscale indicates that the respondents were not consistent in the way they rated the four items on this subscale. For instance, one respondent may have scored Item 1 as 4 and Item 4 as 1, whereas another respondent may have reversed these ratings. The means for the items were fairly consistent, but the individual respondents did not score the items consistently. Similar conclusions can be made about the Living Area and Dining Area subscales for the Solar Attic plan, although the respondents' inconsistency is not as great.

Table 8

Inter-rater Reliability Ratings for the Benchmark and Solar Attic House Plans for the Subscales of the House Plan Evaluation Checklist

Subscales	Benchmark	Solar Attic
Zoning	.97	.10
Circulation	.89	.94
Storage	.97	.97
Living Area	.87	.49
Dining Area	.98	.61
Kitchen	.95	.95
Bedrooms	.96	.92
Bathroom	.97	.97
Laundry	.99	.97
Service and Facilities	.91	.98

The low inter-rater reliability of the Zoning subscale indicates that there can be little confidence in the ratings the Solar Attic plan received for these items. It is possible that the items were not clear, that the house plan was not complete or clear, or that the housing professionals that rated the plan were not in agreement about what constitutes good or poor zoning of residential space as measured by these items. Some confidence can be placed in the reliability of the Living Area and Dining Area subscales. However, the reliability scores indicate that there may be some problem with the clarity of the items on these subscales, their application to the Solar Attic house plan, or the housing professionals' understanding about the concepts presented in these items. The other ratings on the subscales for the Solar Attic and Benchmark plans should be viewed with confidence. The respondents were consistent in the scores they assigned to the items within these subscales.

Testing the Hypothesis

The analyses of the data collected in Phase II-A included testing the following null hypothesis:

> Ho 1: There is no difference in the mean scores of the house plan evaluation of the Benchmark and Solar Attic houses for the following subscales:

a. Zoning
b. Circulation
c. Storage
d. Living Area
e. Dining Area
f. Kitchen
g. Bedrooms
h. Bathroom
i. Laundry
j. Service and Facilities

The differences in the mean ratings of each item and subscale were compared for the two house types using the two-tailed paired samples _t_ test. Since each housing professional evaluated both house plans, it was assumed that their ratings would be dependent and that the data would be correlated data. The paired samples _t_ test eliminates the subject-to-subject variability by taking into account the covariance between the two mean ratings (SPSS, 1983).

In the following sections, the differences between the mean ratings of each of the subscales of the House Plan Evaluation Checklist and the items within each subscale are reported and discussed.

Zoning. The respondents rated the Solar Attic house plan significantly higher on two of the four items on the Zoning subscale (Table 9). The Solar Attic plan received Good ratings on the items "separation of quiet areas from noisy areas of the house" and "separation of bedrooms from living areas using closets, quiet rooms or sound insulation," while the Benchmark plan received Fair ratings on these items. Both house plans received Good ratings on the item "relation of rooms to each other" and there was no significant difference in the mean scores. The Benchmark plan received an Excellent rating on the item "visual privacy of bedroom-bathroom area" while the Solar Attic plan received a Good rating. The mean scores were significantly different from one another. When the four items were combined there was no significant difference between the mean scores of the Zoning subscale for the Benchmark and Solar Attic plans; therefore, the null hypothesis for this subscale was retained.

Circulation. The respondents rated the Solar Attic house plan higher than the Benchmark plan on seven of the ten items on the Circulation subscale (Table 10). Both plans received Excellent ratings on the item "doors open into the room they serve" and there was no significant difference in the mean scores. Even though the Solar Attic plan received an Excellent rating on the item "location of doors near adjacent corner of rooms," and the Benchmark plan received a Good rating on this item, there was no statistically significant difference in the mean scores. Both plans received Good ratings on the following items: "width of major traffic paths," "traffic pattern does not interfere with activities in rooms," "length of

Table 9

Housing Professionals' Mean Rating of Benchmark and Solar Attic House Plan Evaluation Items and Subscale: Zoning

Variable	N	Bench-mark	Solar Attic	Difference Between Means	Standard Error of Difference	Calculated p value
Separation of quiet and noisy areas	32	2.44	2.88	-0.44	0.18	0.021
Separation of bedrooms from living areas	31	2.10	2.94	-0.84	0.21	<0.001
Relation of rooms to each other	31	3.42	3.10	0.32	0.17	0.067
Visual privacy of bedroom-bathroom area	32	3.47	2.78	0.69	0.15	<0.001
Zoning Total	31	11.39	11.68	-0.29	0.45	0.522

Table 10

Housing Professionals' Mean Rating of Benchmark and Solar Attic House Plan Evaluation Items and Subscale: Circulation

Variable	N	Bench-mark	Solar Attic	Difference Between Means	Standard Error of Difference	Calculated p value
Door near adjacent corner of rooms	32	3.41	3.53	-0.13	0.09	0.161
Doors open into rooms they serve	32	3.47	3.50	-0.03	0.13	0.813
Width of major traffic paths	31	3.42	3.36	0.07	0.13	0.625
Traffic pattern does not interfere with room activities	31	2.87	3.26	-0.39	0.21	0.076
Length of hall	31	2.56	3.16	-0.59	0.16	0.001
Connection between front entry and living areas	32	2.72	3.03	-0.31	0.22	0.161
Access from service entry to kitchen	29	3.14	3.07	0.07	0.27	0.798
Access from service entry to bath	30	2.43	1.60	0.83	0.25	0.002
Access from service entry to other rooms without interfering with kitchen work triangle						
Relation of traffic to conversation areas in living areas	30	2.77	2.93	-0.17	0.15	0.258
Circulation Total	27	30.00	30.85	-0.85	0.45	0.522

hall," "connection between front entry and living areas," "access from service entry to kitchen," "access from service entry to other rooms in the house without interference with kitchen work triangle," and "relation of traffic pattern to conversation areas in living areas." There were no significant differences in the mean scores for these items. The Benchmark plan and the Solar Attic plan received Fair ratings on the item "access from service area to bath, lavatory or mud room." However, the mean score received by the Benchmark plan was significantly higher than the score received by the Solar Attic plan. The mean scores for the combined items on the Circulation subscale were not significantly different for the two house plans and the null hypothesis for this subscale was retained.

<u>Storage</u>. The respondents rated the Solar Attic house plan higher than the Benchmark plan on six of the eight items on the Storage subscale (Table 11). Both house plans received Good ratings on the item "closet space in other bedroom;" however, the mean score rating received by the Solar Attic plan was significantly higher than the mean score received by the Benchmark plan. The Solar Attic plan received Good ratings and the Benchmark plan received Fair ratings on the following items: "closet space in master bedroom," "storage for cleaning equipment and

supplies," and "closet space convenient to front entry." The mean scores were significantly different for the first and last items. The Solar Attic plan also received a Good rating for the item "storage for yard and lawn equipment," but the Benchmark plan received a Not Present rating for this item and the mean scores were significantly different. The Benchmark plan did not indicate the presence of any outdoor storage. Both plans received Fair ratings on the item "closet space for storing out-of season clothes" and there was no significant difference in the mean scores. Although the Benchmark plan received a Good rating on the item "storage for household linens" and the Solar Attic plan received a Fair rating on this item, there was no significant difference in the mean scores received by the plans on this item. Both plans received Poor ratings on the item "storage in bathroom" though the Solar Attic plan received a significantly higher mean score than the Benchmark plan. Overall, the Solar Attic plan received a significantly higher mean score for the combined items on the Storage subscale and the null hypothesis for this subscale was rejected.

Living Area. The respondents rated the Solar Attic house plan higher than the Benchmark plan on three of the four items on the Living Area subscale (Table 12). Both house plans received Good ratings on the items "floor and

Table 11

Housing Professionals' Mean Rating of Benchmark and Solar Attic House Plan Evaluation Items and Subscale: Storage

Variable	N	Bench-mark	Solar Attic	Difference Between Means	Standard Error of Difference	Calculated p value
Master bedroom closet	32	1.78	2.78	-1.00	0.19	<0.001
Other bedroom closet	32	2.69	3.38	-0.69	0.16	<0.001
Out-of-season clothes storage	31	1.97	1.58	0.39	0.24	0.117
Storage for household linens	32	2.91	2.44	0.47	0.25	0.070
Storage for cleaning equipment	32	2.16	2.47	-0.31	0.25	0.217
Storage for yard equipment	32	0.16	3.34	-3.19	0.17	<0.001
Closet convenient to front entry	31	2.10	2.55	-0.45	0.20	0.028
Storage in bathroom	32	0.53	0.91	-0.38	0.15	0.021
Storage Total	31	14.19	19.39	-5.19	0.81	<0.001

Table 12

Housing Professionals' Mean Rating of Benchmark and Solar Attic House Plan Evaluation Items and Subscale: Living Area

Variable	N	Bench-mark	Solar Attic	Difference Between Means	Standard Error of Difference	Calculated p value
Space for furnishings	32	2.56	2.56	0.00	0.16	1.000
Flexibility in furniture arrangement and room use	32	2.28	2.44	-0.16	0.19	0.420
Size of living area	32	2.16	2.50	-0.34	0.16	0.039
Arrange furniture for conversation	31	2.58	2.77	-0.19	0.16	0.226
Living Area Total	31	9.52	10.29	-0.77	0.58	0.194

wall space for living room furnishings" and "size and shape of living area allows furniture to be arranged for conversation," and there were no significant differences in the mean scores for these items. The Solar Attic plan received a Good rating on the item "size of living area," but the Benchmark plan received a Fair rating and the mean scores for this item were significantly different. Both plans received Fair ratings on the item "shape of room and location of doors and windows provide for flexibility in furniture arrangement and room use" and there was no significant difference in the mean scores. There was also no significant difference between the mean scores of the combined items on the Living Area subscale; therefore, the null hypothesis for this subscale was retained.

Dining Area. The respondents rated the Benchmark house plan significantly higher than the Solar Attic plan on two of the three items on the Dining Area subscale (Table 13). The Benchmark plan received Excellent ratings on the items "access to living areas" and "access to kitchen areas," while the Solar Attic plan received Good ratings on these items. Both house plans received Good ratings on the item "space for dining furniture." Although the Solar Attic plan received a higher mean score on this item, the difference in the means was not significant at the .05 level. When all three items were combined for the Dining Area subscale, there was no significant difference in the mean scores of the two plans; therefore, the null hypothesis for this subscale was retained.

Kitchen. The respondents rated the Solar Attic house plan higher than the Benchmark house plan on eleven of the twelve items on the Kitchen subscale (Table 14). The Solar Attic plan received Excellent ratings and the Benchmark plan received Fair ratings on the following items: "amount of counter space on latch side of refrigerator," "amount of counter space for mix center," "amount of wall cabinet space," "work triangle between 12 and 22 feet in length," "traffic does not pass through work areas," and "work centers flow from refrigerator, mix, sink to range." The mean scores were significantly different. Both plans received Good ratings on the items: "access to front and/or service entries," "amount of counter space on both sides of sink," and "location of serving center in relation to dining area." The Solar Attic plan received a significantly higher mean score than the Benchmark plan on the first of these items, but there was so significant difference in the mean scores of the last two items. The Solar Attic plan received Good ratings and the Benchmark plan received Fair ratings on the items "amount of base cabinet space" and "amount of counter space on both sides

Table 13

Housing Professionals' Mean Rating of Benchmark and Solar Attic House Plan Evaluation Items and Subscale: Dining Area

Variable	N	Bench-mark	Solar Attic	Difference Between Means	Standard Error of Difference	Calculated p value
Access to living area	32	3.50	3.22	0.28	0.13	0.037
Access to kitchen	31	3.61	3.03	0.58	0.15	<0.001
Space for dining furniture	32	2.56	2.88	-0.31	0.16	0.057
Dining Area Total	31	9.65	9.07	0.58	0.30	0.067

Table 14

Housing Professionals' Mean Rating of Benchmark and Solar Attic House Plan Evaluation Items and Subscale: Kitchen

Variable	N	Bench-mark	Solar Attic	Difference Between Means	Standard Error of Difference	Calculated p value
Convenience to outdoor living area	31	3.39	1.58	1.81	0.22	<0.001
Access to front or service entry	30	2.63	3.40	-0.77	0.21	0.001
Counter space on latch side of refrigerator	29	2.28	3.72	-1.45	0.19	<0.001
Counter space at mix center	32	1.88	3.56	-1.69	0.17	<0.001
Counter space on both sides of sink	32	3.13	3.22	-0.09	0.17	0.586
Counter space on both sides of range	32	1.94	2.69	-0.75	0.21	0.001
Wall cabinet space	31	2.48	3.48	-1.00	0.19	<0.001
Base cabinent space	32	2.06	3.06	-1.00	0.15	<0.001
Work triangle	31	2.45	3.45	-1.00	0.21	<0.001
Traffic does not pass through work areas	31	1.94	3.72	-1.78	0.20	<0.001
Work center flow	29	2.21	3.76	-1.55	0.15	<0.001
Location of serving center	31	2.84	3.23	-0.39	0.22	0.090
Kitchen Total	24	29.25	39.08	-9.83	1.07	<0.001

of range," and the differences in the mean scores were significant. The Benchmark plan received a Good rating and the Solar Attic plan received a Fair rating on the item "convenience to outdoor living areas" and the difference in the mean scores for this item was significant. When all items were combined to form the Kitchen subscale the Solar Attic plan had a mean score significantly higher than the Benchmark house plan and the null hypothesis for this subscale was rejected.

Bedrooms. The respondents rated the Solar Attic house plan higher than the Benchmark plan on six of the seven items on the Bedroom subscale (Table 15). Both plans received Excellent ratings on the item "all bedrooms entered without going through another bedroom" and there was no significant difference in the mean scores. On the following items the Solar Attic house plan received Excellent ratings while the Benchmark plan received Good ratings: "closets on wall adjacent to bedroom door so that bed placement will not interfere with traffic," "location of windows and doors permit flexible furniture arrangements," and "wall area for at least two bed positions." The mean scores for the last two items were significantly different for the two house plans, but there was no significant difference for the first item. Both of the plans received Good ratings on the items "other bedrooms of sufficient size to accommodate bedroom furniture" and "bathroom adjoining or accessible via hall." The Solar Attic plan received a significantly higher mean score on the first item, but there was no significant difference in the mean score on the second item. The Solar Attic plan received a Good rating on the item "master bedroom of sufficient size to accommodate bedroom furniture" while the Benchmark plan received a Fair rating and the mean scores were significantly different. The Solar Attic house plans had a mean score significantly higher than the Benchmark plan for the Bedrooms subscale and the null hypothesis for this subscale was rejected.

Bathroom. The respondents rated the Solar Attic house plan higher than the Benchmark plan on four of the six items on the Bathroom subscale (Table 16). Both house plans received Good ratings on the items "convenience to bedrooms" and "size of bathrooms." There was no significant difference in the means for the first item, but the Benchmark plan received a significantly higher mean score on the second item. The Solar Attic plan received Good ratings and the Benchmark plan received Fair ratings on the items "space arranged for convenient and private use" and "bathroom has window or exhaust fan." The Solar Attic plan received a significantly higher mean

Table 15

Housing Professionals' Mean Rating of Benchmark and Solar Attic House Plan Evaluation Items and Subscale: Bedrooms

Variable	N	Bench-mark	Solar Attic	Difference Between Means	Standard Error of Difference	Calculated p value
Closets on wall adjacent to bedroom door	31	3.29	3.48	-0.19	0.12	0.110
Windows and doors located to permit flexible furniture arrangement	32	2.66	3.50	-0.84	0.13	<0.001
Wall area for two bed positions	30	2.93	3.57	-0.63	0.16	<0.001
Master bedroom sized to accomodate furniture	30	2.20	2.83	-0.63	0.17	0.001
Other bedroom sized to accomodate furniture	32	2.67	3.19	-0.53	0.10	<0.001
Bathroom adjoining or accessible via hall	31	2.36	3.23	0.13	0.13	0.325
Bedrooms entered without going through other bedrooms	32	3.81	3.88	-0.06	0.04	0.161
Bedrooms Total	29	21.17	24.04	-2.86	0.48	<0.001

Table 16

Housing Professionals' Mean Rating of Benchmark and Solar Attic House Plan Evaluation Items and Subscale: Bathroom

Variable	N	Bench-mark	Solar Attic	Difference Between Means	Standard Error of Difference	Calculated p value
Number of bathrooms	32	2.00	2.03	-0.03	0.08	0.712
Convenience to bedrooms	32	3.41	3.19	0.22	0.13	0.090
Convenience to outside areas	31	2.36	1.42	0.94	0.14	<0.001
Arrangement of space	32	2.38	2.53	-0.16	0.20	0.432
Window or exhaust fan	32	2.34	2.66	-0.31	0.13	0.023
Size of bathroom	32	2.81	3.38	-0.56	0.13	<0.001
Bathroom Total	29	13.28	14.97	-1.69	0.54	0.004

score on the last of these items, but there was no significant difference in the mean scores on the first item. Both house plans received Fair ratings on the item "number of bathrooms" and there was no significant difference in the mean scores. The Benchmark plan received a significantly higher mean score on the item "convenience to outside areas." It received a Fair rating on this item, while the Solar Attic plan received a Poor rating. The Solar Attic plan received a significantly higher mean score for that combined items on the Bathroom subscale and the null hypothesis for this subscale was rejected.

Laundry. The respondents rated the Solar Attic house plan higher than the Benchmark plan on all three of the items on the Laundry subscale (Table 17). The Solar Attic plan received Good ratings on all of these items. The Benchmark plan also received a Good rating on the item "space for washer," but the mean score received by the Solar Attic plan was significantly higher. The Benchmark plan received a Poor rating on the item "space for dryer," which was significantly different from the mean score received by the Solar Attic plan. The Benchmark plan did not indicate the presence of a dryer. The Benchmark plan received a Fair rating on the item "location of laundry area," but there was no significant difference in the mean scores. The Solar Attic house plan received a significantly higher mean score on the Laundry subscale and the null hypothesis for this subscale was rejected.

Service and Facilities. The respondents rated the Benchmark house plan significantly higher than the Solar Attic plan on two of the four items on the Service and Facilities subscale (Table 18). The Benchmark plan received Good ratings on the items "centralized plumbing core" and "location of windows and doors for ventilation." The Solar Attic plan received a Fair rating on the first item and a Good rating on the second item. The Solar Attic plan received Good ratings on the items "provision for private outdoor living areas" and "convenience of outdoor living areas to indoor living areas." The Benchmark plan received Fair ratings on these items and the difference in the mean scores between these two house plans was significant. The Benchmark plan received a higher mean score on the combined items that formed the Service and Facilities subscale, but it was not significant at the .05 level; therefore, the null hypothesis for this subscale was retained.

Summary

The Solar Attic plan received mean scores significantly higher than the Benchmark plan on 28 of the

Table 17

Housing Professionals' Mean Rating of Benchmark and Solar Attic House Plan Evaluation Items and Subscale: Laundry

Variable	N	Bench-mark	Solar Attic	Difference Between Means	Standard Error of Difference	Calculated p value
Space for washer	32	2.81	3.38	-0.56	0.13	<0.001
Space for dryer	32	0.66	3.38	-2.72	0.24	<0.001
Location of laundry	32	2.44	2.56	-0.13	0.21	0.546
Laundry Total	32	5.91	9.31	-3.41	0.49	<0.001

Table 18

Housing Professionals' Mean Rating of Benchmark and Solar Attic House Plan Evaluation Items and Subscale: Service and Facilities

Variable	N	Bench-mark	Solar Attic	Difference Between Means	Standard Error of Difference	Calculated p value
Centralized plumbing core	30	3.00	1.27	1.83	0.20	<0.001
Location of windows and doors	31	2.97	2.48	0.48	0.17	0.007
Provision for outdoor living areas	31	2.23	3.10	-0.87	0.27	0.003
Convneience of outdoor living areas to indoor living areas	32	2.16	3.00	-0.84	0.25	0.002
Service and Facilities Total	29	10.41	9.79	-0.62	0.57	0.280

61 items analyzed and on five of the ten subscales. The Benchmark house plan received significantly higher mean scores on eight of the items and on none of the subscales. The subscales on which the Solar Attic plan received significantly higher mean scores were: Storage, Kitchen, Bedrooms, Bathroom, and Laundry.

CHAPTER VII

PHASE II-B

RESIDENTS' EVALUATION OF THE BENCHMARK AND SOLAR ATTIC HOUSES

During the Phase II-B investigation, residents living in the Benchmark and Solar Attic houses were interviewed in order to obtain users' responses to living in the two house types. The investigation incorporated the use of the Housing Satisfaction Scale, as well as an interview schedule. The study was undertaken so that the reliability of the Housing Satisfaction Scale could be determined, and so that residents' evaluation of the Benchmark and Solar Attic houses could be ascertained, analyzed, and compared when appropriate.

Description of the Instruments

Several different data collection instruments were used in the Phase II-B investigation. The Housing Satisfaction Scale, which was developed and revised in Phase I-B, was incorporated into a mailed questionnaire that was sent to the selected Benchmark and Solar Attic residents (Appendix I). The scale contained 81 items categorized under the following headings: Layout of Floor

Plan, Storage, Living Areas, Dining, Kitchen, Bedrooms, Bathroom, Laundry, Appearance, Exterior, Systems, Structure and Materials, and Costs. The Solar Attic residents were asked to respond to eight additional items that were related to the Solar Attic system. All of these items required the respondent to rate how important each housing feature was to them and to rate their satisfaction with the feature. The residents rated the importance of each feature on a scale of: 1--Very Unimportant to 6--Very Important. They rated their satisfaction on a scale of: 1--Very Dissatisfied to 6--Very Satisfied.

The Housing Livability Interview Schedule was also used in this phase of the study (Appendix K). It was adapted by S-141 Technical Committee members involved with Objective A from an instrument developed for Objective C of the regional housing research project "Housing for Low- and Moderate-Income Families." The items on the interview schedule were related to: demographic charactertics, present housing characteristics, indicators of housing satisfaction and adjustment, and responses to the energy situation. Only certain items on the interview schedule were of importance to this study. These items are indicated by asterisks on the interview schedule in Appendix K.

The interview schedule also included a section developed by the investigator to determine the actual house plan of the residents. This section, which will be referred to as the House Plan Diagram, included questions to determine if the respondents lived in houses identical to the Benchmark and Solar Attic plans (plan nos. H5-41 and 7220 respectively). The interviewer was provided with the appropriate house plan (Appendix A) and was able to sketch in any changes that existed between the original plan and the actual dwelling. These changes were also recorded on the interview schedule.

The final data collection procedure was to photograph the houses of the respondents. Slides were taken on the interior and exterior of 22 of the 30 houses. These were used to visually record the respondents' homes and to verify some of the house plan diagrams.

The investigator was responsible for collecting data in Kentucky, Tennessee, Virginia, and West Virginia. Researchers associated with the state Agricultural Experiment Stations in Georgia and North Carolina also collected data. In order to assist the researchers and interviewers in the accurate and consistent use of these various data collection instruments, an interviewer manual was developed by the investigator. It included information about each item on the Housing Livability

Interview Schedule and about the diagraming of house plans. Interviewer training was conducted at the S-141 Annual Technical Committee Meeting, held at Joe Wheeler State Park in Rogerville, Alabama, October 1982.

Participants in the Study

The populations for this phase of the study were residents of Benchmark and Solar Attic houses in the six southern states of Georgia, Kentucky, North Carolina, Tennessee, Virginia, and West Virginia. Every identified and cooperative Solar Attic resident was involved in the study. For each Solar Attic household selected, a Benchmark household in the same geographic area was also identified and contacted.

The investigator and participating researchers identified the Solar Attic residents first. A letter was sent to persons who had contacted the RHRU for plan no. 7220. The letter asked them to return an enclosed postcard if they had actually built a solar attic house (correspondence in Appendix L). Response from this mailing was very limited in all states. Further attempts to identify residents of Solar Attic houses were made by contacting the U. S. Department of Housing and Urban Development which had provided funding for building houses of this type through the Cycle Grant Programs. Five households were identified through these programs. Residents were also identified by the Helio-thermics Company in Greenville, South Carolina, and by Solar Aztec of Athens, Georgia, both commercial suppliers of the solar attic system. In Virginia, two households were also identified by a county extension agent. Fifteen residents in the six states finally were identified and agreed to cooperate in the study (Figure 2).

Once the residents of Solar Attic houses were identified the investigator and researchers in the other states located Benchmark households in similar geographic areas. These households were identified by contacting the state Farmers Home Administration offices and then pursuing the search for these households with district and local FmHA offices (example of correspondence in Appendix L). Benchmark households were also identified by county extension agents and builders of Benchmark houses. Fifteen residents of Benchmark houses in the six states were identified and agreed to cooperate in the study (Figure 2).

Procedure for Data Collection

The procedure for collecting data was identical for residents of the Benchmark and Solar Attic houses. Residents were first contacted by a letter that explained

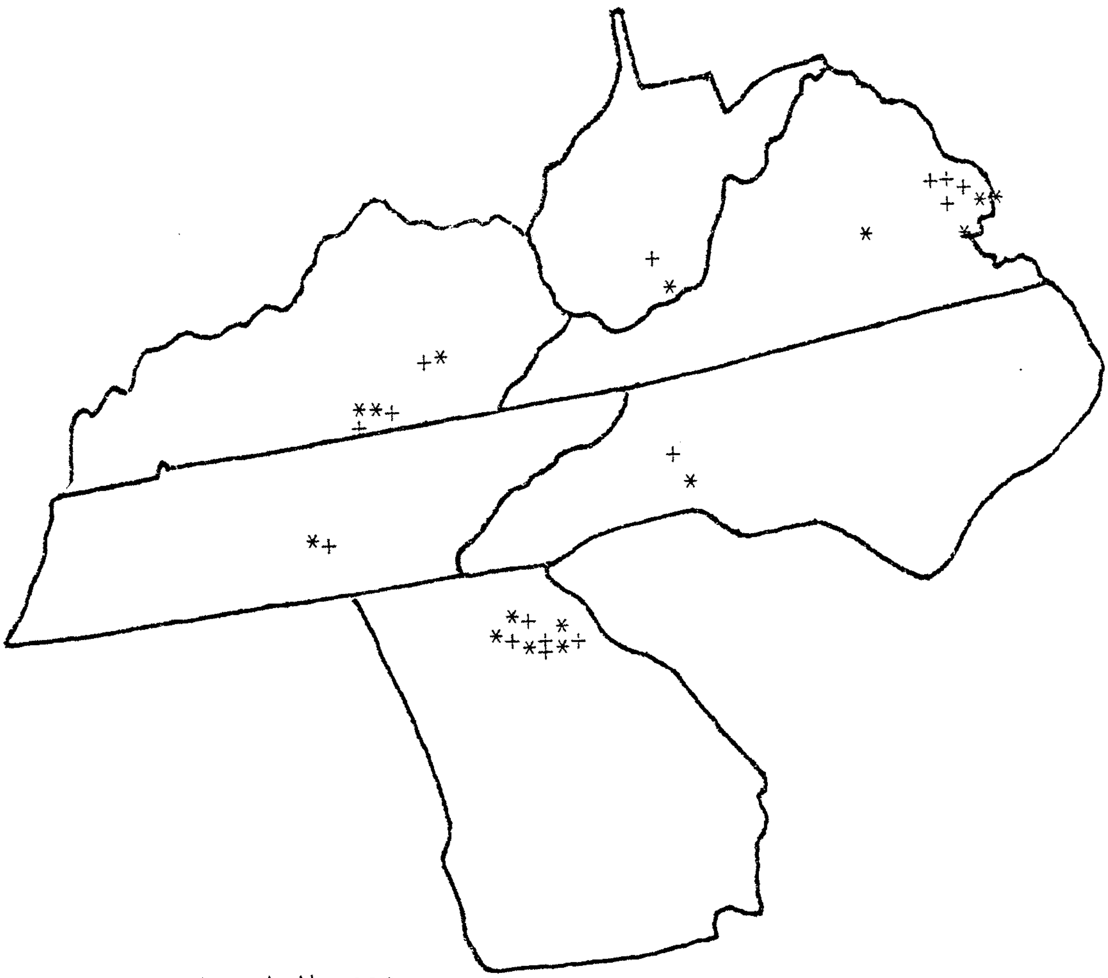

FIGURE 2

Location of Benchmark and Solar Attic Houses the study and asked for their cooperation. The investigator and participating researchers in other states followed the letter with a telephone call so that further explanations of the study could be made and an appointment for an interview could be arranged. A second letter followed the phone call in order to thank the respondents for their cooperation, confirm the appointment time, and ask them to complete the enclosed Housing Satisfaction Scale before the interview. Copies of the correspondence for data collection are in Appendix M. The investigator and researchers in other states then visited the households and completed the Housing Livability Interview Schedule, retrieved the Housing Satisfaction Scale, checked the House Plan Diagram to make sketches when appropriate, and photographed the interior and exterior of the houses when possible. Complete procedures for contacting the residents, arranging the interview, and conducting the interview were explained to the interviewers in the interviewer manual developed by the investigator.

Analyses of the Housing Livability Interview Schedule

Responses to the Housing Livability Interview Schedule were coded, transferred to the computer, and verified for accuracy. Various statistical procedures in the Statistical Analysis System (SAS Institute, 1982) were performed to test the hypotheses applicable to the data on this instrument.

In the following sections, the Benchmark and Solar Attic house types are described and compared on residents' demographic characteristics, housing characteristics, energy factors, and housing alterations.

Demographic Characteristics of the Respondenets

Demographic characteristics examined were household size, household income, stage in the family life cycle, and sex, age, race, marital status, years of education, employment, and occupation of household head. Household heads included the member from each household who identified him or herself as a head and the male member from those households that identified male and female coheads. In order to make meaningful comparisons it was necessary to combine the number of categories for the variable occupation of household head. The categories professional/technical; semi-professional; farmers and farm managers; and managers, officials, and proprietors were combined to form the category professional/managerial. The categories clerical, sales, craftsman and foremen, operators, farm laborers, laborers, domestic service workers, and other service workers were combined to form the category non-professional/ managerial. Annual household income was calculated using the variables frequency of payments, months worked, take home pay, and annual supplemental income. The computer program to calculate this variable was developed by Cavell (1982) for her analysis of one- and two-earner families in the Virginia sample of the S-141 Objective C data.

The average household in the Benchmark houses had 3.13 members. Seventy-three percent of the households were in the expanding stage of the family life cycle and 27 percent were in the contracting stage. The households were primarily white (73%) and were headed primarily by males (60%). Sixty percent of the respondents in the Benchmark sample were married, 26 percent were divorced, and 13 percent were widowed. The ages of the heads ranged from 25 to 65 and the average age of the household heads was 42.2. Amount of education for the household head ranged from 6 to 14 years and the average amount of education was 11.4 years. The majority of the heads were employed either part- or full-time (73%) and most of these persons were employed in non-professional/managerial occupations. The average annual household income for the Benchmark households was $12,279 with a range from $5,772 to $24,264.

The average size of the households in Solar Attic houses was 3.07. Fifty-three percent of these households were in the expanding stage of the family life cycle, 27 percent were in the beginning stage, and 20 percent were in the contracting stage. These households were entirely white and all of them were headed by males. A large proportion of the heads were married (93%), while only one head was divorced, and none of the heads were widowed. The age of the household heads ranged from 28 to 72 years and the average age was 40.8. The years of education for the household heads ranged from 12 to 17 and the average was 16 years. The majority of the heads were employed part or full-time (73%) and most of these persons were employed in professional/managerial occupations (67%). The average annual household income for the Solar Attic households was $31,910 and the incomes among the residents in this house type ranged from $10,380 to $77,900.

Comparison of Demographic Characteristics by House Type

In order to compare the demographic characteristics of the residents of the two house types the following hypothesis was tested:

> Ho 2: There is no difference between the residents of the Benchmark and Solar Attic houses on the following demographic characteristics:

a. household size
b. sex of household head
c. race
d. age of household head
e. stage in the family life cycle
f. years of education of household head
g. occupation of household head
h. household income

The Student's t test was used to determine if the mean scores on household size, age and years of education of household head, and household income differed between the residents of Benchmark and Solar Attic house types. The Fisher's Exact test (two-tailed) was used to determine if the residents in the Benchmark and Solar Attic house types differed significantly on the variables sex, race, and occupation of household head. The Fishers' Exact test is used with small samples to compute the probability of obtaining more extreme cell proportions when the marginal totals are equal to those observed on the 2 X 2 contingency table (Blalock, 1960). The chi-square test statistic was used to determine if the residents in the Benchmark and Solar Attic house types differed significantly in percentage distribution on the variable stage in the family life cycle. For each of these tests alpha was set at .05.

The residents of the two house types differed significantly on the variables sex of household head, years of education of household head, and annual household income (see Table 19). There were six female-headed

Table 19

Demographic Characteristics of Households by House Type

Variable	Benchmark	Solar Attic	Calculated p Value
Household Size			
N	15	15	0.932
Mean	3.13	3.07	
Standard Deviation	1.13	1.10	
Sex of Household Head (a)			
N	15	15	0.017
Male	60.0%	100.0%	
Female	40.0%	0.0%	
Race (b)			
N	15	15	0.099
White	73.3%	100.0%	
Black	26.7%	0.0%	
Age of Household Head			
N	15	15	0.826
Mean (years)	42.20	40.80	
Standard Deviation	12.40	13.16	
Stage in Family Life Cycle (c)			
N	15	15	0.099
Beginning Couple	0.0%	26.7%	
Expanding Family	73.3%	53.3%	
Contracting or Older Family	26.7%	20.0%	
Years of Education of Household Head			
N	13	15	0.049
Mean (years)	11.38	16.00	
Standard Deviation	2.29	1.31	

Table 19 -- Continued

Variable	Benchmark	Solar Attic	Calculated p Value
Occupation of Household Head (d)			
N	11	12	0.220
Professional/ Managerial	36.4%	66.7%	
Non-professional/ Managerial	63.6%	33.3%	
Annual Household Income			
N	11	15	0.001
Mean	$12,279	$31,910	
Standard Deviation	6.078	18,117	

(a) df=1; Phi=-0.50.
(b) df=1; Phi=0.39
(c) Chi-square=4.62; df=1; C=0.37.
(d) df=1; Phi=-0.30.

households in the Benchmark sample, while none of the Solar Attic households were headed by females. The phi value (.50) indicated that the magnitude of this relationship was moderate. The phi coefficient is the measure of association used with a 2 X 2 contingency table. The Solar Attic household heads had a higher mean number of years of education. The average Solar Attic household head was a college graduate (16.0 years), while the average Benchmark household head had not completed high school (11.4 years). The Solar Attic residents had higher annual incomes than the Benchmark households. The average annual household income for the Solar Attic households was $31,910, which is 2-1/2 times larger than the average annual household income of the Benchmark households ($12,279). There were no significant differences between the residents of the two house types regarding household size; stage in the family life cycle; race, age, and occupation of household head. The distribution among the categories for the variable stage in the family life cycle was uneven and over 20 percent of the cells had expected values of less than five. This may indicate that the chi-square test is not valid for testing this hypothesis. However, it did not seem appropriate to combine categories so that the Fisher's Exact test could be performed. In summary, sub-hypotheses b, f, and h of

Hypothesis 2 were rejected and sub-hypotheses a, c, d, e, and h were retained.

Housing Characteristics of the House Types

The following housing characteristics were examined: age of dwelling, length of residence, size of dwelling, tenure, and relative amount of income spent on housing. The variable relative amount of income spent on housing was calculated by multiplying the monthly house payment or rent by 12 and then dividing by annual household income.

The average age of the Benchmark house was 9.2 years, and the range of age was 3 to 18 years. The number of years that the residents had lived in the houses ranged from 1 to 18 years and the average length of residence was 8.3 years. The average size of the Benchmark house was 1018.4 square feet and the houses ranged in size from 960 to 1536 square feet. A large proportion of the Benchmark respondents were buying their home (87%), while a few had already paid for their dwelling or were renting (7% each). The relative amount of income spent on housing ranged from 6 to 30 percent, while the average Benchmark resident who made house payments spent 16 percent of his or her income on these housing costs.

The average age of the Solar Attic house was 3.4 years, and the range of age was 1 to 5 years. The number of years that the residents had lived in the houses also ranged from 1 to 5 years and the average length of residence was 2.8 years. The Solar Attic houses ranged in size from 1080 to 5550 square feet. The average size of the dwellings was 1872.67 square feet, but the median size was 1400 square feet. While the largest proportion of Solar Attic respondents were still paying for their housing (73%), 20 percent had already paid for the unit. Only one respondent (7%) was renting his house. The percent of income spent on housing ranged from 1 to 38 percent, while the average Solar Attic resident who made house payments spent 19 percent of his income on these housing costs.

Comparison of Housing Characteristics by House Type

In order to compare the housing characteristics of the two house types the following hypothesis was tested.

> Ho 3: There is no difference in the Benchmark and Solar Attic house types on the following housing characteristics:
>
> a. age of dwelling
> b. respondents' length of residence
> c. size of dwelling
> d. relative amount of income spent on housing

The Student's t test was used to determine if the mean scores on these variables differed. Alpha was set at .05.

The two house types differed significantly on the variables age of dwelling, length of residence, and size of dwelling (Table 20). The average Benchmark house was older (9.21 years) than the average Solar Attic house (3.4 years). The length of residency for the respondents living in the Benchmark houses was also longer (8.33) than for the Solar Attic residents (2.8 years). The average size of the Benchmark house was significantly smaller (1018.4 sq. ft.) than the Solar Attic house (1872.7 sq. ft.). The variability of the square footage of the Benchmark house as indicated by the standard deviation of the scores was also smaller. Most of the Benchmark houses had been built by the FmHA plan no. H5-41. The houses were financed primarily through the Farmers Home Administration which limited the size of the units. Several of the Solar Attic units were not built by the Solar Attic plan no. 7220, but were custum built. These houses were financed primarily through conventional sources that did not limit house size. The relative amount of annual household income spent on monthly housing payments was not significantly different for the two house types. This is also a reflection of the financing of the

Table 20

Housing Characteristics by House Type

Variable	Benchmark	Solar Attic	Calculated p Value
Age of Dwelling			
N	14	15	<0.001
Mean (years)	9.21	3.40	
Standard Deviation	4.79	1.40	
Length of Residence			
N	15	15	<0.001
Mean (years)	8.33	2.80	
Standard Deviation	5.08	1.32	
Size of Dwelling			
N	15	15	<0.001
Mean (square feet)	1018.40	1872.67	
Standard Deviation	147.99	1131.01	
Relative Amount of Income Spent on Housing			
N	11	11	0.530
Mean (percent)	16	19	
Standard Deviation	0.80	0.10	

Benchmark houses through the low-cost mortgages of the Section 502 FmHA program. In summary, sub-hypothesis a, b, and c of Hypotheses 3 were rejected and sub-hypothesis d was retained.

Alterations to the Houses

Past housing alterations were examined using the house plan diagrams as well as the respondents' report of alterations. Only those houses that were built by one of the two selected plans (plan no.H5-41 and plan no. 7220) were included in this discussion. Alterations, improvements, and repairs planned by all of the respondents were also examined.

In the final sample 12 of the Benchmark houses were built by the H5-41 or H5-41a plan. The other three Benchmark houses were of a size and design similar to these plans, but varied enough that they could not be categorized as being built by this plan. Diagrams of the actual Benchmark house plans found in this sample are in Appendix N. Among the 12 houses built by the H5-41 plans there were a variety of housing alterations performed prior to construction or in past remodeling that slightly changed the design of the house plan. The most frequent changes prior to construction included the installation of a chimney flue in the living room closet, the rearrangement of doors and windows in the kitchen and dining area, and the inclusion of walls separating the living and dining areas. Some of the more unique changes prior to construction were the inclusion of a fireplace, the installation of a bathroom in the closet area, the installation of a closet over the basement stairs, and the rearrangement of bedroom closets so that one bedroom had two. Most of the alterations since construction involved cosmetic changes such as adding shelving in the utility area. Exterior improvements such as landscaping and the addition of outdoor living and storage areas were also performed by some of the Benchmark residents. Two households had made major alteration by adding on to their housing. One household had converted their basement to a recreation and utility area and one household was completing a 24-foot extension to the home. The added area provided a master bedroom, bath, and walk-in closet.

The planned alterations, improvements, and repairs of all Benchmark residents were also examined. Exterior and interior painting were the most frequently mentioned improvements (33%). Caulking, weatherstripping, and the addition of a fireplace or wood stove was mentioned by 27 percent of the Benchmark respondents. The average number of alterations, improvements, and repairs planned by the Benchmark households was 2.8.

Only six of the Solar Attic houses in the sample were built by plan no. 7220. Most of the Solar Attic houses had been custum built and many had been built and designed by the residents. Diagrams of eleven of the actual Solar Attic house plans found in this sample are in Appendix N. All of the houses built by the 7220 plan were altered prior to construction, however they did maintain the size and general design of this plan. Some of the alterations made prior to construction included the rearrangement of the laundry and bathroom area so that two bathrooms were included in the design. The living-dining-kitchen area was rearranged in several of the houses so that the living area was in the front of the house. In a few of the houses the air-lock entry had been eliminated. A few of the houses had added wood stoves or fireplaces prior to or after construction. Other alterations made after construction included the addition of shelving in utility areas, the enclosure of the patio, and the installation of a greenhouse.

Among the total sample of Solar Attic respondents several housing alterations, improvements, and repairs were planned. Improving landscaping was planned by 80 percent of the sample, exterior painting by 53 percent, and cosmetic changes by 40 percent. The average number of alterations, improvements, and repairs planned by the Solar Attic residents was 4.47.

Comparison of Housing Alterations by House Type

In order to compare the number of housing alterations occurring in the two house types the following hypothesis was tested:

> Ho 4: There is no difference in the Benchmark and Solar Attic houses on the following housing alterations:
>
> a. number of past housing alterations
> b. number of planned housing alterations, improvements, and repairs

The Student's t test was used to determine if the mean number of past alterations and planned alterations, improvements, and repairs differed between the two house types. Alpha was set at .05. There were no significant differences in the mean number of past alterations or planned alterations, improvements, and repairs between the two house types (Table 21). Both sub-hypotheses of Hypothesis 4 were retained.

Energy Useage and Features

Several variables related to energy useage by the residents in the two house types were examined. These included: types of utilities, amount of utilities, types

Table 21

Housing Alterations by House Type

Variable	Benchmark	Solar Attic	Calculated p Value
Number of Past Housing Alterations			
N	12	6	0.195
Mean	1.75	3.50	
Standard Deviation	1.91	1.05	
Number of Planned Housing Alterations, Improvements, and Repairs			
N	15	15.00	0.467
Mean	2.80	4.47	
Standard Deviation	3.26	2.67	

of energy saving features present, belief in energy crisis, and changes made to reduce utility costs. Respondents were asked to give their permission for their electric utility and natural gas suppliers to provide the investigator with their utility useage for the past year.

All of the Benchmark houses used electricity, 33 percent used wood, 27 percent used natural gas, 13 percent used kerosene, and none used bottled gas (Table 22). The annual amount of electricity used by the Benchmark households ranged from 6,159 to 21,180 kilowatt hours. The average amount of wood used annually was 3 cords. The amount of natural gas used was not reported and the average amount of kerosene used was 30 gallons annually. All of the Benchmark houses had ceiling and wall insulation, 86 percent had floor insulation, 80 percent had storm doors and caulking, 73 percent had storm windows and weather stripping, 64 percent had exterior insulation for the water heater, 20 percent had double pane windows, and 13 percent had plastic covering on the windows. Fifty-three percent of the Benchmark residents did not believe that there is an energy crisis, but 73 percent of the households had made changes to reduce their utility costs. These changes included using appliances more efficiently (63%), using a wood stove or energy efficient heater (55%), lowering water heater thermostat (55%),

Table 22

Utility Useage by House Type

Variable	Benchmark	Solar Attic	Calculated p value
Type of Utility Used			
Electricity	100.0%	100.0%	
Natural Gas	26.7%	0.0%	
Bottled Gas	0.0%	3.3%	
Wood	33.3%	73.3%	
Kerosene	13.3%	26.7%	
Amount of Electricity Used			
N	10	14	0.039
Mean (a)	0.0034	0.0026	
Standard Deviation	0.0018	0.0009	

(a) annual kWh/ square footage/ 1982 heating degree days closing off rooms (55%), lowering thermostat in winter (38%), and reducing wattage or lighting use (36%).

All of the Solar Attic houses used electricity, 73 percent used wood, 27 percent used kerosene, 3 percent used bottled gas, and none used natural gas (Table 22). The annual amount of electricity used by the Solar Attic households ranged from 8,400 to 26,165 kilowatt hours. The average amount of wood used annually was 1.6 cords. The average amount of kerosene used annually was 50 gallons and the one family using bottled gas used 34 pounds annually. All of the Solar Attic houses had ceiling and wall insulation, 93 percent had double pane windows, 87 percent had weatherstripping and caulking, 80 percent had exterior insulation for the water heater, 75 percent had floor insulation, 53 percent had storm doors, 40 percent had storm windows, and none of the houses had plastic coverings on the windows. Eighty percent of the residents in Solar Attic houses believed that there is an energy crisis and 93 percent had made changes to reduce their utility costs. These changes included using a wood stove or energy efficient heater (86%), using fans instead of air conditioners (79%), adding or increasing insulation (79%), lowering thermostat in winter (71%), using appliances more efficiently (64%), lowering water heater thermostat (64%), reducing wattage or lighting use (57%), weatherstripping and caulking (57%), raising thermostat in summer (57%), adding storm or double pane windows (50%), closing off rooms (50%), and adding insulation to water heater (36%).

Comparison of Energy Useage and Features by House Type

In order to compare the energy characteristics of the house types the following hypothesis was tested:

> Ho 5: There is no difference between the Benchmark and Solar Attic house types on the following energy characteristics:
>
> a. amount of electricity used
> b. presence of energy saving features
> c. changes to reduce utility costs

The Student's t test was used to determine if the mean amount of electricity used by the two house types was significiantly different. Fisher's Exact test was used to determine if the two house types differed significantly in the presence of energy saving features and in the changes made by residents to reduce utility costs. For both tests alpha was set at .05. The variable amount of electricity was determined by dividing the annual amount of kilowatt hours by the square footage of the house and dividing this score by the heating degree-days of each locality. A degree-day is a unit that represents one degree of declination from a standard temperature in the average temperature of one day (_Webster's New World Dictionary_, 1970). The 1982 heating degree-days for the various locations of the different houses was obtained from the National Climatic Data Center in Asheville, North Carolina.

The two house types were significantly different in the adjusted amount of electricity used (Table 22). The Benchmark houses had an average score of 0.0034 on this variable, indicating that these houses used more electricity than the Solar Attic houses (0.0026) when the annual kilowatt hour useage was adjusted for house size and geographic location. The two house types did not differ significantly on the presence of most of the ten energy saving features; however, there were significantly more double pane windows present in Solar Attic houses (93%) than in Benchmark houses (20%) (Table 23). The proportion of Benchmark and Solar Attic residents who had made changes to reduce utility costs differed significantly on the following: added or increased insulation, added storm or double pane windows, used fans instead of air conditioner, and added insulation to water heater (Table 24). For each of these variables, a larger proportion of Solar Attic respondents reported that they had completed the activity that would reduce their utility consumption. The phi values (.40, .60, .51, and .44)

Table 23

Presence of Energy Saving Features by House Type

Variable	Benchmark N	Benchmark Percent	Solar Attic N	Solar Attic Percent	Calculated p Value
Ceiling Insulation	14	100.0	15	100.0	
Wall Insulation	13	100.0	15	100.0	
Floor Insulation (a)	14	85.7	12	75.0	0.635
Storm Windows (b)	15	73.3	15	40.0	0.140
Double Pane Windows (c)	15	20.0	15	93.3	<0.001
Plastic Covering on Windows (d)	15	13.3	15	0.0	0.483
Storm Doors (e)	15	80.0	15	53.3	0.245
Weatherstripping (f)	15	73.3	15	86.7	0.651
Caulking (g)	15	80.0	15	86.7	1.000
Exterior Insulation for Water Heater (h)	14	64.3	15	80.0	0.427

(a) df=1: Phi=-0.14.
(b) df=1; Phi=-0.34.
(c) df=1; Phi=0.74.
(d) df=1; Phi=-0.27.
(e) df=1; Phi=-0.28.
(f) df=1; Phi=0.17.
(g) df=1; Phi=0.09.
(h) df=1; Phi 0.18.

Table 24

Changes to Reduce Utility Costs by House Type

Variable	Benchmark N=11	Solar Attic N=14	Calculated P Value
Lowered thermostat in winter (a)	37.7%	71.4%	0.116
Raised thermostat in summer (b)	18.2%	57.1%	0.099
Added or increased insulation (c)	18.2%	78.6%	0.005
Added storm or double pane windows (d)	9.1%	50.0%	0.042
Used wood stove or energy efficient heater (e)	54.6%	85.7%	0.178
Used appliances more efficiently (f)	63.4%	64.3%	1.000
Lowered water heater thermostat (g)	54.6%	64.3%	0.697
Reduced wattage or lighting use (h)	36.4%	57.1%	0.428
Weatherstripped and caulked (i)	18.2%	57.1%	0.099
Closed off rooms (j)	54.6%	50.0%	1.000
Covered windows with plastic (k)	9.1%	0.0%	0.440
Used fans instead of air conditioner (l)	27.3%	78.6%	0.017
Added insulation to water heater (m)	0.0%	35.7%	0.047

(a) df=1; Phi=-0.35.
(b) df=1; Phi=-0.40.
(c) df=1; Phi=-0.60.
(d) df=1; Phi=-0.44.
(e) df=1; Phi=-0.35.
(f) df=1; Phi=-0.01.
(g) df=1; Phi=-0.10.
(h) df=1; Phi=-0.21.
(i) df=1; Phi=-0.40.
(j) df=1; Phi=0.05.
(k) df=1; Phi=0.23.
(l) df=1; Phi=-0.51.
(m) df=1; Phi=-0.44.

indicated that the magnitude of these relationships was moderate. All three sub-hypotheses of Hypothesis 5 were rejected.

General Indicators of Housing Satisfaction

Several questions on the interview schedule were general indicators of the respondents' housing satisfaction and inclination to make housing adjustments. These variables included an examination of why the respondents' selected their housing, an overall measure of housing satisfaction, the most and least liked features of their housing, and the desire to move.

Respondents were asked to identify reasons why they had selected their present dwelling. The item "location; neighborhood" was mentioned most frequently by the Benchmark sample (60%) and affordablity was also mentioned by a large proportion of the respondents (53%). The provision of more space and the limited choice of housing at the time of their purchase were both mentioned by 27 percent of the Benchmark households. All of the Benchmark households reported being satisfied or very satisfied with their present dwelling. Their average score on the overall housing satisfaction question was 1.47 when 1 was Very Satisfied and 5 was Very Dissatisfied. Location was rated the most liked feature about where they lived by the greatest proportion of respondents (67%). Neighborhood and privacy were both rated the most liked feature by 13 percent of the sample, and only one person (7%) rated the house design as the most liked feature. There was no consensus on what the least liked feature was. Twenty percent cited neighborhood and 13 percent each cited location, lack of privacy, and traffic. Only one respondent cited the cost of utilities as the least liked feature. Sixty percent of the Benchmark families reported that they did not desire to move. Their reasons for not desiring to move were: location (56%), house meeting the family's needs (56%), and convenience (44%). For the 40 percent that did desire to move the main reasons reported were that the present house was the wrong size (33%) and that the respondents planned to build or buy a new house (33%).

The item "location; neighborhood" was the most frequently cited reason for selecting the Solar Attic houses (87%); however, each of the following items were also cited by 80 percent of the sample: house design, innovative feature, and energy savings. Many of the respondents had built the house (60%), they felt that it was affordable (60%) and that it provided them with more space (53%). Most of the Solar Attic respondents reported being satisfied or very satisfied with their present dwelling. The average score on the overall satisfaction variable was 1.33 on a scale of 1 to 5. The most liked features of their housing were house design (43%) and location (29%). Twenty percent each reported that the least liked aspect of their housing was the neighborhood, the site and yard, or the cost of the unit. Most of the Solar Attic respondents did not desire to move (67%) and cited the following reasons: location (80%), not liking to move (80%), house meeting family needs (70%), economic reasons (70%), convenience (70%), innovative features (60%), costs of utilities (60%), and privacy (50%). For the 33% that did desire to move most planned to build or buy a new house (60%).

Comparison of General Indicators of Housing Satisfaction by House Type

The house types were compared on a few of the variables that were general indicators of housing satisfaction or adjustment. The following hypothesis was tested.

> Ho 6: There is no difference between the Benchmark and Solar Attic house types on the following:
>
> a. respondents' reasons for selecting their housing
> b. respondents' overall housing satisfaction
> c. respondents' desire to move

Fisher's Exact test was used to determine if the respondents of the two house types differed in their reasons for selecting their house and in their desire to move. The Student's t test was used to determine if the mean scores on the overall housing satisfaction variable differed significantly. For all tests alpha was set at .05.

Significantly more Solar Attic respondents reported that they selected their housing because of the house design, the presence of innovative features, and the energy savings they thought the house would have (Table 25). The phi values for these variables (.60, .82, and .67) indicate that the relationship between house type and these reasons for selecting the housing were fairly strong. The respondents of the two house types did not differ in their overall rating of housing satisfaction or in their desire to move (Table 26). Sub-hypothesis a of Hypothesis 6 was rejected, but sub-hypotheses b and c were retained.

Analyses of the Housing Satisfaction Scale

Responses to the Housing Satisfaction Scale were coded transferred to computer, and verified for accuracy. Respondents had rated the importance of each feature on a scale of 1 to 6 and they had rated their satisfaction with

Table 25

Reasons for Selecting Dwelling by House Type

Variable	Benchmark N=15	Solar Attic N=15	Calculated p Value
Affordable (a)	53.3%	60.0%	1.000
Location; neighborhood (b)	60.0%	86.7%	0.215
House design; plan and layout (c)	20.0%	80.0%	0.003
Built new house (d)	20.0%	60.0%	0.060
Provide more space (e)	26.7%	53.3%	0.264
Limited choice; needed immediately (f)	26.7%	0.0%	0.100
Innovative feature (g)	0.0%	80.0%	<0.001
Energy savings (h)	13.3%	80.0%	0.001
Inherited or gift (i)	0.0%	6.7%	1.000
School district (j)	6.7%	20.0%	0.598
Be near family (k)	13.3%	26.7%	0.651

(a) df=1; Phi=-0.07.
(b) df=1; Phi=-0.30.
(c) df=1; Phi=-0.60.
(d) df=1; Phi=-0.41.
(e) df=1; Phi=-0.27.
(f) df=1; Phi=0.39.
(g) df=1; Phi=-0.82.
(h) df=1; Phi=-0.67.
(i) df=1; Phi=-0.19.
(j) df=1; Phi=-0.20.
(k) df=1; Phi=-0.17.

Table 26

General Indicators of Housing Satisfaction by House Type

Variable	Benchmark	Solar Attic	Calculated p Value
Overall Housing Satisfaction			
N	15	15	0.513
Mean (a)	1.47	1.33	
Standard Deviation	0.52	0.62	
Desire to Move (b)			
N	15	15	1.000
Yes or Maybe	40.0%	33.3%	
No	60.0%	66.7%	

(a) 1=Very satisfied; 2=Satisfied; 3=Neither satisfied or dissatisfied; 4=Dissatisfied; 5=Very dissatisfied.

(b) df=1; PPhi=0.07.

each feature on a scale of 1 to 6. These responses were combined and a weighted score was assigned that took into account both importance and satisfaction. These weightings were developed by Goss (1982) and based on an index developed by Morris (1976). The weighted scores ranged from 0 to 17, with 0 meaning the respondent was very dissatisfied with a feature that was very important. A score of 17 meant the respondent had indicated that the feature was very important and he or she was very satisfied. The complete weighted scores are in Appendix O. These weighted scores were assigned when the responses to the Housing Satisfaction Scale were coded and have been used in all analyses. Inter-rater reliability of the Housing Satisfaction Scale was determined by a data transformation that organized the data so that the General Linear Model (SAS Institute, 1982) could be used to perform the appropriate analysis of variance procedure. Further analysis for this reliability procedure was performed with a calculator. A second reliability procedure, Cronbach's Alpha was performed using the reliability procedure specified in *SPSS*^{x} (SPSS, 1983). The t-test procedure specified in the *Statistical Analysis System* (SAS Institute, 1982) was used to test the sub-hypothesis related to the Housing Satisfaction Scale.

In the following sections, residents' satisfaction with Benchmark and Solar Attic housing are examined, the reliability coefficients of the Housing Satisfaction Scale are reported, and mean scores for items and subscales are compared.

Responses to the Housing Satisfaction Scale

Benchmark respondents. The Benchmark residents had mean scores on the Housing Satisfaction Scale ranging from 7.71 to 16.93. There were seven items with an average rating of 16 or above, 53 items between 13 and 15, 20 items between 9 and 12, and only one item with a score of 8 or less. All scores above 9 indicated that the residents had expressed some degree of satisfaction. The higher the score the greater the satisfaction and the greater the importance. The item with the highest score was "house payment or rent" and the item with the lowest score was "private outdoor living areas." Other items receiving high mean scores were related to the structural soundness of the home, the materials used in construction, location and number of electrical outlets, closets in other bedrooms, and access between different areas in the house. The items that received low satisfaction ratings by the Benchmark respondents were related to size of living areas, master bedroom, and laundry area; number of bathrooms, dining areas, and living areas; flexibility in room uses; arrangment of furniture in the primary living area and the master bedroom; children's play area indoors; entry, bathroom, outdoor, and car storage; control of noises from outside; privacy from neighbors; control of humudity; and security systems.

Solar Attic respondents. The Solar Attic residents had mean scores on the Housing Satisfaction Scale ranging from 8.20 to 16.29. There were 17 items with an average rating of 16 or above, 53 items between 13 and 15, nine items between 9 and 12, and two items with 8 or less. The item with the highest score was "appearance of inside of home." The two items "ability to arrange furniture to avoid traffic - secondary" and "size of living area - secondary" had the lowest mean scores. Other items receiving high mean scores were related to the structural soundness of the home, the number and location of bathrooms, the location and design of the kicthen, materials and ease of cleaning, arrangement and number of rooms, exterior appearance, energy efficiency, control of external noises, and privacy. The items that received low satisfaction ratings by the Solar Attic respondents were related to the number of levels in the home, children's play area indoors, arranging furniture in the secondary living area and in the master bedroom, storage for out-of-season clothes, outdoor storage, control of humidity, and security systems.

The Solar Attic residents responded to eight additional items that were related to specific features of the Solar Attic design. The mean score ratings on these items ranged from 12.60 to 15.87 (Table 27). The lowest rating was on the item "attic storage" and the highest rating was on "exterior wall thickness." The high satisfaction-importance ratings indicated that these respondents thought the Solar Attic features were satisfactory and that most of these features were important.

Reliability of the Housing Satisfaction Scale

Two different measures of reliability were calculated on the respondents' ratings on each of the Housing Satisfaction subscales. Inter-rater reliability using Ebel's (1951) formula was determined for the respondents living in houses built by the Benchmark and Solar Attic plans (HS-41 and 7220). Internal consistency reliability was determined for all responses. Inter-rater reliability is an indication that the items on the instrument are being rated in a consistent manner by all of the respondents. Since the scores used in this analysis were from respondents living in basically the same house, it

Table 27

Satisfaction-Importance Ratings of
Solar Attic Features

Variable	N	Mean	SD
Shape of roof	15	13.67	3.58
Attic storage	15	12.60	4.52
Exterior wall thickness	15	15.87	1.85
Air lock entry	10	12.90	6.37
Heating controls	15	14.00	5.01
Manual conversion of system in summer and winter	11	13.18	4.90
Floor temerature	15	15,73	2.09
Ceiling temperature	15	14.53	2.70

was assumed that these respondents should be consistent in the way that they rated their houses. Internal consistency reliability is an indication that the items on a particular subscale are measuring the same concept and that each respondent has been consistent in the rating given to each item on the subscale. Cronbach's alpha coefficient is a measure of inter-item covariance that was used to determine the internal consistency reliability of the subscales.

Inter-rater reliability. In order to calculate Ebel's formula of inter-rater reliaiblity it was necessary to transform the data set so that an item number and its score were on each record. The data were sorted by house type so that only the responses from the 12 Benchmark residents in houses built by plan no. H5-41 and the six Solar Attic residents in houses built by plan no. 7220 were used in the analysis. "Respondent number" and "question" were the variables used in an analysis of variance for each subscale as specified in the SAS General Linear Model (SAS Institute, 1982). This procedure provided information about the mean square for the questions and for the error. Both of these factors were used in the calculation of Ebel's formula.

The inter-rater reliability of the Housing Satisfaction subscales by house type are presented in

Table 28. Although the inter-rater reliaiblity coefficient can be no greater than 1, there is no lower limit to the ratio. All ratings of 0 or below indicate that respondents have not been consistent in their evaluation of the various items on the subscales. The inter-rater reliability of the Benchmark responses indicate that the respondents were consistent to highly consistent in their ratings of the items on the Costs and Appearance subscales. They were moderately consistent in their ratings of the items on the Layout of Floor Plan, Structure and Materials, and Systems subscales. There was also some consistency among the ratings of the Bedroom subscale. The low inter-rater reliability ratings on the other subscales indicate that the respondents were not consistent in their ratings.

The inter-rater reliability of the Solar Attic responses indicate that the respondents were consistent to highly consistent in their ratings of the items on the Layout of Floor Plan and Storage subscales. They were moderately consistent in their ratings of the items on the Bath, Laundry, and Structure and Materials subscales. The low inter-rater reliability ratings on the other subscales indicate that the respondents were not consistent in their ratings.

Table 28

Reliability Coefficients of the Housing Satisfaction Subscales

Subscales	Inter-rater		Internal Consistency	
	Benchmark	Solar Attic	Benchmark	Solar Attic
Layout of Floor Plan	0.44	0.75	0.83	0.87
Storage	- 0.02	0.51	0.86	0.91
Living Area	0.13	- 1.57	0.96	0.81
Dining	- 0.12	- 0.16	0.61	0.64
Kitchen	- 1.52	- 0.05	0.76	0.92
Bedrooms	0.24	- 5.75	0.90	0.91
Bathroom	0.05	0.47	0.83	0.85
Laundry	0.09	0.37	0.93	0.87
Exterior	0.02	- 1.14	0.78	0.61
Appearance	0.55	0.00	0.99	0.85
Systems	0.35	- 1.14	0.81	0.79
Structure and Materials	0.43	0.39	0.85	0.79
Costs	0.77	-34.22	0.47	0.16

The inconsistency of the ratings would occur if one resident rated an item very important - very satisfied (17) and another respondent rated the same item very important - very dissatisfied (0) and visa versa on other items within the subscale. Although the house types that the Benchmark and Solar Attic respondents lived in were basically the same, there was some variation in design that might have affected their responses. There were also variations within each sample on such variables as household size, stage in the family life cycle, income, relative amount of income spent on housing, age of dwelling, and length of residence which may have affected the respondents' ratings. Other factors that may have affected the inter-rater reliability of the subscales were the clarity of the items, the respondents' ability to understand the items, and their inclination to rate each item with the same score.

Internal consistency reliability. The internal consistency of the subscales of the Housing Satisfaction Scale was determined using the reliability procedure specified in SPSS^{x} (SPSS, 1983). This procedure calculated Cronbach's Alpha coefficient for each subscale by house type. The coefficients indicated that most of the Housing Satisfaction subscales were highly reliable (Table 28). The responses of Benchmark and Solar Attic residents had reliability ratings of .60 or above on twelve of the 13 subscales. High reliability indicates that the respondents were providing similar responses to each of the items in a subscale and that the items were very closely related. The subscales that had lower reliability coefficients might have more diverse items that were not closely related. The Costs subscale received the lowest coefficient for residents of both house types. Items on this subscale related to house payment, maintenance costs, and utility costs. An examination of the means of the respondents indicated that the Benchmark respondents were very satisfied with their house payments but not as satisfied with their utility costs. The Solar Attic respondents were satisfied with their utility costs but not with their house payments. All of these responses are understandable considering the reduced housing costs that the Benchmark households experienced as part of the FmHA Section 502 program and the energy savings experienced by the Solar Attic residents. If internal consistency of each subscale is desired then the items on the Costs subscale should not be grouped together or several other items related to costs should be added to it. Reliability coefficients for a scale can be increased by increasing the number of related items (Kerlinger, 1973).

Comparison of Responses to the Housing Satisfaction Scale by House Type

In order to compare the Benchmark and Solar Attic residents' responses to the Housing Satisfaction Scale the following null hypotheses was tested:

> Ho 7: There is no difference in the mean scores the Benchmark and Solar Attic residents assigned to the following subscales of the Housing Satisfaction Scale:
>
> a. Layout of Floor Plan
> b. Storage
> c. Living Areas
> d. Dining
> e. Kitchen
> f. Bedrooms
> g. Bath
> h. Laundry
> i. Appearance
> j. Exterior
> k. Systems
> l. Structure and Materials
> m. Costs

The Student's t test was used to determine if the mean scores on these subscales were significantly different. Alpha was set at .05. In the following subsections the differences between the mean ratings of each of the subscales of the Housing Satisfaction Scale and the items within each subscale are reported and discussed.

Layout of Floor Plan. The Solar Attic respondents rated their housing significantly higher on seven of the

Table 29

Residents' Mean Rating of Benchmark and Solar Attic Housing Satisfaction Scale Items and Subscale: Layout of Floor Plan

Variable	Benchmark			Solar Attic			Calculated p value
	N	Mean	SD	N	Mean	SD	
Separation of work, living and sleeping areas	14	14.21	4.21	15	15.20	1.74	0.002
Privacy for family members	14	14.43	4.13	15	15.46	1.46	<0.001
Separation of children and parent areas	14	14.14	3.16	12	15.50	1.68	0.043
Children's play area indoors	14	10.36	6.44	11	11.36	5.68	0.700
Children's play area outdoors	11	13.00	5.95	12	15.08	2.75	0.018
Number of rooms	15	14.07	4.43	14	15.79	1.25	<0.001
Access between different areas in house	15	15.60	1.45	14	14.57	3.84	0.001
Arrangement of rooms	15	14.94	4.03	14	15.93	1.27	<0.001
Number of levels in home	14	13.86	4.42	15	11.93	5.66	0.378
Types of rooms	13	14.54	3.67	14	14.21	3.89	0.846
Flexibility of spaces for more than one use	15	10.87	6.47	15	14.07	3.73	0.048
Layout of Floor Plan Total	9	141.78	33.80	10	161.80	24.22	0.340

eleven items on the subscale Layout of Floor Plan (Table 29). These seven items were: "separation of work, living and sleeping areas," "privacy for family members," "separation of children and parent areas," "children's play area outdoors," "number of rooms," "arrangement of rooms," and "flexibility of spaces for more than one use." The Benchmark respondents rated their housing significantly higher on one item, "access between different areas in house." The Benchmark respondents also rated their housing higher on the items "number of levels in home" and "types of rooms," but there was no significant differences in their ratings and those of the Solar Attic respondents. "children's play area indoors" was the only item rated higher by the Solar Attic respondents than by the Benchmark respondents that was not significantly different. When the scores for the subscale Layout of Floor Plan were combined several cases were eliminated because they had missing information on one of the items in the subscale. There was no significant difference between the mean scores of the Layout of Floor Plan subscale and the null hypothesis for this subscale was retained.

<u>Storage</u>. The respondents rated only one of the eight items on the Storage subscale significantly different (Table 30). Benchmark respondents were significantly more

satisfied with the feature "closet in other bedroom." The Benchmark respondents also rated the following items higher than the Solar Attic respondents, but there were no significant differences: "storage for out-of-season clothes," "storage for cleaning equipment and supplies," and "outdoor storage for lawn and yard equipment." The Solar Attic respondents rated the following four items higher than the Benchmark respondents and there were no significant differences: "closet in master bedroom," "storage for household linens," "storage at entry," and "storage space in bath." When the items on the Storage subscale were combined there was no significant difference in the mean scores, therefore, the null hypothesis for the Storage subscale was retained.

Living Area. Most of the respondents did not have a second living area; therefore, the four items related to this space were not included in the Living Area subscale. The respondents rated their houses significantly different on only one of the five remaining items on this subscale (Table 31). The Solar Attic respondents were significantly more satisfied than the Benchmark respondents on the item "size of living area - primary." The Solar Attic respondents also reported greater satisfaction on all of the other items on the subscale, but the ratings were not significantly different. The items were "number of living

Table 30

Residents' Mean Rating of Benchmark and Solar Attic Housing Satisfaction Scale Items and Subscale: Storage

Variable	Benchmark			Solar Attic			Calculated p value
	N	Mean	SD	N	Mean	SD	
Closet in master bedroom	15	14.00	5.14	15	14.47	4.60	0.681
Closet in other bedroom	15	15.60	1.64	15	13.93	4.68	<0.001
Storage for out-of-season clothes	15	13.87	5.37	15	11.60	6.28	0.567
Storage for household linens	15	12.53	6.11	15	14.13	5.11	0.515
Storage for cleaning equipment and supplies	15	14.53	4.00	15	12.93	6.19	0.113
Outdoor storage for lawn and yard equipment	15	12.33	6.06	15	12.27	5.89	0.917
Storage at entry	15	11.60	6.46	15	12.93	5.43	0.526
Storage space in bath	14	11.86	6.44	15	12.80	5.75	0.675
Storage Total	14	107.14	30.56	15	105.07	34.90	0.638

Table 31

Residents' Mean Rating of Benchmark and Solar Attic Housing Satisfaction Scale Items and Subscale: Living Area

Variable	Benchmark			Solar Attic			Calculated p value
	N	Mean	SD	N	Mean	SD	
Number of living areas	15	11.13	6.53	15	13.60	5.11	0.369
Flexibility in arranging furniture - Primary	15	11.87	5.89	15	13.60	4.69	0.403
Ability to arrange furniture to avoid traffic - Primary	15	12.07	5.98	15	14.00	4.07	0.162
Size of living area - Primary	15	11.47	7.00	14	15.00	3.42	0.014
Ability to arrange furniture for conversation - Primary	15	13.20	5.48	15	13.47	4.47	0.456
Living Area Total	15	59.73	28.96	14	71.14	15.15	0.025

areas," "flexibility in arranging furniture - primary," "ability to arrange furniture to avoid traffic - primary," and "ability to arrange furniture for conversation - primary." When all the items were combined to form the Living Area subscale the Solar Attic respondents had rated their housing significantly higher than the Benchmark respondents and the null hypothesis for this subscale was rejected.

Dining. None of the three items on the Dining subscale were significantly different; however, the Solar Attic respondents reported greater satisfaction than the Benchmark respondents on each of the items (Table 32). These items were "size of dining space," "location of dining area," and "number of dining area." When these items were combined to form the Dining subscale there was no significant difference in the mean score and the null hypothesis was retained.

Kitchen. The Solar Attic respondents rated each of the seven items on the Kitchen subscale higher than the Benchmark respondents (Table 33). Four of these items were significantly higher: "amount of counter space," "amount of storage space," "location of kitchen," and "counter and cabinet finishes." The items that were not significantly different were "arrangement of work space," "arrangement of storage space," and "traffic pattern in kitchen." When

Table 32

Residents' Mean Rating of Benchmark and Solar Attic Housing Satisfaction Scale Items and Subscale: Dining

Variable	Benchmark N	Benchmark Mean	Benchmark SD	Solar Attic N	Solar Attic Mean	Solar Attic SD	Calculated p value
Size of dining space	15	12.67	6.39	13	13.92	4.59	0.258
Location of dining area	15	13.87	5.80	13	13.92	4.55	0.406
Number of dining areas	14	12.07	6.40	11	12.45	5.66	0.708
Dining Total	14	38.07	17.25	11	40.36	14.93	0.656

Table 33

Residents' Mean Rating of Benchmark and Solar Attic Housing Satisfaction Scale Items and Subscaale: Kitchen

Variable	Benchmark N	Benchmark Mean	Benchmark SD	Solar Attic N	Solar Attic Mean	Solar Attic SD	Calculated p value
Amount of counter space	15	13.47	6.17	15	15.40	3.56	0.048
Amount of storage space	15	13.27	6.10	15	16.07	1.28	<0.001
Arrangement of work space	15	13.33	5.82	15	15.47	3.60	0.084
Arrangement of storage space	15	13.13	6.02	15	15.40	3.64	0.070
Location of kitchen	15	14.27	5.48	15	16.20	1.27	<0.001
Traffic pattern in kitchen	15	12.87	6.19	15	15.00	3.44	0.036
Counter and cabinet finishes	15	14.00	5.20	15	15.80	1.47	<0.001
Kitchen Total	15	94.33	33.59	15	109.33	16.87	0.015

all of these items were combined the Solar Attic respondents had rated their housing significantly higher on the Kitchen subscale than the Benchmark respondents. The null hypothesis for this subscale was rejected.

Bedrooms. There were no significant differences in the respondents' level of satisfaction with the six items on the Bedroom subscale (Table 34). The Solar Attic respondents rated their housing higher on the following three items: "number of bedrooms," "size of master bedroom," and "location of bedrooms." The Benchmark respondents reported greater satisfaction on the items "flexibility in arranging furniture in master bedroom," "flexibility in arranging furniture in other bedrooms," and "size of other bedrooms." When the items to form the Bedroom subscale were combined there was no significant difference in the mean scores of the respondents' ratings and the null hypothesis for this subscale was retained.

Bathroom. The Solar Attic respondents reported greater satisfaction than the Benchmark respondents on four of the five items on the Bathroom subscale (Table 35). They reported significantly higher satisfaction on the two items, "number of bathrooms" and "location of bathroom(s)." They also had higher scores on the items "bathroom fixtures" and "size of bathroom(s)," but there was no significant difference between these scores and

Table 34

Residents' Mean Rating of Benchmark and Solar Attic Housing Satisfaction Scale Items and Subscale: Bedrooms

Variable	Benchmark			Solar Attic			Calculated p value
	N	Mean	SD	N	Mean	SD	
Number of bedrooms	15	13.20	6.24	15	14.80	4.33	0.185
Flexibility in arranging furniture in master bedroom	15	11.87	6.31	15	11.00	6.75	0.815
Flexibility in arranging furniture in other bedrooms	15	13.73	4.33	14	12.57	5.08	0.563
Size of master bedroom	15	11.20	7.20	15	12.73	6.01	0.505
Size of other bedrooms	15	12.87	5.68	15	12.53	5.60	0.961
Location of bedrooms	15	14.40	4.24	15	14.47	3.98	0.816
Bedroom Total	15	77.27	28.31	14	80.14	25.54	0.716

Table 35

Residents' Mean Rating of Benchmark and Solar Attic Housing Satisfaction Scale Items and Subscale: Bathroom

Variable	Benchmark			Solar Attic			Calculated p value
	N	Mean	SD	N	Mean	SD	
Number of bathrooms	14	11.86	6.90	14	16.14	1.10	<0.001
Location of bathroom(s)	15	13.27	6.30	15	16.13	1.19	<0.001
Bathroom fixtures	15	13.87	5.11	15	14.47	4.22	0.485
Size of bathroom(s)	15	13.67	5.65	14	14.21	4.37	0.362
Arrangement of bathroom fixtures	15	14.93	3.81	15	14.67	3.87	0.955
Bath Total	14	67.00	22.14	13	75.15	13.80	0.112

those of the Benchmark respondents. The Benchmark respondents reported greater satisfaction with the "arrangement of bathroom fixtures," but the difference was not significant. When the scores for the five items were combined there was no significant difference in the total Bathroom subscale mean scores and the null hypothesis for this subscale was retained.

Laundry. The Solar Attic respondents reported greater satisfaction than the Benchmark respondents on all three of the items on the Laundry subscale (Table 36). Their ratings were significantly higher for the two items "size of laundry area" and "arrangement of space for laundry." They also rated the "location of laundry area" higher than the Benchmark respondents, though there was no significant difference in their scores. When the items on the Laundry subscale were combined the Solar Attic respondents had rated their satisfaction with the laundry significantly higher than the Benchmark respondents and the null hypothesis related to the Laundry subscale was rejected.

Exterior. The Solar Attic respondents reported greater satisfaction than the Benchmark respondents on all four of the items on the Exterior subscale (Table 37). Their ratings were significantly higher for the two items "control of noise from outside" and "private outdoor living areas." Their ratings were also higher on the

Table 36

Residents' Mean Rating of Benchmark and Solar Attic Housing Satisfaction Scale Items and Subscale: Laundry

Variable	Benchmark			Solar Attic			Calculated p value
	N	Mean	SD	N	Mean	SD	
Location of laundry area	15	13.47	5.91	15	14.13	4.21	0.215
Size of laundry area	14	12.36	6.89	15	14.53	2.85	0.002
Arrangement of space for laundry	15	13.93	5.28	15	14.73	2.84	0.027
Laundry Total	14	39.86	17.33	15	43.40	8.99	0.021

Table 37

Residents' Mean Rating of Benchmark and Solar Attic Housing Satisfaction Scale Items and Subscale: Exterior

Variable	Benchmark			Solar Attic			Calculated p value
	N	Mean	SD	N	Mean	SD	
Privacy from neighbors and public	15	10.27	6.83	15	14.53	4.91	0.223
Control of noise from outside	15	11.00	6.74	14	15.71	1.59	<0.001
Private outdoor living areas	14	7.71	6.76	15	15.20	3.34	0.013
Car storage and drive	15	11.13	6.71	14	13.21	6.25	0.806
Exterior Total	14	38.86	21.12	14	59.43	11.59	0.039

items "privacy from neighbors and public" and "car storage and drive," though there was no significant difference in their scores and those of the Benchmark respondents. When the items on the Exterior subscale were combined the Solar Attic respondents had rated their satisfaction with the exterior aspects of their home significantly higher than the Benchmark respondents and the null hypothesis related to the Exterior subscale was rejected.

Appearance. The Solar Attic respondents reported significantly greater satisfaction with both of the items on the Appearance subscale (Table 38). They were more satisfied with the "appearance of outside of home" and with the "appearance of inside of home" and when these items were combined to form the Appearance subscale there was a significant difference in the mean score ratings. The hypothesis for this subscale was rejected.

Systems. The Benchmark respondents reported greater satisfaction on five of the 12 items on the Systems subscale (Table 39). Their ratings were significantly higher on only one item "location and number of electrical outlets." However, they also reported greater satisfaction with the following features: "control of mechanical equipment noises," "lighting quality," "air circulation within home," and "absence of drafts." The Solar Attic respondents reported greater satisfaction on

Table 38

Residents' Mean Rating of Benchmark and Solar Attic Housing Satisfaction Scale Items and Subscale: Appearance

Variable	Benchmark			Solar Attic			Calculated p value
	N	Mean	SD	N	Mean	SD	
Appearance of outside of home	15	12.87	6.62	15	15.73	1.22	<0.001
Appearance of inside of home	15	13.33	5.88	14	16.29	0.73	<0.001
Appearance Total	15	26.20	12.47	14	32.21	1.63	<0.001

Table 39

Residents' Mean Rating of Benchmark and Solar Attic Housing Satisfaction Scale Items and Subscale: Systems

Variable	Benchmark			Solar Attic			Calculated p value
	N	Mean	SD	N	Mean	SD	
Control of plumbing noises	15	13.40	5.44	14	14.36	4.03	0.290
Control of mechanical equipment noises	15	14.13	4.45	15	13.40	4.60	0.909
Plumbing system	15	14.00	5.39	15	14.13	5.29	0.948
Location and number of electrical outlets	15	16.40	1.06	15	15.33	4.08	<0.001
Lighting quality	15	15.07	3.84	15	14.87	4.39	0.627
Control of humidity	15	12.06	5.95	15	12.40	5.54	0.795
Control of interior space temperature	15	13.93	5.18	14	13.29	6.53	0.472
Air circulation within home	14	14.64	3.93	15	14.27	5.13	0.345
Control of ventilation	15	12.93	6.14	15	14.73	4.08	0.139
Absence of drafts	14	13.93	5.38	14	13.29	6.07	0.673
Energy efficiency of home	15	15.33	4.34	15	15.67	2.79	0.112
Security systems	15	10.80	6.85	13	12.00	6.32	0.791
Systems Total	12	168.25	36.63	11	168.00	35.32	0.916

the following items: "control of plumbing noises," "plumbing system," "control of humidity," "control of interior space temperature," "control of ventilation," "energy efficiency of home," and "security systems." When the items on the Systems subscale were combined there was no significant difference in the mean satisfaction scores of Benchmark and Solar Attic respondents and the null hypothesis for this subscale was retained.

Structure and Materials. The Benchmark respondents reported greater satisfaction than the Solar Attic respondents on four of the eight items on the Structure and Materials subscale (Table 40). For three of these items the differences in the mean scores were significant: "floor materials," "ceiling materials," and "structural soundness of home." The Benchmark respondents also reported greater satisfaction on the item "number, location, and type of windows," although the difference in the mean scores were not significant. The Solar Attic respondents also reported greater satisfaction on four of the items on this scale, including the item "wall materials," which was significantly greater than the Benchmark response. Their responses were not significantly higher on the items "ease of cleaning walls," "ease of cleaning floors," and "number, location and type of doors." When the scores for the items on the

Structure and Materials subscale were combined there was no significant difference in the respondents' mean scores and the null hypothesis for this subscale was retained.

Costs. The Benchmark respondents reported significantly greater satisfaction with one of the three items on the Costs subscale, "house payment or rent" (Table 41). The Solar Attic respondents were more satisfied than the Benchmark respondents with the two items "maintenance costs" and "utility costs," but there were no significant differences in their mean scores. When these items were combined to form the Costs subscale there was no significant difference in the respondents' mean scores and the null hypothesis for this subscale was retained.

Summary. The Solar Attic respondents reported significantly higher satisfaction-importance ratings on 22 of the 77 items analyzed and on five of the 13 subscales. The Benchmark respondents had significantly higher mean scores on six of the items and on none of the subscales. The subscales that the Solar Attic respondents rated higher were Living Area, Kitchen, Laundry, Exterior, and Appearance.

Table 40

Residents' Mean Rating of Benchmark and Solar Attic Housing Satisfaction Scale Items and Subscale: Structure and Materials

Variable	Benchmark			Solar Attic			Calculated p value
	N	Mean	SD	N	Mean	SD	
Floor materials	15	16.00	1.31	14	14.57	4.36	<0.001
Wall materials	15	13.93	5.57	15	15.53	1.30	<0.001
Ceiling materials	15	16.07	1.16	15	14.73	4.25	<0.001
Ease of cleaning walls	15	13.07	6.25	15	13.87	5.42	0.602
Ease of cleaning floors	15	14.53	4.31	15	15.93	1.22	<0.001
Number, location and type of windows	15	14.67	4.30	15	14.40	4.95	0.606
Number, location and type of doors	15	13.87	5.29	15	15.00	3.78	0.221
Structural soundness of home	15	16.67	0.62	15	16.20	1.21	0.017
Structure and Materials Total	15	118.80	23.25	14	120.07	20.27	0.626

Table 41

Residents' Mean Rating of Benchmark and Solar Attic Housing Satisfaction Scale Items and Subscale: Costs

Variable	Benchmark			Solar Attic			Calculated p value
	N	Mean	SD	N	Mean	SD	
House payment or rent	15	16.93	0.26	14	13.72	5.30	<0.001
Maintenance costs	15	15.40	4.41	15	15.33	3.33	0.308
Utility costs	15	12.47	7.04	15	15.20	4.35	0.082
Costs Total	15	44.80	10.00	14	44.07	8.21	0.484

Relation of Housing Satisfaction to Other Factors

In an attempt to relate the findings of this investigation to past research on housing satisfaction and to the housing adjustment theory (Morris and Winter, 1978) the following hypotheses were tested.

Ho 8: There is no difference in the mean Housing Satisfaction Scale scores of households:

a. in different locations
b. in different stages of the family life cycle
c. whose heads have different occupations

Ho 9: There is no relationship between the Housing Satisfaction Scale scores and:

a. household income
b. household size
c. years of education of household head
d. respondents' length of residence
e. relative amount of income spent on housing
f. amount of electricity used
g. age of dwelling
h. size of dwelling
j. number of past alterations
k. number of planned alterations, improvements, repairs

The analysis of variance procedure as specified in the SAS General Linear Model procedure (SAS Institute, 1982) was used to test Hypothsis 8. The Pearson Product Moment Correlation was calculated between the satisfaction score and the variables in Hypothseis 9 and their difference from 0 was tested. All of the subscale scores of the Housing Satisfaction Scale were combined to form a total Housing Satisfaction variable. Only 13 of the 30 Benchmark and Solar Attic respondents had completed the Housing Satisfaction Scale and had a total score. There were no significant differences in the mean scores of households in different locations, in different stages of the family life cycle, and whose heads had different occupations; therefore, Hypothesis 8 was retained. The correlations calculated between housing satifaction and the demographic and housing characteristics in Hypothesis 9 were not significantly different from 0 and this hypothesis also was retained.

Summary of the Phase II-B Investigation

The Benchmark and Solar Attic respondents surveyed in this investgation were significantly different in the following ways. The Benchmark households had lower annual incomes, more female heads, and on the average the heads had less education than the Solar Attic households. The Benchmark houses were significantly older and smaller than the Solar Attic houses and the Benchmark residents had lived there longer; however, they did not pay significantly more of their income for their housing than the Solar Attic residents. The Benchmark households used significantly more electricity than the Solar Attic households. Double pane windows were significantly more frequent in the Solar Attic houses than in the Benchmark houses, but this was the only energy saving feature that was significantly different for the two house types. Significantly more Solar Attic households had made changes to reduce their utility consumption by adding or increasing insulation, adding storm or double pane windows, using fans instead of air conditioners, and adding insulation to the water heater.

Respondents in both house types most frequently reported that they had selected their housing because of location. The Solar Attic respondents had also selected their present house because of house design, its innovative features, and energy efficiency. These reasons for selection were reported by significantly more Solar Attic households than Benchmark households. Respondents in both house types were satisfied or very satisfied on an overall housing satisfaction variable and they did not desire to move. When the specific subscales of the Housing Satisfaction Scale were examined the Solar Attic respondents reported greater satisfaction on the following five subscales: Living Area, Kitchen, Laundry, Exterior, and Appearance. No significant relationships were found between the respondents' total Housing Satisfaction Scale scores and certain demographic and housing characeristics.

CHAPTER VIII

DISCUSSION AND IMPLICATIONS

The purposes of the study were to develop and test a methodology for evaluating the livability of single-family houses. The instruments developed as part of this methodology were tested in the evaluation of Benchmark and Solar Attic houses. In the following discussion, the methodology developed in this study has been examined. In the following section, the results of the two evaluation investigations have been compiled in order to discuss the overall findings regarding the livability of the two house types. Recommendations are included in both sections and a final section summarizes implications for designers, educators, policymakers, and researchers.

Discussion of the Evaluation Methodology

The methodology in this study included the development of two housing evaluation instruments and the use of these instruments in the evaluation of the Solar Attic and Benchmark houses. The various stages of the study that were undertaken to accomplish the development and implementation of this methodology are discussed below.

Phase I

In Phase I of the study the House Plan Evaluation Checklist and the Housing Satisfaction Scale were developed, analyzed for content validity, and revised. The process of having housing professionals evaluate the items on these instruments was useful. The professionals identified many specific problems and made suggestions for general improvements. These comments were helpful during the revision of the items. Researchers using this process for developing and revising an instrument should consider sending the revised instrument back to the judging sample for final approval and comments. Although this was not done in this study, a second round of comments and ratings might indicate the extent to which the revised instrument fulfilled the professionals' recommendations.

Phase II-A

In the Phase II-A investigation housing professionals used the House Plan Evaluation Checklist to evaluate the house plans of the Benchmark and Solar Attic houses. The procedure was successful in that there was a high rate of return among the sample and there was a high response rate on the items. The instrument also had high reliability ratings when used with the Benchmark plan. Information obtained from the instrument was codeable and appropriate for use in statistical analysis. Researchers using this process in the future should make sure that the house plans used in the investigation include features identified on the checklist. They may also want to revise the items on the Zoning subscale. The low inter-rater reliability ratings that the Solar Attic plan received on this subscale may indicate that the items are not clear or applicable to all situations.

Phase II-B

In the Phase II-B investigation residents of the Benchmark and Solar Attic houses provided information related to their housing. They responded to the Housing Livabilty Interview Schedule and to the Housing Satisfaction Scale. The investigation provided information about the residents of these house types, their housing characteristics, housing alterations, energy usage, and housing satisfaction. Information about the respondents' electric utility usage for the past year was collected from the utility supplier. This provided accurate data and should be considered by other investigators seeking this information when the costs and sample size permit. The use of the House Plan Diagram was important in this study since it provided an indication of how the actual

Benchmark and Solar Attic houses differed from the original plans (H5-41 and 7220). The plans were used in determining the number of alterations that had been performed on the two house types and in identifying houses with similar plans that were used in the determination of the inter-rater reliability of the Housing Satisfaction Scale. The information on the diagrams was difficult to classify into categories since there were many different types of alterations and changes in the plans. Researchers seeking design feedback through a case study approach might find this procedure useful; however, interviewers should be carefully trained in drawing the diagrams and recording the alterations.

The Housing Satisfaction Scale was successful in providing information related to the design of the two house types. The use of the satisfaction-importance ratings provided weighted scores that were useable in comparing the two house types. There was a problem in combining the ratings to get a total score, since respondents with missing data on any one item were excluded from the analysis. Only 13 of the 30 sample members had complete information. It is not practical to test hypotheses using such a small sample. Researchers using the Housing Satisfaction Scale in the future may need to reduce the number of items so that it is easier to use. However, a smaller scale would not provide the detail present in the current scale. This information may be desirable for the researcher or designer who wants an in-depth analysis of the resident's evaluation of the house design.

Research Design

In the testing and use of the instruments developed for this methodology two house types were compared. The research design of this study was quasi-experimental in that a conventional house was compared with a prototypical house. The conventional house could be considered the "control" or standard plan and the prototypical house was the "treatment" plan. The Benchmark house had been designated as a "yardstick" plan that could be used as the basis for comparing prototypical designs (Zornig, 1976) and the use of this plan and the Solar Attic plan had been specified in the S-141 Southern Regional Housing Research Project Outline (1979). The use of the two house plans with a sample of housing professionals who evaluated the livability of the designs using the House Plan Evaluation Checklist presented no major problems. However there were some problems in the implementation of this research design when residents of these house types were sampled and when the professionals' evaluation was combined with the residents' evaluation.

There were major difficulties in identifying, locating, and securing the cooperation of both the Benchmark and Solar Attic residents. The Solar Attic system is not common and there are not many of these houses available in the southern region. Complete records of the location of the Solar Attic houses were not available from the designers of the solar attic system or the commercial suppliers of this system. Respondents that were identified through commercial suppliers often had custom built homes that differed substantially from the Solar Attic plan. This affected the results and made the interpretation of findings from the combination of both investigations difficult. Benchmark respondents were also difficult to identify since many local Farmers Home Administration offices did not keep records of the house design of their clients. A few compromises in the location or house design had to be made when securing the Benchmark sample. Because of these difficulties the sample of Benchmark and Solar Attic residents were very small (15 each). This caused some difficulty in testing hypotheses, especially when the residents did not respond to some items.

By using conventional and prototypical house types in evaluation studies, information about residents of these house types could be compared. This information might help explain factors associated with the acceptance of innovative housing. In this investigation several differences were detected in the samples of residents. The Benchmark residents were less educated, had more female heads, and lower incomes. Their housing was older and smaller, and they had lived in them longer. But, because of the small sample sizes the investigator was unable to determine that any relationship existed between housing satisfaction and these demographic and housing variables. Margulis (1981) suggested that matched samples be used in evaluation studies and that the samples be matched on several physical, social, and economic variables. Although it was impossible for this investigation to accomplish this kind of sampling, it should be considered by other researchers trying to determine the differences between conventional and prototypical residents.

Discussion of the House Type Evaluation

Housing professionals and residents evaluated the Benchmark and Solar Attic houses on many of the same design features. Both plans received primarily good ratings from the housing professionals and satisfactory ratings from the residents. The professionals and residents agreed in assigning the lowest ratings to the Benchmark house on the features: outdoor living areas; size of living area, master bedroom, and laundry area; number of bathrooms; flexibility in room uses; and arrangement of furniture in the living area and master bedroom. The professionals had also rated many kitchen features as fair but the residents indicated a relatively high level of satisfaction with this space. Although there was little agreement between the two groups on the best features of the Benchmark house, the professionals rated the plan excellent on access to dining area and bedrooms entered without going through other bedrooms and the residents indicated high satisfaction with the access between different areas in the house. Several of the features highly rated by the residents were not related to the house plan design per se. These included the amount paid on house payments, the structural soundness of the home, and certain construction features. Appropriate comparisons could not be made.

The housing professionals and Solar Attic residents agreed on the ratings of only a few features of this house type. Both rated various aspects of the kitchen very highly. They rated storage for out-of-season clothes and arranging furniture in the master bedroom low. A major discrepancy in the ratings was that the professionals rated the number and location of the bathroom as poor or fair, but the residents had rated these features highly. Many of the residents had included a second bath during the construction of their house; therefore, the housing professionals and the Solar Attic residents were not rating the same thing. In fact, the Solar Attic plan (no.7220) that the professionals evaluated and the actual houses that the Solar Attic residents lived in were quite different (see Appendices A and N). Because of these differences it is understandable that there is little agreement between the two evaluations. On the other hand, the Benchmark houses were very similar to the Benchmark plan and more agreement was expected and was found.

When the subscales of the Phase II investigations were examined, it was evident that the the Solar Attic house type received higher scores than the Benchmark house. The Solar Attic plan was assigned significantly higher ratings by the housing professionals on the subscales: Storage, Kitchen, Bedrooms, Bathroom, and Laundry. The residents of the Solar Attic houses rated their homes higher than the residents of the Benchmark houses on the subscales: Living Area, Kitchen, Laundry, Exterior, and Appearance. Both investigations found the kitchen and laundry areas of the Solar Attic house better than in the Benchmark house and neither investigation found the Benchmark plan rated significantly higher on any of the subscales.

The overall evaluation of the livability of the two house types seems to indicate that the Benchmark house is a relatively satisfactory house plan, although there were some poor or fair features identified by both housing professionals and residents. The Solar Attic house received higher evaluation ratings than the Benchmark house by both the housing professionals and residents; however, there was little agreement between these groups in identifying the best and worst livability features of this house type. Since many of the actual Solar Attic residents lived in custom designed houses or Solar Attic houses that had been altered from the Solar Attic plan, this discrepancy in ratings is understandable. The customizing of these houses also might help explain the overall high scores that the Solar Attic residents assigned to their housing. The higher scores that the Solar Attic plan received from the housing professionals is also understandable, since the designers of this plan were aware of some of the problems with the Benchmark house and had corrected for them when they designed the Solar Attic house (Fish, 1978).

Implications

The results of this study have implications for several different groups of housing professionals, including designers, educators, policymakers, and researchers. The following suggestions and recommendations are concerned with the implementation of the methodology or instruments developed in this study and with the usefulness of the findings related to the house type evaluations.

For Designers

The House Plan Evaluation Checklist could be used by designers as a pre-design evaluation instrument. It contains a checklist of features that could guide the designer in planning the spatial organization of a single-family residence. With modification, the instrument might also be useful in planning multi-family units.

The Housing Satisfaction Scale might also be useful to the designer that seeks post-occupancy feedback on his or her design. This instrument would provide information about the unit that could assist the designer in planning the next similar unit.

Designers of the Solar Attic system may be interested in the findings of this study related to the evaluation of this house type. Some specific information is available about the solar attic system, structure, materials, and systems. Further analyses of these data on a case by case basis might prove useful in the development of future innovative designs.

The examination of the Benchmark evaluation might also prove useful to designers seeking to provide small efficient housing. The house has only 960 square feet, but received satisfactory scores on most of the identified components. Designers might compare the scores their design received on the House Plan Evaluation Checklist to the scores the Benchmark plan received.

For Educators

The information provided in the House Plan Evaluation Checklist is similar to other checklists written for consumers about the selection of housing. However, this instrument has undergone a process that indicates it has content validity and reliability. Educators in housing classes may wish to use the checklist as a design guideline for students studying single-family housing. Extension specialists may also wish to use this tool as a guide for consumers who are buying or building single-family housing.

For Policymakers

The House Plan Evaluation Checklist might also be useful to personnel in government agencies that are involved in evaluating single-family housing. Since the U. S. Department of Housing and Urban Development (HUD) no longer includes livability and marketability requirements in the Minimum Property Standards for One- and Two-Family Dwellings, there are no written guidelines that assist the HUD officials in evaluating these factors during the Valuation Analysis. This type of checklist could provide guidelines for this evaluation process.

Government officials may be interested in the findings of this study related to house type evaluation. The U. S. Department of Housing and Urban Development, the U. S. Department of Agriculture, and the Farmers Home Administration were involved in developing, financing, or sponsoring the construction of many of these units. Feedback on the design of the units and the residents' responses to living in them might be useful in the evaluation of these various programs.

For Researchers

Researchers performing design-oriented studies should be encouraged to design their studies so that information related to theory can be collected. The use of matched samples is an appropriate research design when one is attempting to compare house types and identify specific differences. Researchers should consider matching the samples on several relavent variables so that these factors do not confound the results. Researchers should also consider the use of large sample sizes, so that appropriate statistical tests can be used with meaningful data. The Housing Satisfaction Scale used in this study seemed appropriate particularly for design-oriented studies since it provided feedback on the design of the structure. For theory-oriented studies the instrument should be revised so that less specific information is obtained. The instrument might be used with a large sample of households and then factor analyzed so that some items could be combined or eliminated. For theory-oriented studies, the instrument might also require the addition of items related to other factors such as location and community services. The residents in this study frequently cited location as the housing feature that they liked best and the housing adjustment theory indicates that this factor is an important consideration in housing satisfaction (Morris and Winter, 1978).

CHAPTER IX

SUMMARY AND CONCLUSIONS

Summary

Housing livability is the capability of a residential space to meet the daily living needs of a family or household through its design, arrangement, and construction. Evaluating livability in the pre-construction process or during post-occupancy can assist the designer in planning residential spaces that meet the needs of users. Meeting these needs may be of special importance to developers of innovative and prototypical housing who wish to have their design widely accepted. Standardized methods of evaluating livability have not been available. Researchers associated with the S-141 Southern Regional Housing Research Project "Housing for Low- and Moderate-Income Families" recognized the need to establish a user-oriented evaluation so that it could be applied to the prototypical houses that they developed. The project outline specified that questionnaires be developed to examine the social, behavioral, psychological, and aesthetic responses of families living in prototypical and conventional houses.

The project outline further specified that the Solar Attic house should be the prototypical model and that the Benchmark house should be the conventional model.

The purposes of this study were to develop a methodology for evaluating the livability of single-family houses and to test the methodology by using it to assess the Benchmark and Solar Attic house types. In order to accomplish these objectives, several separate investigations were conducted and were organized into two phases. During Phase I the House Plan Evaluation Checklist and the Housing Satisfaction Scale were developed by the investigator and analyzed for content validity using samples of housing professionals. For each investigation, 40 randomly selected housing professionals contacted through a mailed questionnaire, were asked to rate on a scale of 0 to 4 the appropriateness of each item on the particular instrument. Mean scores for the items were calculated and all items with means of 2.5 or below were omitted from the revised instruments. Comments and suggestions made by the respondents were useful in revising, expanding, combining, and/or adding items.

During Phase II of the study the two instruments developed in Phase I were used to collect data to determine the reliability of the instruments and provide information that could be used to evaluate the Benchmark and Solar Attic house types. In Phase I-A, the House Plan Evaluation Checklist was used by a sample of 41 housing professionals to evaluate plans of the two house types. Respondents were contacted through a mail survey. During the Phase II-B investigation, residents living in Benchmark and Solar Attic houses in six southern states were interviewed. These residents responded to the Housing Satisfaction Scale, a Housing Livability Interview Schedule developed by S-141 researchers, and a House Plan Diagram developed by the investigator. Fifteen Solar Attic residents were identified through contacts with the Rural Housing Research Unit, the U. S. Department of Housing and Urban Development, and commercial suppliers of the solar attic system. Fifteen Benchmark residents were identified in similar geographic areas through contacts with the Farmers Home Administration, local builders, and county extension agents.

The findings of the Phase II-A investigation revealed that the housing professionals assigned significantly higher mean scores to the Solar Attic house plan than to the Benchmark plan on 28 of the 61 items analyzed and on five of the ten subscales. The Benchmark house plan received significantly higher mean scores on eight of the items. The analysis of the residents' responses to the Housing Satisfaction Scale indicates that the Solar Attic respondents reported significantly higher satisfaction-importance ratings than the Benchmark respondents on 22 of the 77 items on this scale and on five of the 13 subscales. The Benchmark respondents had significantly higher mean scores on six of the items. The housing professionals and residents agreed in evaluating the Solar Attic house type higher on the Kitchen and Laundry subscale.

Information about the residents' demographic and housing characteristics were also obtained in the Phase II-B investigation. There were more female-headed households in the Benchmark sample and the heads had fewer years of education than the Solar Attic residents. The Benchmark households had lower incomes, but did not pay significantly more of their income for housing. The Benchmark houses were older and smaller than the Solar Attic houses and the families had lived in them longer. The Benchmark houses used more electricity per square foot and degree day, but they had most of the same energy saving features as the Solar Attic houses. More Solar Attic residents had made changes to reduce their utility consumption by adding energy saving features or modifying their behavior. Both groups of respondents were satisfied to very satisfied with their housing and most did not desire to move.

Conclusions

A housing evaluation methodology that incorporated a House Plan Evaluation Checklist and a Housing Satisfaction Scale was developed in this study and was tested by evaluating conventional and prototypical house types (Benchmark and Solar Attic houses). The following statements are conclusions about the evaluation of these house types and the use of these instruments.

1. The Benchmark house is a satisfactory dwelling. It received primarily good ratings by the housing professionals who evaluated the plan and satisfactory ratings from the residents who live in it.

2. The Solar Attic plan is better than the Benchmark plan in several ways. The plan received higher scores than the Benchmark plan from the housing professionals. The plan also received higher scores from the residents that live in it than the Benchmark plan received from its residents. Both investigations rated the Solar Attic house type higher on the kitchen and laundry subscale.

3. The residents of the Benchmark and Solar Attic houses differed on several demographic variables that indicated that the Benchmark residents were probably from a lower socio-economic background than the Solar Attic residents.

4. The Benchmark and Solar Attic houses were different from one another in several ways. The Benchmark house was older, smaller, and used more electric energy. The houses had similar energy saving features.

5. The House Plan Evaluation Checklist had a high inter-rater reliability rating when used with housing professionals to evaluate the Benchmark plan. The checklist also had primarily high ratings when used to evaluate the Solar Attic plan, but the Zoning scale of this checklist may need to be further revised.

6. Most of the subscales of the Housing Satisfaction Scale had high internal consistency reliability scores when used with the Benchmark and Solar Attic residents. Internal consistency of a subscale means that the residents provided similar responses to all of the items on the subscale. The Costs subscale was the only subscale that did not have a high reliability rating. This was due to the diversity of responses to the items on house payments and utility costs. This subscale may need to be revised.

7. Many of the subscales of the Housing Satisfaction Scale did not have high inter-rater reliability coefficients when used with either plan. This indicates that the residents in each of the two different house types did not evaluate their houses consistently. This

could occur for several reasons, but this type of reliability measure is probably not appropriate for studies with actual residents since there are many external factors that might confound their responses.

Recommendations for Further Research

1. Further study could be conducted with the House Plan Evaluation Checklist to adapt it for use with multi-family housing, which could be a useful pre-construction tool for designers and developers of this house type. It also might be especially useful to developers and government officials if the livability and marketability criteria of the Minimum Property Standards for Multi-Family Housing are eliminated.

2. The Housing Satisfaction Scale should be used in other post-occupancy studies to determine its applicability to other settings. Its usefulness in obtaining specific information in a case study evaluation should be examined.

3. Further research should be conducted with the Housing Satisfaction Scale if it is to be used in more general research settings, such as testing housing adjustment theory or comparing less specific samples of conventional and innovative housing. The instrument provides a great deal of detailed information that may not

be useful to research studies of this type. Researchers may consider reducing the number of items on the scale by factor analyzing its contents with a large sample of households in various housing types. The high ratings of internal consistency may indicate that many of the items are related and could be combined.

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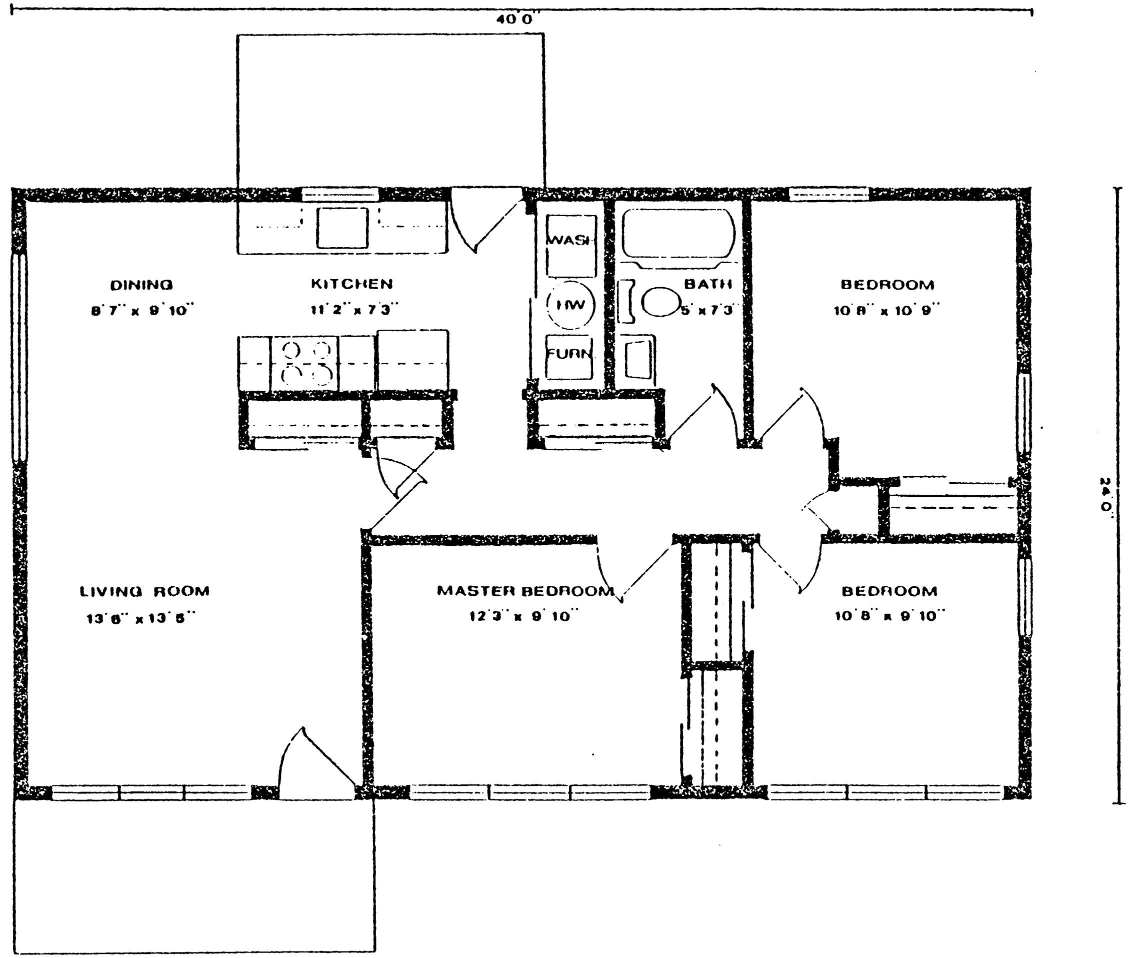
APPENDIX A

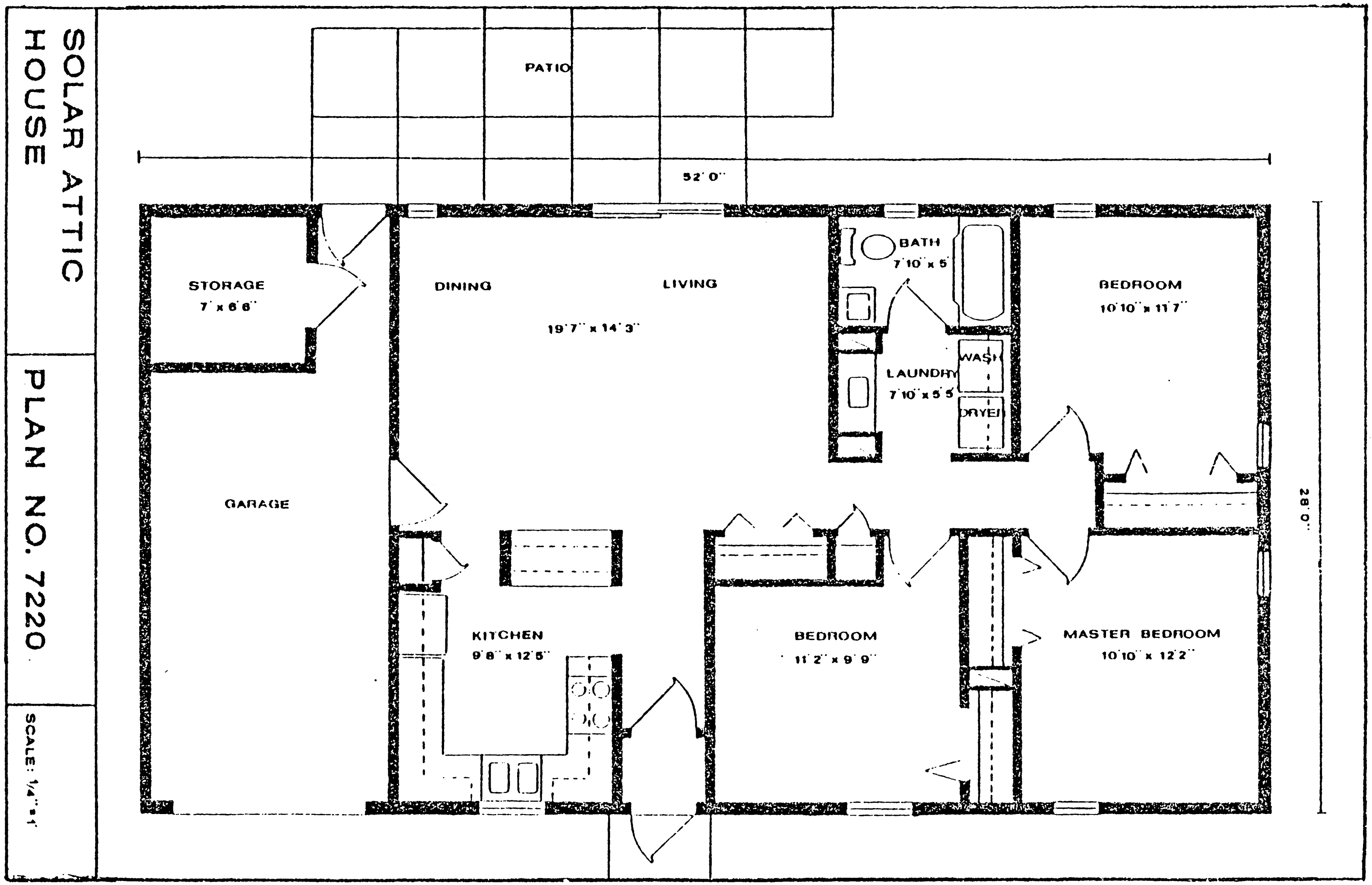
Benchmark and Solar Attic House Plans

BENCHMARK HOUSE

PLAN NO. H5-41

SCALE: 1/4"=1'




SOLAR ATTIC HOUSE
PLAN NO. 7220
SCALE: 1/4"=1'
PATIO
52' 0"
STORAGE
7' x 6'6"
DINING
LIVING
19'7" x 14'3"
BATH
7'10" x 5'
LAUNDRY
7'10" x 5'5"
WASH
DRYER
BEDROOM
10'10" x 11'7"
28'0"
GARAGE
KITCHEN
9'8" x 12'5"
BEDROOM
11'2" x 9'9"
MASTER BEDROOM
10'10" x 12'2"

APPENDIX B

Original House Plan Evaluation Checklist

RATING OF THE HOUSE PLAN EVALUATION CHECKLIST

The items below are to be assessed for incorporation into a checklist that is to be used by housing professionals to rate and evaluate single-family house plans. The items should reflect the principles of house planning and design. The checklist will be revised based on your assessment of the items and on the evaluation of other housing professionals. After the checklist has been revised housing professionals will be able to rate a house plan on each item using the following system: 0--Does not have, 1--Poor, 2--Fair, 3--Good, 4--Excellent. The house plan would be rated on each of the items below. For example:

	Does Not Have	Poor	Fair	Good	Excellent
Door located near corner of room	0	1	2	3	4
Limited hall space	0	1	2	3	4

Please rate the items on this checklist judging them on their appropriateness for a House Plan Evaluation Checklist and on their quality. Mark the columns using the following codes.

0 - Should Not Be Included - Should not be included on the checklist
1 - Poor item - Inclusion is marginal/needs major revision
2 - Fair item - Could be included/needs some revision
3 - Good item - Should be included/ needs minor revision
4 - Excellent item - Should be included/ needs no revision

Please check only one column for each item and make any suggestions for improving the item in the space provided beside the list.

Suggestions for Improving the Item		Should Not Be Included	Poor Item	Fair Item	Good Item	Excellent Item
	ZONING					
________	Quiet areas separated from noisy areas	0	1	2	3	4
________	Living, working, sleeping areas separated from each other	0	1	2	3	4
________	Bedrooms separated from living zone by change in floor level, other rooms, or sound isolation	0	1	2	3	4
________	Rooms related to each other in a convenient manner, entry to living room, dining room to kitchen, bedrooms to bath	0	1	2	3	4
	CIRCULATION					
________	Doors located near corner of room	0	1	2	3	4
________	Doors open into the room they serve	0	1	2	3	4
________	Major traffic paths 3 ft. wide	0	1	2	3	4
________	Traffic pattern away from areas of activity	0	1	2	3	4
________	Limited hall space	0	1	2	3	4
________	Front entry with direct connection to living area	0	1	2	3	4

Suggestions for Improving the Item		Should Not Be Included	Poor Item	Fair Item	Good Item	Excellent Item
______	Short access from front entry to family room or recreation room	0	1	2	3	4
______	Short access from front entry to kitchen and service area	0	1	2	3	4
______	Front entry to bath, powder room or lavatory via hall	0	1	2	3	4
______	Front door located to prevent direct view of any room	0	1	2	3	4
______	Direct access from service entry to kitchen	0	1	2	3	4
______	Easy and short access to bath, lavatory or mud room from service area	0	1	2	3	4
______	Easy access from service entry to other rooms in house without passing through kitchen work triangle	0	1	2	3	4
______	Traffic pattern does not pass through conversation areas	0	1	2	3	4
	<u>STORAGE</u>					
______	Adequate bedroom closet storage (minimum of 24" depth)	0	1	2	3	4
______	Adequate closet space for storing out-of-season clothes	0	1	2	3	4
______	Adequate storage for household linens; located close to bedrooms and baths	0	1	2	3	4
______	Adequate storage for cleaning equipment and supplies	0	1	2	3	4
______	Adequate storage for yard and lawn equipment	0	1	2	3	4
______	Coat closet within six feet of front door	0	1	2	3	4
	<u>LIVING AREAS</u>					
______	Adequate floor and wall space for a sofa and other large pieces of furniture	0	1	2	3	4
______	Shape of room and location of doors and windows provide for flexibility in furniture arrangement and room use	0	1	2	3	4
______	At least one wall uninterrupted by windows and long enough to accommodate a sofa	0	1	2	3	4
______	Conservation areas focus on center of interest	0	1	2	3	4
______	Room large enough to allow for seating family and guests	0	1	2	3	4

Suggestions for Improving the Item		Should Not Be Included	Poor Item	Fair Item	Good Item	Excellent Item
________	Proportions of room adequate for comfortable conversation distances	0	1	2	3	4
	DINING AREAS					
________	Direct access to living area	0	1	2	3	4
________	Direct access to kitchen	0	1	2	3	4
________	Separate room or sufficient space in dual-purpose room to permit arrangement of appropriate furnishings	0	1	2	3	4
	KITCHEN					
________	Convenient to outdoor living areas	0	1	2	3	4
________	Next to or near garage or carport	0	1	2	3	4
________	Within easy access of front and service entries	0	1	2	3	4
________	Work triangle between 13 and 22 feet in length	0	1	2	3	4
________	Work centers flow from sink, mix, to range	0	1	2	3	4
________	Serving center close to dining area	0	1	2	3	4
________	Minimum of 18" counter space on latch side of refrigerator	0	1	2	3	4
________	Minimum of 36" of counter space for mix center, between refrigerator and sink	0	1	2	3	4
________	Minimum of 36" of counter space to the right of sink (may be part of mix center) and 30" of counter space to the left of sink	0	1	2	3	4
________	Minimum of 24" of counter space on both sides of range	0	1	2	3	4
________	Kitchen layout is functional - range, sink, and refrigerator within easy access of each other	0	1	2	3	4
________	Minimum wall cabinet space - 10 ft.	0	1	2	3	4
________	Minimum base cabinet space	0	1	2	3	4
________	Traffic does not pass through work areas	0	1	2	3	4
	BEDROOMS					
________	Closets in bedrooms can be reached without having to go around bed	0	1	2	3	4
________	Windows and doors located so that furniture arrangement can be flexible	0	1	2	3	4

Suggestions for Improving the Item		Should Not Be Included	Poor Item	Fair Item	Good Item	Excellent Item
________	Wall area for two or three bed positions	0	1	2	3	4
________	Large enough to contain appropriate furniture	0	1	2	3	4
________	Bathroom adjoining or accessible via hall	0	1	2	3	4
________	All bedrooms entered without going through another bedroom	0	1	2	3	4
	BATHROOM					
________	Adequate number of bathrooms for the number of bedrooms	0	1	2	3	4
________	Convenient to bedrooms	0	1	2	3	4
________	Accessible from outside areas	0	1	2	3	4
________	Within 20 ft. of kitchen	0	1	2	3	4
________	Space adequate and arranged for convenient and private use	0	1	2	3	4
________	Bathroom has window or exhaust fan	0	1	2	3	4
________	SERVICES AND FACILITIES					
________	Centralized plumbing core	0	1	2	3	4
________	Centralized location for hot water heater	0	1	2	3	4
________	Space for washer and dryer	0	1	2	3	4
________	Laundry area convenient to bedroom and bath	0	1	2	3	4
________	Windows located to provide air, light and ventilation	0	1	2	3	4
________	Provisions for private outdoor living areas	0	1	2	3	4
________	Outdoor space convenient to indoor space	0	1	2	3	4

What other items do you think should be included in a House Plan Evaluation Checklist?

APPENDIX C

Correspondence for Phase I-A Data Collection

COLLEGE OF HUMAN RESOURCES

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

DEPARTMENT OF HOUSING, INTERIOR DESIGN AND RESOURCE MANAGEMENT

Dear Housing Professional:

Principles of house planning and design are important concepts that can be used to evaluate residential structures. A variety of checklists have been used as guidelines for planning and evaluating houses and there appears to be a lack of agreement among housing professionals regarding items that should be included in a house plan evaluation checklist. In an effort to come to some consensus about the content of such a checklist, it is important to obtain the ideas and input from several people who are knowledgeable in the housing field.

You are one of a small number of randomly selected housing professionals who is being asked to examine and evaluate a proposed house plan evaluation checklist. The checklist is to be used by housing professionals to evaluate the livability of single-family house plans.

In order that the results of the investigation will truly represent the opinions of housing professionals it is important that each questionnaire be completed and returned. You may be assured of complete confidentiality. The questionnaire has an identification number for mailing purposes only.

The results of the research will be used to revise the house plan evaluation checklist. It will then be used by a sample of housing professionals who will evaluate two single-family house types. You may receive a summary of results and a copy of the revised checklist by writing "copy of results requested" on the back of the return envelope, and printing your name and address below it.

If you have any questions or concerns I would be very happy to answer them. Please write or call me at .

Thank you for your assistance.

Sincerely,

Julia O. Beamish
Graduate Research Assistant

cls

Enc.

COLLEGE OF HOME ECONOMICS
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
Blacksburg, Virginia 24061
DEPARTMENT OF MANAGEMENT, HOUSING AND FAMILY DEVELOPMENT

Dear Housing Professional:

A questionnaire was recently sent to you regarding the content validation of a housing satisfaction scale. If you have returned the questionnaire, your time and effort are greatly appreciated. If you did not complete the questionnaire, would you please take a few minutes to do so and drop it in the mail today.

In order for the results of this investigation to represent the opinions of a variety of housing professionals, it is important that I receive a questionnaire from you. Thank you very much for your cooperation.

Julia O. Beamish

cls

COLLEGE OF HUMAN RESOURCES

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

DEPARTMENT OF HOUSING, INTERIOR DESIGN AND RESOURCE MANAGEMENT

Dear Housing Professional:

Approximately three weeks ago a questionnaire was sent to you regarding the content validation of a house plan evaluation checklist. I am writing to you again because of the significance each questionnaire has in the process of revising this instrument. As of today, I have not received your response. If you have already returned the questionnaire, please accept my sincere appreciation. However, if you have not completed it, would you please take a few minutes to do so and return it today.

In the event that the questionnaire originally sent to you was not received or has been misplaced, a replacement is enclosed.

Thank you very much for your cooperation and assistance.

Sincerely,

Julia O. Beamish
Graduate Research Assistant

cls

Enc.

APPENDIX D

Suggestions and Comments for Improving Original House Plan Evaluation Checklist

Summary of Suggested Items, Suggested Revisions, and General Comments to the Original House Plan Evaluation Checklist

Comments and Suggestions	Total Number
Suggested Additional Items	
Energy Features	8
Orientation	6
Lighting and Electrical Features	4
Construction Features	3
Window Location	3
Visual Privacy of Bedroom-Bathroom Area	2
Heating and Cooling System	2
Bath Convienent to Outdoors	1
Kitchen Convient to Family Room	1
Bath of First Floor in Two-story House	1
Location, Size, and Facilities of Garage	1
Door Swing in Bathroom	1
Fire Exits	1
Piping in Warm Walls	1
Areas for Hobbies	1
Space for Soring and Ironing Laundry	1
Place for Hand Laundry	1
Laundry Convienent to Outdoors	1
Soiled Laundry Stroage	1
Suggested Revisions	
Do Not Use "Adequate" or "Minimum"	2
Shorten List	1
General Comments	
Application to Smaller Homes; Traditional	5
Evaluation in Relation to Family	3

APPENDIX E

Revised House Plan Evaluation Checklist

HOUSE PLAN EVALUATION CHECKLIST

This checklist is to be used to rate and evaluate floor plans for single-family houses. The items on the checklist reflect principles of house planning and design. Please rate the attached floor plan using this checklist. Examine the floor plan to determine how well it meets the criteria identified in each item. Use the following codes:

0 = Does Not Have
1 = Poor
2 = Fair
3 = Good
4 = Excellent

Circle one number for each item.

NOTE: FHA Minimum Property Standards (MPS) for a 3-bedroom dwelling have been included in parenthesis beside some items. Small Home Council recommendations for minimum spaces have been included in 2 items. This information is to be used as a guideline for minimum space requirements.

	Does Not Have	Poor	Fair	Good	Excellent
Zoning					
Separation of quiet (private) areas from noisy (public) areas of the house	0	1	2	3	4
Separation of bedrooms from living areas using closets, quiet rooms, or sound insulation	0	1	2	3	4
Relation of rooms to each other, i.e. entry next to living area, dining area next to kitchen, bedrooms close to bathrooms	0	1	2	3	4
Visual privacy of bedroom-bathroom area	0	1	2	3	4
Circulation					
Location of door near adjacent corner of rooms	0	1	2	3	4
Doors open into the room they serve	0	1	2	3	4
Width of major traffic paths (MPS specifies 3' wide halls	0	1	2	3	4
Traffic pattern does not interfere with activites in rooms	0	1	2	3	4
Length of hall	0	1	2	3	4
Connection between front entry and living areas	0	1	2	3	4
Access from service entry to kitchen	0	1	2	3	4
Access from service area to bath, lavatory or mud room	0	1	2	3	4
Access from service entry to other rooms in the house without interference with kitchen work triangle	0	1	2	3	4
Relation of traffic pattern to conversation areas in living areas	0	1	2	3	4
Storage					
Closet space in master bedroom (MPS - 2' x 5')	0	1	2	3	4
Closet space in other bedroom (MPS - 2' x 3')	0	1	2	3	4
Closet space for storing out-of-season clothes	0	1	2	3	4
Storage for household linens (MPS - 15 sq. feet shelf area)	0	1	2	3	4
Storage for cleaning equipment and supplies	0	1	2	3	4
Storage for yard and lawn equipment	0	1	2	3	4
Closet space convenient to front entry (MPS - 2' x 2')	0	1	2	3	4
Storage in bathroom	0	1	2	3	4

	Does Not Have	Poor	Fair	Good	Excellent
Living Areas					
Floor and wall space for living room furnishings (MPS specifies 1 couch, 2 easy chairs, 1 desk, 1 desk chair, 1 television set, 1 table)	0	1	2	3	4
Shape of room and location of doors and windows provide for flexibility in furniture arrangement and room use	0	1	2	3	4
Size of living areas	0	1	2	3	4
Size and shape of living area allows furniture to be arranged for conversation	0	1	2	3	4
Dining Areas					
Access to living area	0	1	2	3	4
Access to kitchen	0	1	2	3	4
Space for dining furniture (MPS specifies dining table and dining chairs for six people)	0	1	2	3	4
Kitchen					
Convenience to outdoor living areas	0	1	2	3	4
Convenience to garage, carport or drive	0	1	2	3	4
Access to front and/or service entries	0	1	2	3	4
Amount of counter space on latch side of refrigerator (MPS - 15")	0	1	2	3	4
Amount of counter space for mix center (MPS - 36")	0	1	2	3	4
Amount of counter space on both sides of sink (MPS - 24")	0	1	2	3	4
Amount of counter space on both sides of range (MPS - 24")	0	1	2	3	4
Amount of wall cabinet space (Small Home Council - 9')	0	1	2	3	4
Amount of base cabinet space (Small Home Council - 11')	0	1	2	3	4
Work triangle between 12 and 22 feet in length	0	1	2	3	4
Traffic does not pass through work areas	0	1	2	3	4
Work centers flow from refrigerator, mix, sink to range	0	1	2	3	4
Location of serving center in relation to dining area	0	1	2	3	4
Bedrooms					
Closets on wall adjacent to bedroom door so that bed placement will not interfere with traffic	0	1	2	3	4
Location of windows and doors permits flexible furniture arrangements	0	1	2	3	4
Wall area for at least two bed positions	0	1	2	3	4
Master bedroom of sufficient size to accommodate bedroom furniture (MPS specifies 2 twin beds, 1 dresser, 1 chair, 1 crib)	0	1	2	3	4
Other bedrooms of sufficient size to accommodate bedroom furniture (MPS specifies 1 double bed, 1 dresser, 1 chair)	0	1	2	3	4
Bathroom adjoining or accessible via hall	0	1	2	3	4
All bedrooms entered without going through another bedroom	0	1	2	3	4

	Does Not Have	Poor	Fair	Good	Excellent
Bathroom					
Number of bathrooms	0	1	2	3	4
Convenience to bedrooms	0	1	2	3	4
Convenience to outside areas	0	1	2	3	4
Space arranged for convenient and private use	0	1	2	3	4
Bathroom has window or exhaust fan	0	1	2	3	4
Size of bathroom (MPS specifies tub, lavatory water closet)	0	1	2	3	4
Laundry					
Space for washer	0	1	2	3	4
Space for dryer	0	1	2	3	4
Location of laundry area	0	1	2	3	4
Service and Facilities					
Centralized plumbing core	0	1	2	3	4
Location of water heater(s)	0	1	2	3	4
Location of windows and doors for ventilation	0	1	2	3	4
Provision for private outdoor living areas	0	1	2	3	4
Convenience of outdoor living areas to indoor living areas	0	1	2	3	4

Title or Number of Plan Evaluated ________________________

COMMENTS:

APPENDIX F

Original Housing Satisfaction Scale

RATING OF THE HOUSING SATISFACTION SCALE

The items below are to be assessed for incorporation into an instrument that is to be used by residents living in single-family housing to rate their satisfaction with certain features of their housing unit. The satisfaction scale is to be used as an evaluation measure. It will be revised based on your assessment of the items and on the evaluation of other housing professionals. After the scale has been revised residents will be able to rate their satisfaction with the housing features. A scale from one to six will be used by the residents with the value of one indicating that they are very dissatisfied with the feature and the value of six indicating that they are very satisfied. Residents will also be able to rate the importance of the feature with the value of one indicating that the feature is very unimportant and the value of six indicating the the feature is very important. For example:

Very Unimportant					Very Important		Very Dissatisfied					Very Satisfied
1	2	3	4	5	6	Size of rooms	1	2	3	4	5	6
1	2	3	4	5	6	Number of bedrooms	1	2	3	4	5	6

Please rate the items on this checklist judging them on their appropriateness for a Housing Satisfaction Scale and on their quality. Mark the columns using the following codes:

0 - Should Not Have - Should not be included on the checklist
1 - Poor item - Inclusion is marginal/needs majot revision
2 - Fair item - Could be included/ needs some revision
3 - Good item - Should be included/needs minor revision
4 - Excellent item - Should be included/ needs no revision

Please check only one column for each item and make any suggestions for improving the item in the space provided beside the list.

Suggestions for Improving the Item		Should Not Be Included	Poor Item	Fair Item	Good Item	Excellent Item
________	Size of rooms	0	1	2	3	4
________	Amount of work space in kitchen	0	1	2	3	4
________	Amount of storage space in kitchen	0	1	2	3	4
________	Amount of closet space in bedroom	0	1	2	3	4
________	Amount of storage space in bath	0	1	2	3	4
________	Amount of indoor storage	0	1	2	3	4
________	Amount of outdoor storage	0	1	2	3	4
________	Number of rooms	0	1	2	3	4
________	Amount of space for laundry	0	1	2	3	4
________	Size of porch, balconies, decks	0	1	2	3	4
________	Number of bedrooms	0	1	2	3	4
________	Number of bathrooms	0	1	2	3	4
________	Arrangement of rooms	0	1	2	3	4

Suggestions for Improving the Item		Should Not Be Included	Poor Item	Fair Item	Good Item	Excellent Item
________________	Arrangement for preparing food	0	1	2	3	4
________________	Flexibility in arranging furniture in living areas	0	1	2	3	4
________________	Flexibility in arranging furniture in bedrooms	0	1	2	3	4
________________	Location of bathroom(s)	0	1	2	3	4
________________	Location of laundry area	0	1	2	3	4
________________	Location of kitchen	0	1	2	3	4
________________	Appearance of the inside of home	0	1	2	3	4
________________	Appearance of the outside of home	0	1	2	3	4
________________	Privacy from neighbors and public	0	1	2	3	4
________________	Privacy of family from each other	0	1	2	3	4
________________	Elimination of noise from outside	0	1	2	3	4
________________	Control of plumbing noises	0	1	2	3	4
________________	Control of mechanical and equipment noises	0	1	2	3	4
________________	Floor materials	0	1	2	3	4
________________	Wall coverings	0	1	2	3	4
________________	Wall colors	0	1	2	3	4
________________	Ease of cleaning walls	0	1	2	3	4
________________	Ease of cleaning floors	0	1	2	3	4
________________	Electrical outlets	0	1	2	3	4
________________	Lighting fixtures	0	1	2	3	4
________________	Ceiling materials	0	1	2	3	4
________________	Bathroom fixtures	0	1	2	3	4
________________	Plumbing	0	1	2	3	4
________________	Kitchen finishes	0	1	2	3	4
________________	Comfortable air temperature in living areas	0	1	2	3	4
________________	Comfortable humidity level	0	1	2	3	4
________________	Space temperature uniformity in summer	0	1	2	3	4
________________	Space temperature uniformity in winter	0	1	2	3	4
________________	Elimination of drafts	0	1	2	3	4

Suggestions for Improving the Item		Should Not Be Included	Poor Item	Fair Item	Good Item	Excellent Item
____________	Air circulation within home	0	1	2	3	4
____________	Natural outdoor ventilation effects	0	1	2	3	4
____________	Uniformity of daylight in living areas	0	1	2	3	4
____________	Elimination of contrasts such as bright sunny windows near darker walls	0	1	2	3	4
____________	Amount of space for dining	0	1	2	3	4
____________	Amount of living area	0	1	2	3	4
____________	Separation of children and parent areas	0	1	2	3	4
____________	Separation of work areas, living areas and sleeping areas	0	1	2	3	4
____________	Direct access between different areas of the house	0	1	2	3	4
____________	Ability to arrange furniture in living area to avoid traffic	0	1	2	3	4
____________	Traffic pattern in kitchen	0	1	2	3	4
____________	Backyard, front yard	0	1	2	3	4
____________	Car storage	0	1	2	3	4
____________	Amount of hall space	0	1	2	3	4
____________	House payments or rent	0	1	2	3	4
____________	Maintenance costs	0	1	2	3	4
____________	Utility costs	0	1	2	3	4

What other items do you think should be included in a scale to determine residents' satisfactions with their dwelling units?

APPENDIX G

Correspondence for Phase I-B Data Collection

COLLEGE OF HUMAN RESOURCES

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

DEPARTMENT OF HOUSING, INTERIOR DESIGN AND RESOURCE MANAGEMENT

Dear Housing Professional:

Residents' satisfaction with their dwelling units can be an important indication of the fit between house design and users' needs. Various measures of housing satisfaction have been used to evaluate residential structures and to examine family housing decisions. There is currently no one method to evaluate housing satisfaction and housing professionals often disagree about items that should be included in a housing satisfaction scale. In order to come to some consensus about the content of such a scale, it is important to obtain the ideas and input from several people who are knowledgeable in the housing field.

You are one of a small number of randomly selected housing professionals who is being asked to examine and evaluate a proposed housing satisfaction scale. The scale is to be used as a post-occupancy measure of residents' satisfaction with their single-family dwelling units. It purposely excludes items related to neighborhood and community services.

In order that the results of this investigation will truly represent the opinions of housing professionals, it is important that each questionnaire be completed and returned. You may be assured of complete confidentiality. The questionnaire has an identification number for mailing purposes only.

The results of this research will be used to revise the housing satisfaction scale. It will then be used with a sample of residents living in two single-family house types. You may receive a summary of results and a copy of the revised scale by writing "copy of results requested" on the back of the return envelope, and printing your name and address below.

If you have any questions or concerns I would be very happy to answer them. Please write or call me at

Thank you for your assistance.

Sincerely,

Julia O. Beamish
Graduate Research Assistant

cls

Enc.

COLLEGE OF HOME ECONOMICS

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

DEPARTMENT OF MANAGEMENT, HOUSING AND FAMILY DEVELOPMENT

Dear Housing Professional:

A questionnaire was recently sent to you regarding the content validation of a housing satisfaction scale. If you have returned the questionnaire, your time and effort are greatly appreciated. If you did not complete the questionnaire, would you please take a few minutes to do so and drop it in the mail today.

In order for the results of this investigation to represent the opinions of a variety of housing professionals, it is important that I receive a questionnaire from you. Thank you very much for your cooperation.

Julia O. Beamish

cls

COLLEGE OF HUMAN RESOURCES

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

DEPARTMENT OF HOUSING, INTERIOR DESIGN AND RESOURCE MANAGEMENT

Dear Housing Professional:

Approximately three weeks ago a questionnaire was sent to you regarding the content validation of a housing satisfaction scale. I am writing to you again because of the significance each questionnaire has in the process of revising this instrument. As of today, I have not received your response. If you have already returned the questionnaire, please accept my sincere appreciation. However, if you have not completed it, would you please take a few minutes to do so and return it today.

In the event that the questionnaire originally sent to you was not received or has been misplaced, a replacement is enclosed.

Thank you very much for your cooperation and assistance.

Sincerely,

Julia O. Beamish
Graduate Research Assistant

cls

Enc.

APPENDIX H

Suggestions and Comments for Improving Original Housing Satisfaction Scale

Summary of Suggested Items and General Comments to the
Original Housing Satisfaction Scale

Suggestions and Comments	Total Number
Suggested Additional Items	
Energy Features	7
Community and Neighborhood Features	6
Utility Services	6
Flexibility of Space	5
Outdoor Areas	4
Demographic and Family Variables	3
Children's Play Areas	3
Location, Type, and Number of Windows	3
Depreciation of Dwelling	3
Safety and Security Features	2
Special Features for Handicapped and Elderly	2
Number of Floors	1
Arrangement of Space for Laundry	1
Arrangement of Storage Space in Bath	1
Arrangement of Work Space in Kitchen	1
Arrangement of Storage Space in Kitchen	1
Arrangement of Closet Space in Bedroom	1
Outdoor storage	1
Interior Zoning	1
Steps	1
Availability of Special Features, i.e. Fireplace	1
Ability to Entertain	1
Personal Expression in Space	1
Door Swings	1
Dry Basement	1
Closet Doors	1
Closet Venting	1
Dressing Area in Bedroom	1
General Comments	
Categorize and Group Items	3
Shorten Instrument	2

APPENDIX I

Revised Housing Satisfaction Scale

HOUSING SATISFACTION SCALE

For each of the following housing characteristics rate how important each feature is to you, then rate how satisfied you are with the feature. Rate the importance of the feature on a scale of 1 through 6 (1 indicates Very Unimportant; 6 indicates Very Important). Your satisfaction with the feature should also be rated on a scale of 1 through 6 (1 indicates Very Dissatisfied; 6 indicates Very Satisfied). In the space provided, please comment about what you like or dislike about the housing feature.

Very Unimportant			Very Important				Very Dissatisfied			Very Satisfied			What Do You Like Or Dislike About This Feature
						Layout of Floor Plan							
1	2	3	4	5	6	Separation of work areas, living areas and sleeping areas	1	2	3	4	5	6	
1	2	3	4	5	6	Privacy for family members	1	2	3	4	5	6	
1	2	3	4	5	6	Separation of children and parent areas	1	2	3	4	5	6	
1	2	3	4	5	6	Childrens play area indoors	1	2	3	4	5	6	
1	2	3	4	5	6	Childrens play area outdoors	1	2	3	4	5	6	
1	2	3	4	5	6	Number of rooms	1	2	3	4	5	6	
1	2	3	4	5	6	Access between different areas in the house	1	2	3	4	5	6	
1	2	3	4	5	6	Arrangement of rooms	1	2	3	4	5	6	
1	2	3	4	5	6	Number of levels in home	1	2	3	4	5	6	
1	2	3	4	5	6	Types of rooms	1	2	3	4	5	6	
1	2	3	4	5	6	Flexibility of spaces for more than one use	1	2	3	4	5	6	
						Storage							
1	2	3	4	5	6	Closet space in master bedroom	1	2	3	4	5	6	
1	2	3	4	5	6	Closet space in other bedrooms	1	2	3	4	5	6	
1	2	3	4	5	6	Storage for out-of-season clothes	1	2	3	4	5	6	
1	2	3	4	5	6	Storage for household linens	1	2	3	4	5	6	
1	2	3	4	5	6	Storage for cleaning equipment and supplies	1	2	3	4	5	6	
1	2	3	4	5	6	Outdoor storage for lawn and yard equipment	1	2	3	4	5	6	
1	2	3	4	5	6	Storage at entry	1	2	3	4	5	6	
1	2	3	4	5	6	Storage space in bath(s)	1	2	3	4	5	6	
						Living Areas							
1	2	3	4	5	6	Number of living areas	1	2	3	4	5	6	
						1. Formal, Primary or Only Living Area: i.e., living room, great room							
1	2	3	4	5	6	Flexibility in arranging furniture	1	2	3	4	5	6	
1	2	3	4	5	6	Ability to arrange furniture to avoid traffic	1	2	3	4	5	6	

Very Unimportant					Very Important		Very Dissatisfied					Very Satisfied	What Do You Like Or Dislike About This Feature
1	2	3	4	5	6	Size of living area	1	2	3	4	5	6	
1	2	3	4	5	6	Ability to arrange furniture for conversation	1	2	3	4	5	6	
						2. Informal or Secondary Living Area: i.e., family room, den, recreation room							
1	2	3	4	5	6	Flexibility in arrangement of furniture	1	2	3	4	5	6	
1	2	3	4	5	6	Ability to arrange furniture to avoid traffic	1	2	3	4	5	6	
1	2	3	4	5	6	Size of living area	1	2	3	4	5	6	
1	2	3	4	5	6	Ability to arrange furniture for conversation	1	2	3	4	5	6	
						Dining							
1	2	3	4	5	6	Size of dining space	1	2	3	4	5	6	
1	2	3	4	5	6	Location of dining area(s)	1	2	3	4	5	6	
1	2	3	4	5	6	Number of dining areas	1	2	3	4	5	6	
						Kitchen							
1	2	3	4	5	6	Amount of counter or work space in kitchen	1	2	3	4	5	6	
1	2	3	4	5	6	Amount of storage space in kitchen	1	2	3	4	5	6	
1	2	3	4	5	6	Arrangement of work space in kitchen	1	2	3	4	5	6	
1	2	3	4	5	6	Arrangement of storage space in kitchen	1	2	3	4	5	6	
1	2	3	4	5	6	Location of kitchen	1	2	3	4	5	6	
1	2	3	4	5	6	Traffic pattern in kitchen	1	2	3	4	5	6	
1	2	3	4	5	6	Kitchen counter and cabinet finishes	1	2	3	4	5	6	
						Bedrooms							
1	2	3	4	5	6	Number of bedrooms	1	2	3	4	5	6	
1	2	3	4	5	6	Flexibility in arranging furniture in master bedroom	1	2	3	4	5	5	
1	2	3	4	5	6	Flexibility in arranging furniture in other bedrooms	1	2	3	4	5	6	
1	2	3	4	5	6	Size of master bedroom	1	2	3	4	5	6	
1	2	3	4	5	6	Size of other bedrooms	1	2	3	4	5	6	
1	2	3	4	5	6	Location of bedrooms	1	2	3	4	5	6	
						Bath							
1	2	3	4	5	6	Number of bathrooms	1	2	3	4	5	6	
1	2	3	4	5	6	Location of bathroom(s)	1	2	3	4	5	5	
1	2	3	4	5	5	Bathroom fixtures	1	2	3	4	5	6	
1	2	3	4	5	6	Size of bathroom(s)	1	2	3	4	5	6	
1	2	3	4	5	6	Arrangement of bathroom fixtures	1	2	3	4	5	6	

Very Unimportant					Very Important		Very Dissatisfied					Very Satisfied	What Do You Like Or Dislike About This Feature
						Laundry							
1	2	3	4	5	6	Location of laundry area	1	2	3	4	5	6	
1	2	3	4	5	6	Size of laundry area	1	2	3	4	5	6	
1	2	3	4	5	6	Arrangement of space for laundry	1	2	3	4	5	6	
						Appearance							
1	2	3	4	5	6	Appearance of outside of home	1	2	3	4	5	6	
1	2	3	4	5	6	Appearance of inside of home	1	2	3	4	5	6	
						Exterior							
1	2	3	4	5	6	Privacy from neighbors and public	1	2	3	4	5	6	
1	2	3	4	5	6	Control of noise from outside	1	2	3	4	5	6	
1	2	3	4	5	6	Private outdoor living areas	1	2	3	4	5	6	
1	2	3	4	5	6	Car storage and drive	1	2	3	4	5	6	
						Systems							
1	2	3	4	5	6	Control of plumbing noises in living areas	1	2	3	4	5	6	
1	2	3	4	5	6	Control of mechanical equipment noises	1	2	3	4	5	6	
1	2	3	4	5	6	Plumbing system	1	2	3	4	5	6	
1	2	3	4	5	6	Location and number of electrical outlets	1	2	3	4	5	6	
1	2	3	4	5	6	Lighting quality	1	2	3	4	5	6	
1	2	3	4	5	6	Control of humidity	1	2	3	4	5	6	
1	2	3	4	5	6	Control of interior space temperature	1	2	3	4	5	6	
1	2	3	4	5	6	Air circulation within home	1	2	3	4	5	6	
1	2	3	4	5	6	Control of ventilation	1	2	3	4	5	6	
1	2	3	4	5	6	Absence of drafts	1	2	3	4	5	6	
1	2	3	4	5	6	Energy efficiency of home	1	2	3	4	5	6	
1	2	3	4	5	6	Security systems	1	2	3	4	5	6	
						Structure and Materials							
1	2	3	4	5	6	Floor materials	1	2	3	4	5	6	
1	2	3	4	5	6	Wall materials	1	2	3	4	5	6	
1	2	3	4	5	6	Ceiling materials	1	2	3	4	5	6	
1	2	3	4	5	6	Ease of cleaning walls	1	2	3	4	5	6	
1	2	3	4	5	6	Ease of cleaning floors	1	2	3	4	5	6	
1	2	3	4	5	6	Number, location and type of windows	1	2	3	4	5	6	
1	2	3	4	5	6	Number, location and type of doors	1	2	3	4	5	6	
1	2	3	4	5	6	Structural soundness of home	1	2	3	4	5	6	
						Costs							
1	2	3	4	5	6	House payments or rent	1	2	3	4	5	6	
1	2	3	4	5	6	Maintenance costs	1	2	3	4	5	6	
1	2	3	4	5	6	Utility costs	1	2	3	4	5	6	

APPENDIX J

Correspondence for Phase II-A Data Collection

COLLEGE OF HUMAN RESOURCES

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

DEPARTMENT OF HOUSING, INTERIOR DESIGN AND RESOURCE MANAGEMENT

November 1, 1982

Dear Housing Professional:

The S-141 Southern Regional Housing Research Project, "Housing for Low- and Moderate-Income Families," is a USDA cooperative research project that has as one of its objectives the design and evaluation of low-cost energy efficient prototype houses. Principles of house planning and design are important concepts that can be used to evaluate certain aspects of a residential structure. The enclosed House Plan Evaluation Checklist was recently developed and tested for content validity with a random sample of housing professionals. Although these professionals evaluated the items on the checklist, they did not use it to evaluate a house plan.

You are one of a small number of randomly selected housing professionals who is being asked to examine and evaluate two house floor plans using the House Plan Evaluation Checklist. The Solar Attic house (plan no. 7220) is a prototype designed by S-141 researchers. The Benchmark house (plan no. HS 41) is a design that has been widely used by the Farmers Home Administration.

In order for the results of the investigation to truly represent the opinions of housing professionals it is important that each sample member complete and return both checklists. You may be assured of complete confidentiality. The checklists have an identification number for mailing purposes only.

The results of the research will be compiled with the results from other evaluation instruments and will be used to assess the livability of the two house types. You may receive a summary of results by writing "copy of results requested" on the back of the return envelope and printing your name and address below it.

If you have any questions or concerns I would be very happy to answer them. Please write or call me at .

Thank you for your assistance.

Sincerely,

Julia O. Beamish
Instructor

JB/mrr

Enclosure

COLLEGE OF HUMAN RESOURCES

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

DEPARTMENT OF HOUSING, INTERIOR DESIGN AND RESOURCE MANAGEMENT

November 18, 1982

Dear Housing Professional:

Recently a packet of information was sent to you requesting your assistance in evaluating two house floor plans. It is important that each questionnaire is returned so that the responses will reflect the opinions of a variety of housing professionals. As of today I have not received your response. If you have already returned the questionnaire, please accept my sincere appreciation. However, if you have not completed it, would you please take a few minutes to do so and return it today.

Thank you for your cooperation.

Julia O. Beamish
Instructor

COLLEGE OF HUMAN RESOURCES

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

DEPARTMENT OF HOUSING, INTERIOR DESIGN AND RESOURCE MANAGEMENT

January 6, 1983

Dear Housing Professional:

Prior to the rush of the holiday season a packet of information was sent to you requesting your assistance in evaluating two house floor plans. I am writing to you again because of the significance each checklist has in the process of evaluating these houses. As of today I have not received your response. If you have already returned the questionnaires please accept my sincere appreciation for your participation. However, if you have not completed it would you please take a few minutes to do so and return it today.

In the event that the material originally sent to you was not received or has been misplaced, replacements are enclosed.

Thank you very much for your cooperation and assistance.

Sincerely,

Julia O. Beamish
Instructor

JB/mrr

Enclosures

APPENDIX K

Housing Livability Interview Schedule

HOUSING LIVABILITY

Southern Regional Project No. 141

To be completed by Interviewer

1. State ______________________
2. County ______________________
3. Respondent no. ______________________
4. Interviewer ______________________
5. Date ______________________

Time ______________ a.m./p.m.

6. Person Interviewed: ______ 1. Male head
   ______ 2. Female head
   ______ 3. Male co-head
   ______ 4. Female co-head
   ______ 5. Spouse
   ______ 6. Adult son or daughter
   ______ 7. Other (specify) ______________

* 7. Location of Housing/Dwelling Unit:
   ______ 1. Open country
   ______ 2. Suburban area
   ______ 3. Incorporated area (population < 5,000)
   ______ 4. Town (population 5,000-10,000)
   ______ 5. Town (population 10,001-25,000)
   ______ 6. Town (population over 25,000)

8. What Type of Innovation Does The House Have?
   ______ 1. Active solar collectors
   ______ 2. Passive solar design
   ______ 3. Earth sheltered
   ______ 4. Solar attic house
   ______ 5. Bench mark
   ______ 6. Other (specify) ______________

Hello, my name is ______________________. I am working for the ______________ Agricultural Experiment Station on a regional project concerned with housing. The information that we are gathering will help us to evaluate the livability of housing as well as determine present housing conditions. All of the information will be combined to get an overall picture of certain housing types. None of the information will identify a person or his/her income. Your help will assist us in finding out what can be done to assure good housing for all people.

First I want to ask some questions about your present housing unit or dwelling.

* 9. How Old Is Your Housing/Dwelling Unit?
   ______ 1. Years ______ 9. Don't know

* 10. Give Me An Estimate Of The Number Of Square Feet In Housing/Dwelling Unit:
   ______ 1. Sq. Feet ______ 9. Don't know

* 11. What Type(s) Of Utilities Are Used In Your House? (Check as many as apply)
   ______ 1. Electricity
   ______ 2. Gas (natural)
   ______ 3. Gas (bottled)
   ______ 4. Oil
   ______ 5. Water
   ______ 6. Wood
   ______ 7. Other (specify) ______________

The Amount Of Utilities Used Yearly Is Of Particular Interest To This Study.

* Many people have difficulty accurately remembering the amount and cost of electricity and natural gas they use annually because of the way it is measured and because they are billed on a monthly basis. I would like to contact your electric power company [(if applicable) and your gas company] to obtain accurate information about your household utilities. Please complete this form [these forms] so that this information can be released to me. The information will be kept confidential and will help us to better understand your energy use.

* 12. Other Fuels Are Obtained On A More Irregular Basis And In Quantities That Are More Easily Remembered. Please Estimate How Much Of These Fuels You Use Yearly?

______ 1. Gas (bottled) (pounds - cylinders come in pound sizes)
______ 2. Oil (gallons)
______ 3. Wood (cord - 4 ft. x 4 ft. x 8 ft.)

* 13. Which Of The Following Does Your Dwelling Have? (Is it partial or complete?)

	NONE (0)	PARTIAL (1)	COMPLETE (2)	NA (3)	DK (4)
1. Ceiling insulation	______	______	______	______	______
2. Wall insulation	______	______	______	______	______
3. Floor insulation	______	______	______	______	______
4. Storm windows	______	______	______	______	______
5. Double pane windows	______	______	______	______	______
6. Plastic covering on windows	______	______	______	______	______
7. Storm doors	______	______	______	______	______
8. Weather stripping	______	______	______	______	______
9. Caulking	______	______	______	______	______
10. Exterior insulation around hot water heater	______	______	______	______	______

14. Most Houses Have Some Problems That May Cause Discomfort. What Problems Do You Have With Your House?

____

____

____

* 15. How Long Have You Lived In This House? (Record actual number)

______ 1. Years ______ 9. Don't know

* 16. Do You:

______ 1. Own (paid for) (skip to question 18)
______ 2. Own (are buying)
______ 3. Rent (or lease)
______ 4. Receive for services (skip to question 18)
______ 5. Other (specify) ______________________________

* 17. How Much Is Your Monthly House Payment Or Rent?

1. $______________________

18. In What Type Of Home Did You Last Live?

______ 1. Single family	______ 5. Duplex
______ 2. Apartment	______ 6. Other (specify)
______ 3. Townhouse	______________________
______ 4. Mobile home	______ 7. N/A

* 19. Why Did You/Your Household Select The Dwelling/House You Are Now Living In? (Check as many as apply)

______ 1. Affordable	______ 8. Energy savings
______ 2. Location; neighborhood	______ 9. Inherited or gift
______ 3. House design; plan and layout	______10. School district
______ 4. Built new house	______11. Be near family
______ 5. Provide more space	______12. Other (specify) ______________
______ 6. Limited choice; needed immediately	______________________
______ 7. Innovative feature	______13. N/A
	______14. Don't know

* 20. I sent you a Housing Satisfaction Scale in the mail. Did you receive it? I would like for us to look at it together now (Check to see if HSS has been completed.) Are there any other comments you would like to add now?

* 21. (If Solar Attic House) Since you live in a solar attic house you have an innovative method of heating and cooling your dwelling. I would like to ask you to complete a few more questions about your satisfaction with certain features specifically related to the Solar Attic house.

Very Unimportant					Very Important	Solar Attic Feature	Very Dissatisfied					Very Satisfied	What Do You Like Or Dislike About This Feature?
1	2	3	4	5	6	Shape of roof	1	2	3	4	5	6	______
1	2	3	4	5	6	Attic storage	1	2	3	4	5	6	______
1	2	3	4	5	6	Exterior wall thickness	1	2	3	4	5	6	______
1	2	3	4	5	6	Air lock entry	1	2	3	4	5	6	______
1	2	3	4	5	6	Heating controls	1	2	3	4	5	6	______
1	2	3	4	5	6	Manual conversion of system in summer and winter	1	2	3	4	5	6	______
1	2	3	4	5	6	Floor temperature	1	2	3	4	5	6	______
1	2	3	4	5	6	Ceiling temperature	1	2	3	4	5	6	______

* 22. What Do You/Your Household Like Best About Where You Live? (Check only one)

______ 1. Neighborhood and neighbors	______ 6. Site and yard
______ 2. Location	______ 7. Innovative features
______ 3. Privacy	______ 8. Cost of utilities/energy
______ 4. House design, size, plan and layout	______ 9. Low taxes
______ 5. Ease of maintenance and convenience	______10. Other (specify) ______________

* 23. What Thing Do You Like Least About Where You Live? (check only one)

_____ 1. Neighborhood and neighbors
_____ 2. Location
_____ 3. Lack of privacy
_____ 4. House design: size, plan, and layout
_____ 5. Amount of maintenance and inconvenience
_____ 6. Site and yard
_____ 7. Cost of unit
_____ 8. Innovative features
_____ 9. Cost of utilities/energy
_____10. Traffic
_____11. Other (specify) __________

* 24. How Satisfied Are You With Your Present Dwelling?

_____ 1. Very satisfied
_____ 2. Satisfied
_____ 3. Neither satisfied or dissatisfied
_____ 4. Dissatisfied
_____ 5. Very dissatisfied

* 25. Would You Like To Move Into Another Dwelling Within The Next Couple of Years?

_____ 1. Yes
_____ 2. No (skip to question 27)
_____ 3. Maybe

* 26. Why Would You Like To Move? (Check as many as apply)

_____ 1. Present house is wrong size
_____ 2. Plan to build or buy
_____ 3. Improve location
_____ 4. Dissatisfied with conditions of present dwelling
_____ 5. Change in family structure
_____ 6. Plan to change jobs
_____ 7. Innovative feature
_____ 8. Cost of utilities/energy
_____ 9. Not physically able to maintain dwelling
_____ 10. Other (specify) __________
_____ 11. NA

(If "yes" or "Maybe" to Question 25, skip to Question 28.)

* 27. Why Would You Not Like To Move? (Check as many as apply)

_____ 1. House meets family needs
_____ 2. Economic reasons
_____ 3. Close to relatives
_____ 4. Privacy
_____ 5. Location
_____ 6. Convenience
_____ 7. Innovative feature
_____ 8. Cost of utilities/energy
_____ 9. Dislike moving
_____ 10. Born here "roots"
_____ 11. Other (specify) __________
_____ 12. NA

Many professionals feel that a very important factor in how people make decisions about their housing is the cost of energy. For the past several years we have heard a great deal about a shortage of energy.

* 28. Do You Believe There Is An Energy Crisis?

_____ 1. Yes
_____ 2. No (Skip to question 30)
_____ 3. Not sure (Skip to question 30)

29. How Severe Do You Believe The Energy Crisis Is?

_____ 1. Not at all severe
_____ 2. Somewhat severe
_____ 3. Severe
_____ 4. Very severe

30. Do You Believe That The Energy Situation Has Had Any Impact Upon Your Present Dwelling Or Upon How You Make Decisions About Your Housing?

______ 1. Yes

______ 2. No

______ 3. Don't know

* 31. Associated With The Energy Crisis Is The Increasing Cost Of Utilities And Other Housing Related Costs, Particularly Heating And Cooling Expenses. Have You Or Other Members Of Your Household Made Changes That Would Reduce Your Utility Costs Or Other Housing Costs?

______ 1. Yes ______ 2. No (Skip to question 33)

* 32. What Are Some Of These Changes? (Check as many as apply)

______ 1. Lowered thermostat in winter

______ 2. Raised thermostat in summer

______ 3. Added or increased insulation

______ 4. Added storm or double-pane windows

______ 5. Used wood stove or energy efficient heater

______ 6. Used appliances more efficiently

______ 7. Lowered water heater thermostat

______ 8. Reduced wattage or lighting use

______ 9. Weatherstripped and caulked

______ 10. Closed off rooms

______ 11. Covered windows with plastic

______ 12. Used fans instead of air conditioner

______ 13. Added insulation to water heater

______ 14. Other (specify) ______________

____

______ 18. NA

* 33. What Type Of Improvement Or Repairs Do You Plan To Make? (Check as many as apply)

______ 1. Repairing roof

______ 2. Adding rooms

______ 3. Adding storm windows or doors

______ 4. Adding flooring

______ 5. Painting - exterior

______ 6. Painting - interior

______ 7. Remodeling kitchen/bath

______ 8. Making cosmetic changes (building cabinets, book shelves, paneling, etc.)

______ 9. Adding siding

______ 10. Repairing or improving plumbing

______ 11. Repairing or improving electrical systems

______ 12. Improving landscape

______ 13. Adding sunporch

______ 14. Enclosing patio with glass

______ 15. Adding greenhouse

______ 16. Adding insulation

______ 17. Caulking and weatherstripping

______ 18. Adding solar panels

______ 19. Adding solar water heater

______ 20. Adding fireplace/wood stove

______ 21. Other (specify) ______________

____

______ 22. NA

34. (Ask Homeowners Only). Do You Consider Your Home A Good Investment? ______ 1. Yes ______ 2. No

Why? ____

35. (Ask Everyone the Remaining Questions). Do You Consider Your Home/Dwelling Unit Worth The Amount Of Money You Are Presently Paying/Have Paid For It?

______ 1. Yes

______ 2. No

______ 3. Unsure

36. Would You Recommend The Type Of Dwelling/House In Which You Live To Someone Looking To Buy Or Rent A Home?

______ 1. Yes ______ 2. No

* 37. Demographic Data - WE NEED SOME INFORMATION ABOUT EACH PERSON IN YOUR HOUSEHOLD:

HOUSEHOLD MEMBER	RELATION TO HEAD	SEX	AGE	RACE	MARITAL STATUS	EDUCATION	EMPLOYMENT	OCCUPATION
Place an asterick or circle respondent	1-head 2-co-head 3-spouse 4-offspring 5-parent 6-sibling 7-other relative 8-none	1-male 2-female	Code actual years	1-Afro-American 2-White 3-Hispanic 4-American Indian 5-Other	1-single 2-married 3-widowed 4-divorced 5-separated 6-other	Code actual years 1-12; 13-vocational; 14,15,16-college graduate; 17-post graduate	01-full-time 02-part-time 03-retired 04-unemployed 05-student 06-homemaker 07-full & student 08-part & student 09-part & retired 10-part & homemaker 11-NA 12-other-specify	01-Professional/technical 02-Semi-professional 03-Farmers & farm mgrs. 04-Mgrs, officials & proprietors 05-Clerical 06-Sales 07-Craftsmen, foreman 08-Operators 09-Farm laborers 10-Laborers 11-Domestic service workers 12-Other service workers 13-Retired 14-Other (specify
M HD								
F HD								

* 38. Now we need to know something about your family income for 1981. This information is anonymous and will not have your name associated with it in any way. It will be used only for classification purposes to group people together who have similar incomes.

HOUSEHOLD MEMBER	HOW IS HOUSEHOLD MEMBER PAID? 1-Weekly 2-Bi-weekly 3-Monthly 4-Annually 5-Other-Specify	HOW MUCH TIME DID HOUSEHOLD MEMBER WORK DURING 1981? Record actual number of months. (01-12)	AMOUNT OF INCOME FOR 1981			
			TAKE HOME PAY	SUPPLEMENTAL INCOME		
			(Hand Income Card to respondent that corresponds to pay period.) From these cards, please give me the number that corresponds to the amount of take home pay received by each household member. (Record number)	Did any household member receive supplemental income during the year? 1-Yes 2-No	What type of supplemental income? (Check as many as apply) 1-Investment (stock, bonds, etc.) 2-Pension or retirement 3-Government funding (welfare, AFDC, Section 8, etc.) 4-Second job 5-Social Security (handicapped, elderly, dependent children) 6-Alimony 7-Other	(Give respondent Annual Income Card.) Please give me the number that corresponds to the amount of supplemental income received by each household member. (Record number)
MH						
FH						
OTHER HOUSEHOLD MEMBER						
OTHER HOUSEHOLD MEMBER						
OTHER HOUSEHOLD MEMBER						
OTHER HOUSEHOLD MEMBER						
OTHER HOUSEHOLD MEMBER						
OTHER HOUSEHOLD MEMBER						

* 39. (If Solar Attic) I Understand That This House Uses A Solar Attic System For Heating And Cooling. Was This House Built By USDA Plan No. 7220? (Show respondent the plan.)

_____ 1. Yes (Skip to 41) _____ 3. NA

_____ 2. No (Skip to 45) _____ 4. DK (Skip to 45)

* 40. (If Bench Mark) I Understand That This House Was Approved By The Farmers Home Administration. Was This House Built By The FmHA Plan No. H5-41a? (Show respondent the plan.)

_____ 1. Yes _____ 3. NA

_____ 2. No (Skip to 45) _____ 4. DK (Skip to 45)

* 41 (If "yes" on Questions 39 or 40 ask Question 41.) Did You Make Any Changes In The Floor Plan Design Prior To Or During Construction?

_____ 1. Yes (Ask Question 42) _____ 3. NA

_____ 2. No (Skip to 43)

* 42. What Kind Of Changes?

* 43. Have You Made Any Changes Or Additions To The Floor Plan Since You Have Lived Here?

_____ 1. Yes (Ask Question 44)

_____ 2. No (Skip to 45)

_____ 3. NA

* 44. What Kind Of Changes?

45. Do You Have Other Suggestions That You Have Not Previously Mentioned About How The Design Of Your Housing Could Be Improved?

I would like to walk through your house and see what kind of changes you have made (or see how your house has been designed). Seeing how your house is designed will help me to better understand your responses to some of the previous questions. This will also help me to better understand how houses could be better designed to meet the needs of people like you.

Do you mind if I make some sketches and take some pictures to help record the design of your house?

APPENDIX L

Correspondence Requesting Assistance in Locating Solar Attic and Benchmark Houses

COLLEGE OF HUMAN RESOURCES

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

DEPARTMENT OF HOUSING, INTERIOR DESIGN AND RESOURCE MANAGEMENT

Dear

An effort is underway to locate Solar Attic houses that have been constructed in the southern United States. The house type was developed by researchers at the Rural Housing Research Unit (RHRU) at Clemson University. The plan (No. 7220) has been distributed through the USDA Extension Plan Service and through RHRU. Although records have been kept on the distribution of the plan, information is not available regarding the number and location of the units that have actually been constructed.

In our effort to locate Solar Attic houses, we are writing to each person who was sent a copy of the plans. Please return the enclosed card and provide any information you may have on the location of solar attic houses. Even if you have no information, please check the appropriate box and return the card. The identification number on the card is for mailing purposes only so that your name will be removed from the list as soon as you have returned the card.

If you have any questions or concerns I will be very happy to respond. Please write or call me at .

Thank you very much for your assistance.

Sincerely,

Julia O. Beamish
Graduate Research Assistant

cls

Enc.

☐ I have built a Solar Attic house. My name and current address are:

____

____

☐ I have not built a Solar Attic house, but one is located at:

____

____

Name of owner or builder:____________________

☐ I have not built a Solar Attic house and do not know where any are located.

COLLEGE OF HOME ECONOMICS

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

DEPARTMENT OF MANAGEMENT, HOUSING AND FAMILY DEVELOPMENT

January 21, 1983

Dear

The S-141 Southern Regional Housing Research Project, "Housing for Low- and Moderate-Income Families," is a cooperative research project funded through the USDA Agricultural Experiment Stations in nine southern states. One objective of this research project has been to design and evaluate innovative prototype houses that are energy efficient and incorporate low-cost construction methods. As a member of the S-141 Research team, I have been concerned with developing and testing evaluation procedures that assess the floor plan designs of these houses and measure residents' satisfaction with their housing.

To test these methodologies I plan to have housing professionals evaluate the floor plan of the Solar Attic house, a three-bedroom house designed by the Rural Housing Research Unit in Clemson, South Carolina. I also plan to interview residents who live in these houses. Approximately 30 Solar Attic Houses have been identified in seven southern states. In order to make comparisons to a conventional house I would like to use one of the most built Farmers Home Administration house plans as a yardstick and interview residents that live in houses built by such a plan. The S-141 Technical Committee has designated the FmHA plan no. H5-41 as a Benchmark house because the plan has been so widely used. Because of this designation and the research that has been performed and is planned for this house plan, it is desirable that it be used in this investigation.

The location of the conventional houses is an important aspect of the study. These houses need to be in the same general area as the prototype houses so that they are matched on geographic variables. I have identified a Solar Attic house in Gloucester, Virginia, and am very interested in locating a house built by plan H5-41 in eastern Virginia. I would appreciate any help that you can offer in identifying such a house. I have enclosed a copy of the plan that might be useful to you.

Thank you very much for your help. I will check back with you at a later time, or you may call me at   if you have any information.

Your assistance in this matter will be greatly appreciated.

Sincerely,

JB/mrr

Julia O. Beamish

Enclosure - 1

APPENDIX M

Correspondence for Phase II-B Data Collection

COLLEGE OF HUMAN RESOURCES

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

DEPARTMENT OF HOUSING, INTERIOR DESIGN AND RESOURCE MANAGEMENT

October

Dear

The S-141 Southern Regional Housing Research Project is a cooperative research effort funded through the USDA Agricultural Experiment Stations in nine southern states. One of the objectives of this project has been to improve the affordability of housing by designing innovative structures that are energy efficient and that incorporate low-cost construction methods.

Members of the S-141 research team, have designed several innovative houses and would like to have them evaluated in a comprehensive manner. An important part of this evaluation will be the comments and opinions of residents living in these houses. In order to establish the appropriateness of procedures the research team would like to use a questionnaire and an interview schedule with residents living in Solar Attic Houses (a prototype house designed by S-141 members at the Rural Housing Research Unit in Clemson, South Carolina) and with residents living in a more conventional house.

One of the most built Farmers Home Administration houses was selected as the conventional house that would be used as the yardstick for comparison with the innovative houses. Your name and address were provided by the FmHA state office. Your help in responding to the questionnaire and in talking to an interviewer would be appreciated very much. It will give our S-141 team an opportunity to use these instruments and it will provide us with information essential to the evaluation of housing from a residents viewpoint.

In the next few days I will be calling you to further explain this project and to answer any questions that you have. At that time I would also like to make an appointment to visit with you.

I hope that you will agree to participate in this project. I am looking forward to talking with you soon. Thank you for your assistance.

Sincerely,

COLLEGE OF HUMAN RESOURCES

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

DEPARTMENT OF HOUSING, INTERIOR DESIGN AND RESOURCE MANAGEMENT

October

Dear

The S-141 Southern Regional Housing Research Project is a cooperative research effort funded through the USDA Agricultural Experiment Stations in nine southern states. One of the objectives of this project has been to improve the affordability of housing by designing innovative structures that are energy efficient and that incorporate low-cost construction methods.

Members of the S-141 research team have designed several innovative houses and would like to have them evaluated in a comprehensive manner. An important part of this evaluation will be the comments and opinions of residents living in these houses. In order to establish the appropriateness of these procedures the research team would like to use a questionnaire and/or interview schedule with residents living in Solar Attic houses and with residents living in a more conventional house.

Your name, along with others living in Solar Attic houses, was obtained from builders, developers and other individuals. Your help in responding to the questionnaire and in talking to an interviewer would be appreciated very much. It will give our S-141 team an opportunity to use these instruments and it will provide us with information essential to the evaluation of housing from a residents viewpoint.

In the next few days I will be calling you to further explain this project and to answer any questions that you have. At that time I would also like to make an appointment to visit with you.

I hope that you will agree to participate in this project. I am looking forward to talking with you soon. Thank you for your assistance.

Sincerely,

COLLEGE OF HUMAN RESOURCES

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

DEPARTMENT OF HOUSING, INTERIOR DESIGN AND RESOURCE MANAGEMENT

October

Dear

Recently I talked to you about your participation in a study conducted by the S-141 Southern Regional Research team. Thank you very much for agreeing to be involved in this project. I have enclosed a copy of a Housing Satisfaction Scale that I would like for you to complete before our interview. This will give you time at your convenience, to think about your responses and will facilitate the interview process. Please try to have the person that will participate in the interview complete the Housing Satisfaction Scale. This will help to assure that the responses are consistent.

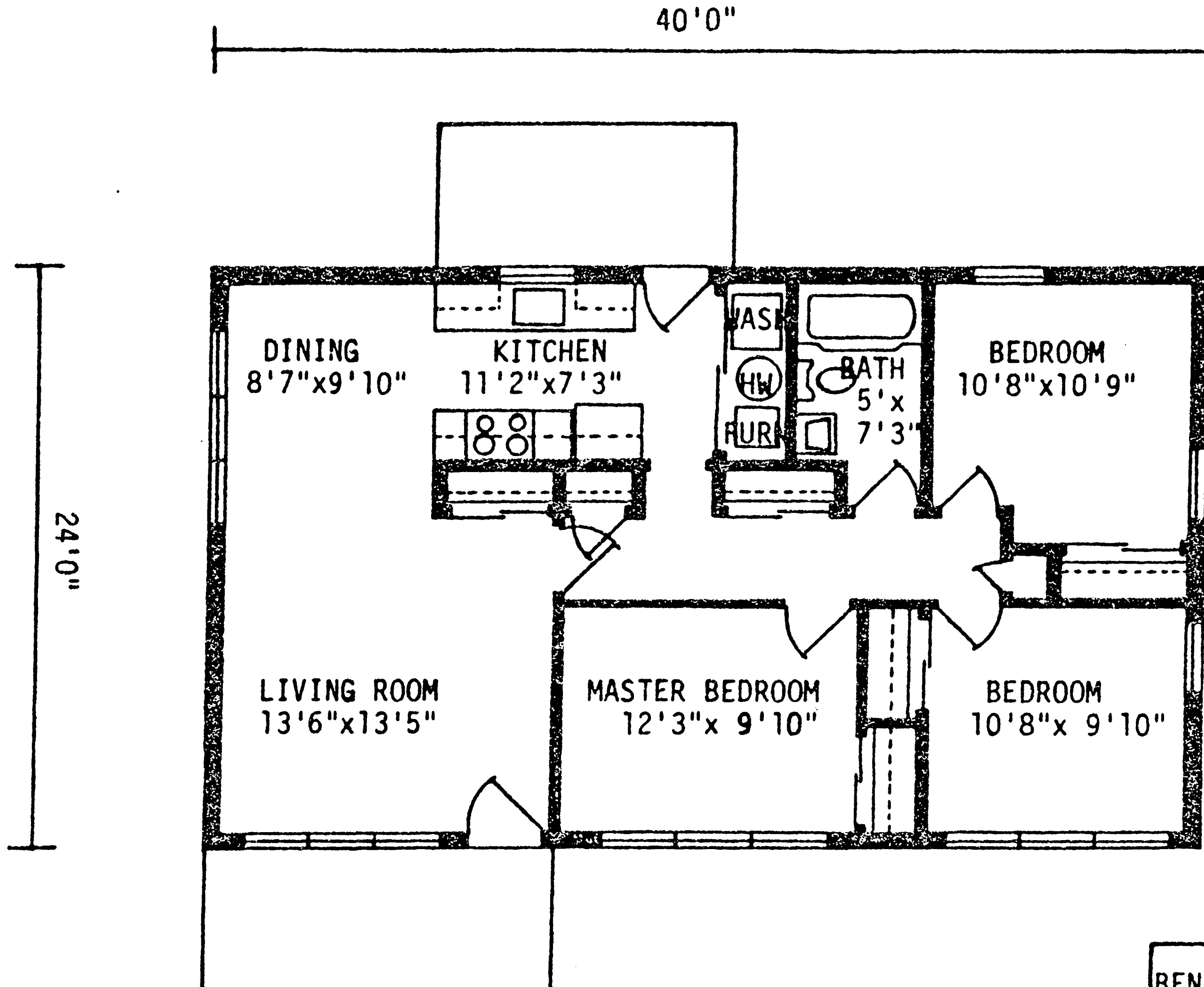
The time and effort that you spend with this study will be greatly appreciated. I am looking forward to seeing you on
at . Again thank you for your participation.

Sincerely,

Enclosure

APPENDIX N

Selected House Plan Diagrams for
Benchmark and Solar Attic Respondents



BENCHMARK: 1,3

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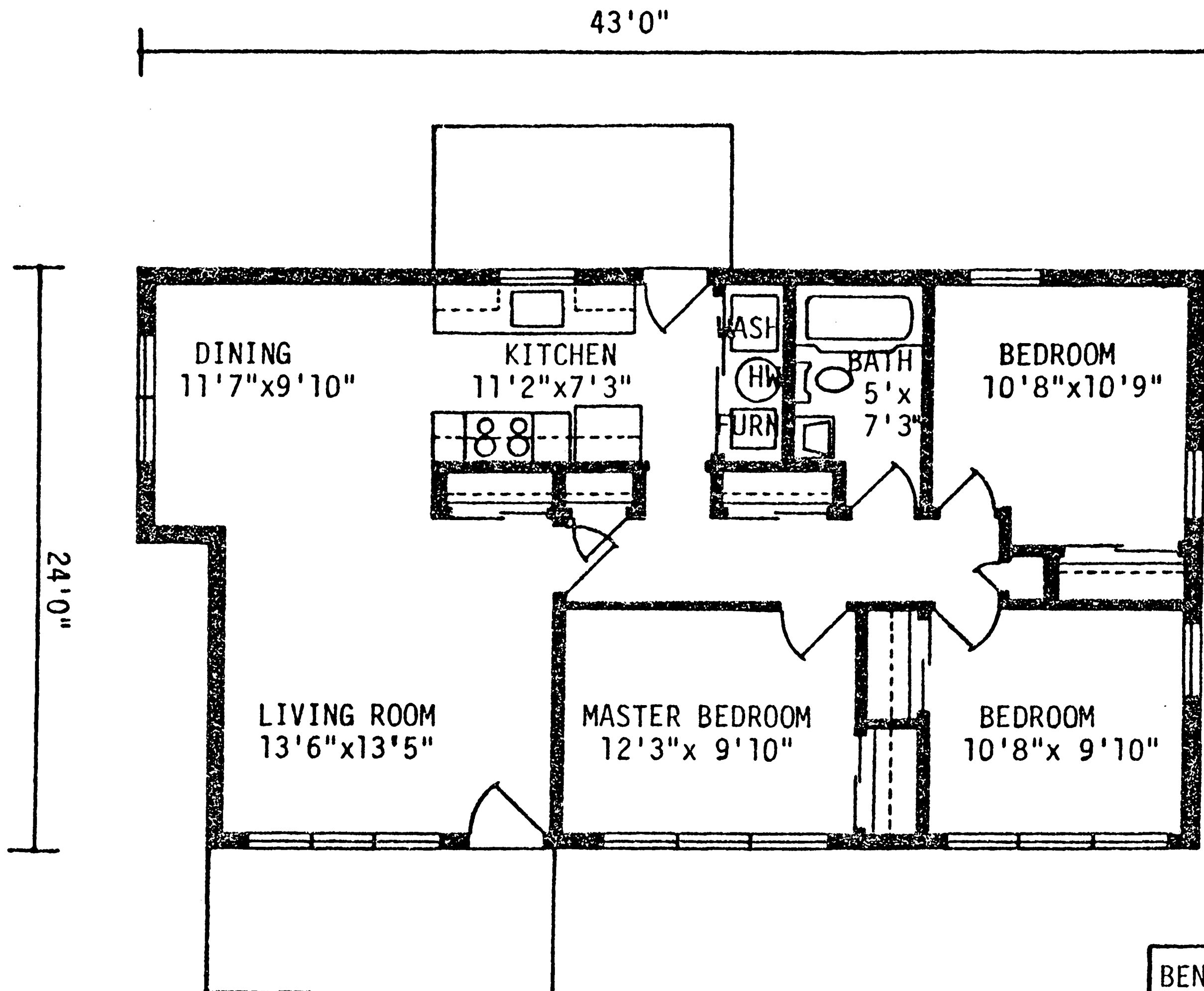
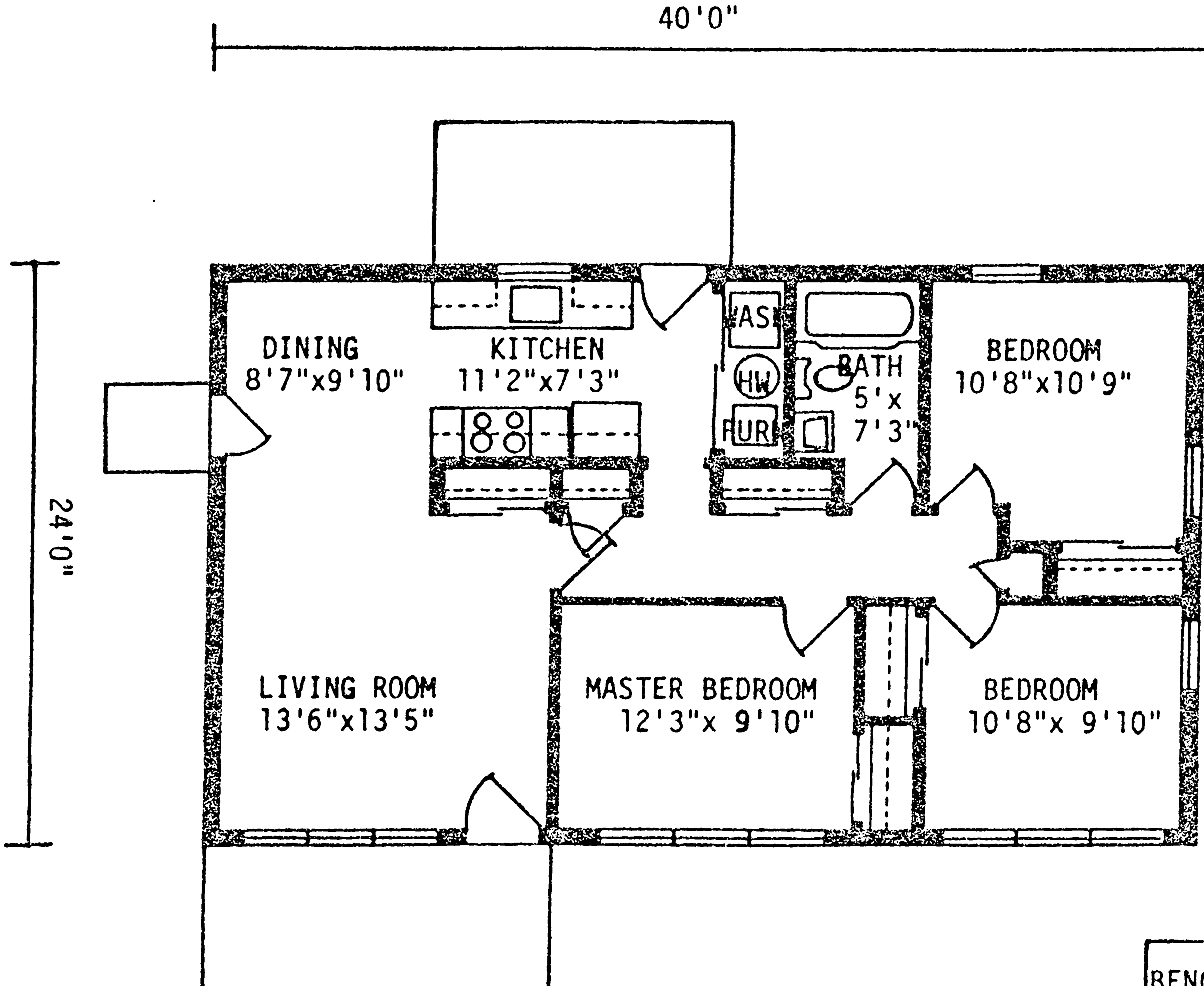


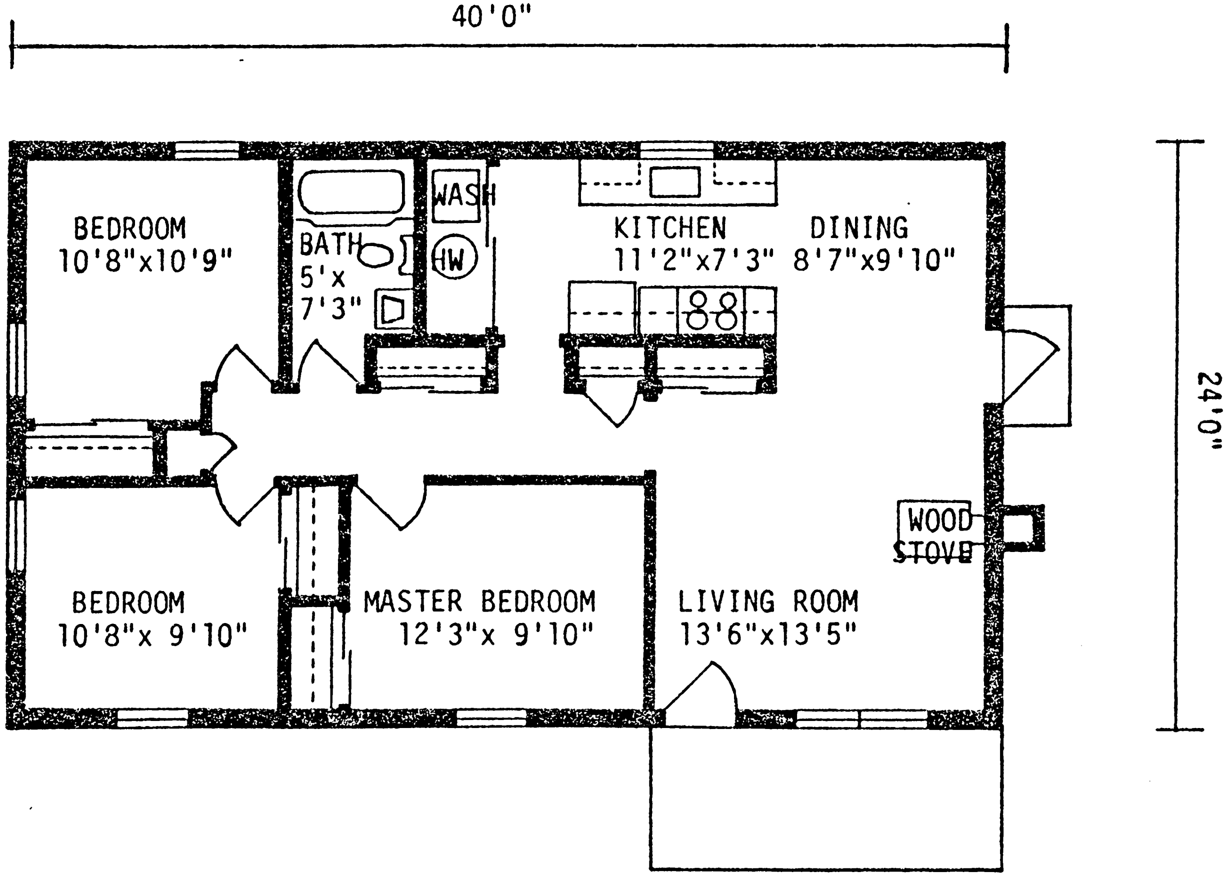
BENCHMARK: 2
SCALE: 1/8"=1'-0"
DRAWN BY J.B.WALKER



BENCHMARK: 4,5

SCALE: 1/8 "=1'-0"

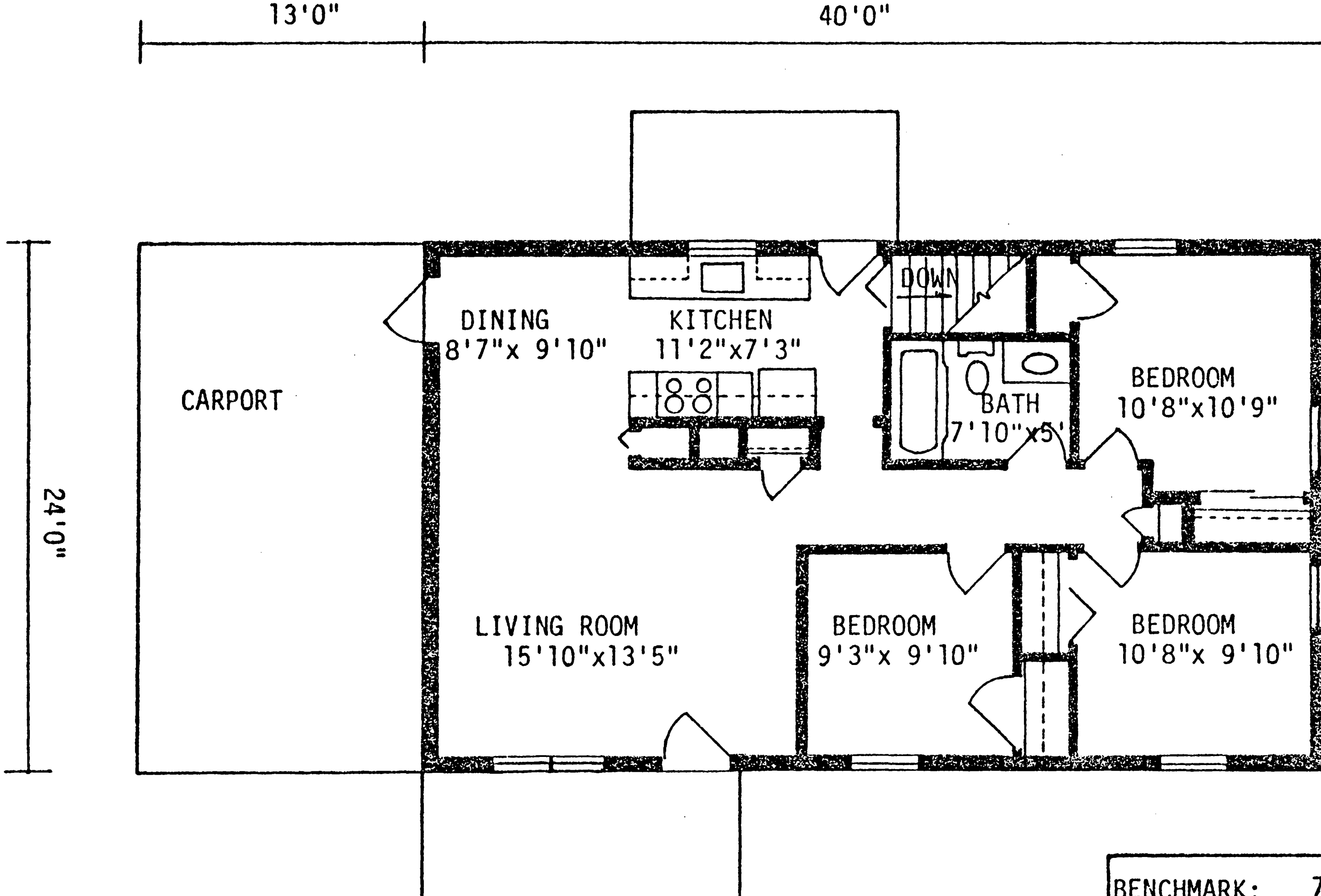
DRAWN BY J.B.WALKER



BENCHMARK: 6

SCALE: 1/8"=1'-0"

DRAWN BY J.B.WALKER



BENCHMARK: 7

SCALE: 1/8"=1'-0"

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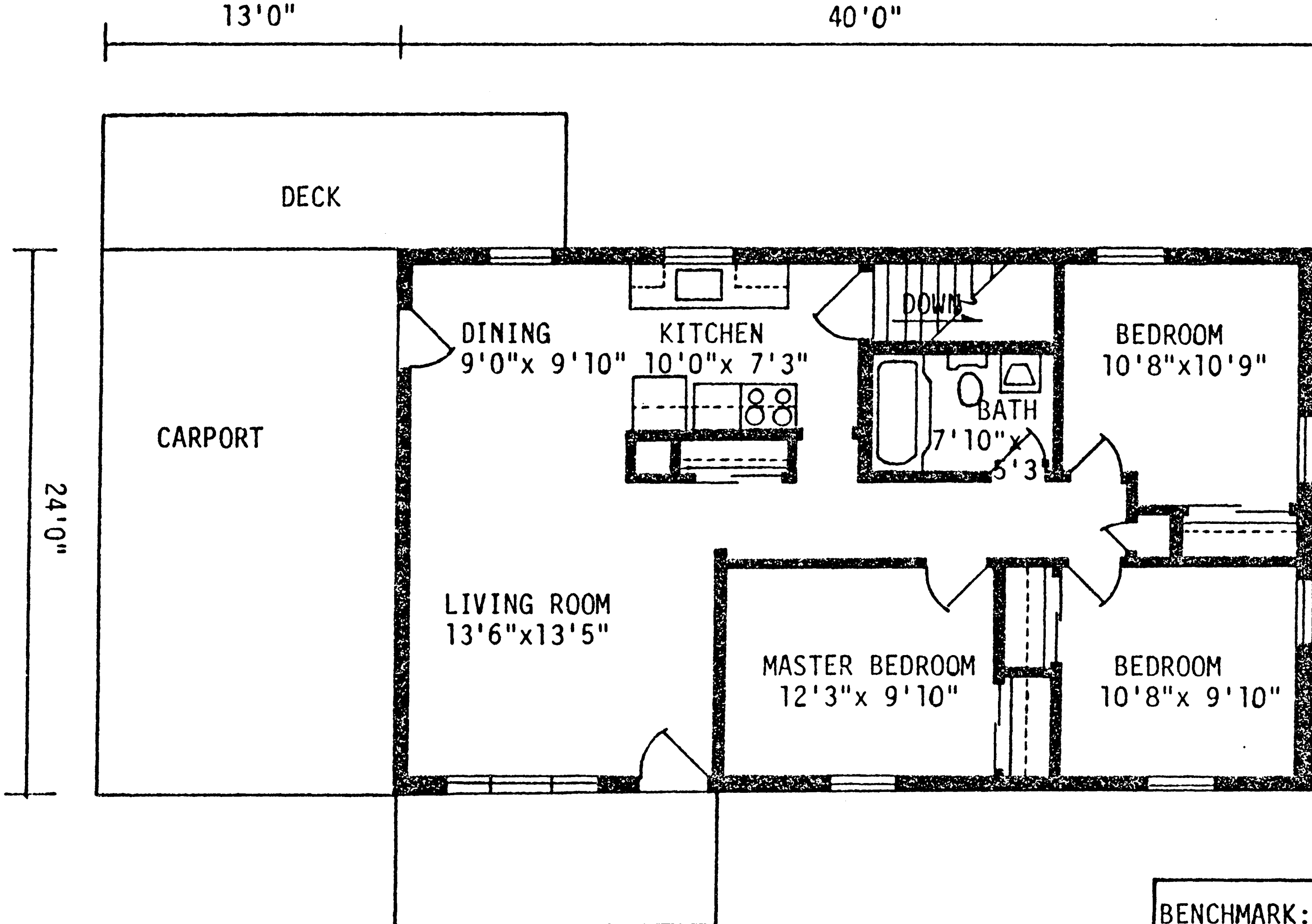
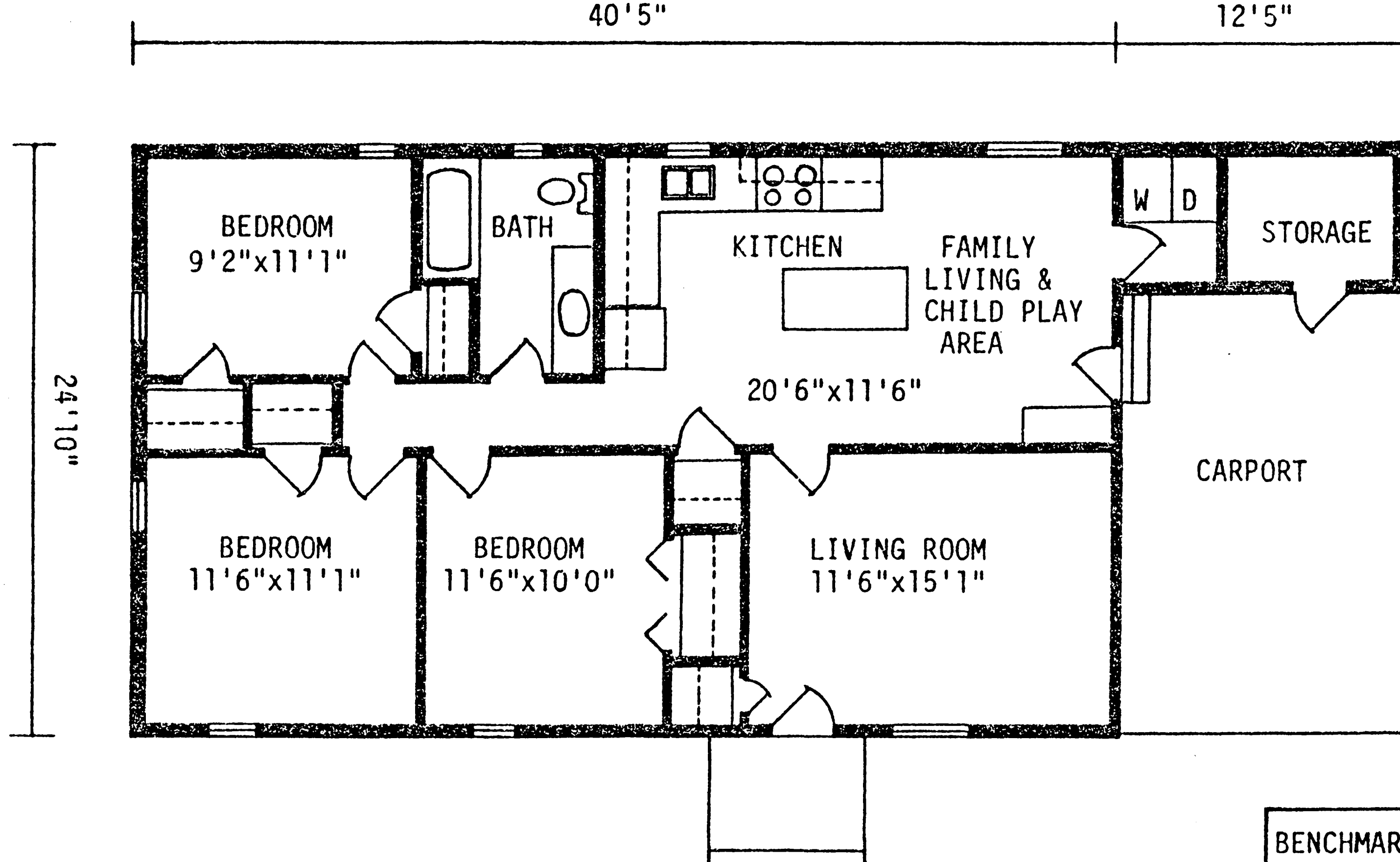


BENCHMARK: 8
SCALE: 1/8"=1'-0"
DRAWN BY J.B.WALKER



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SCALE: 1/8"=1'-0"

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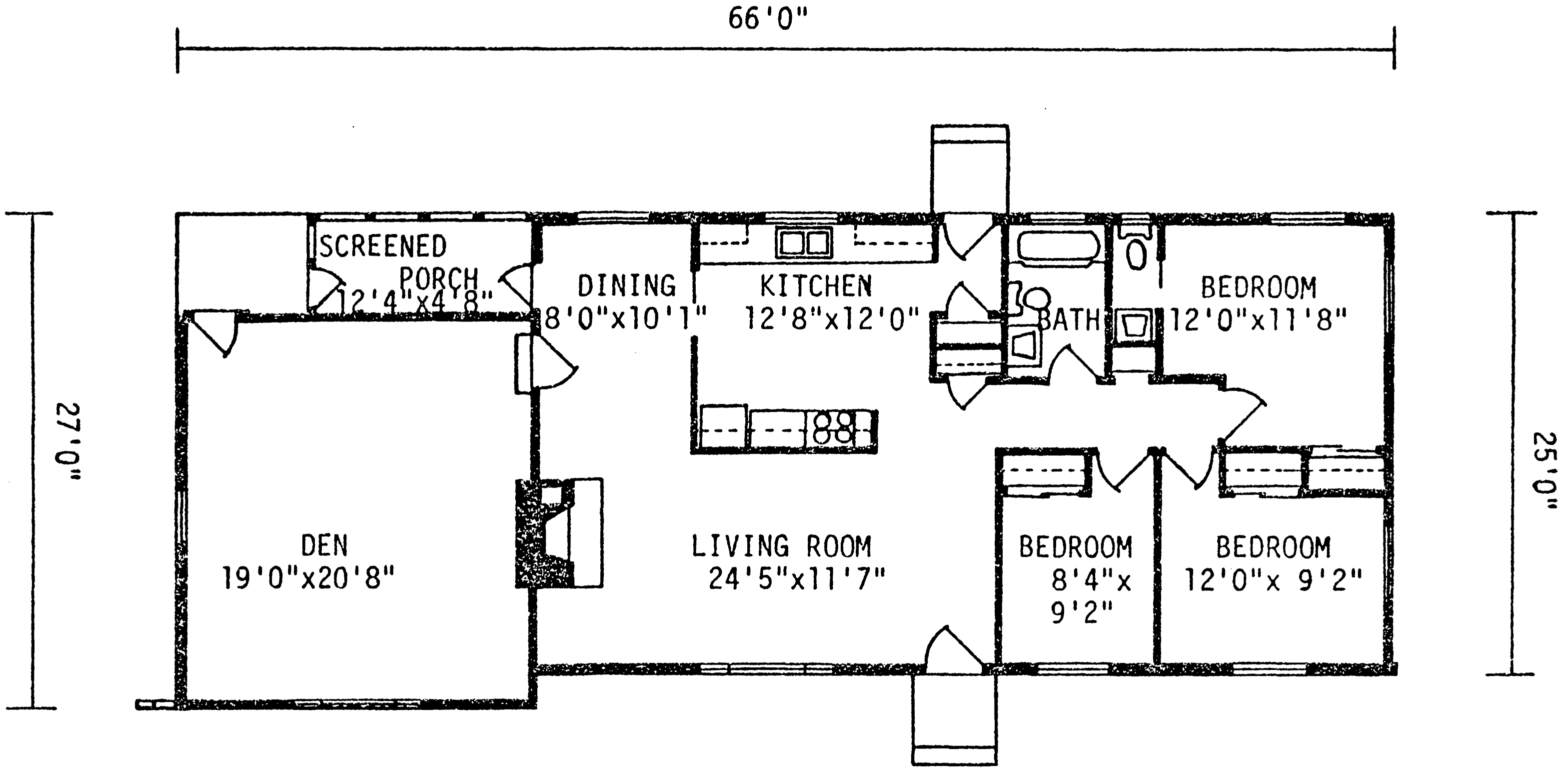

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BENCHMARK: 10

SCALE: 3/32"=1'-0"

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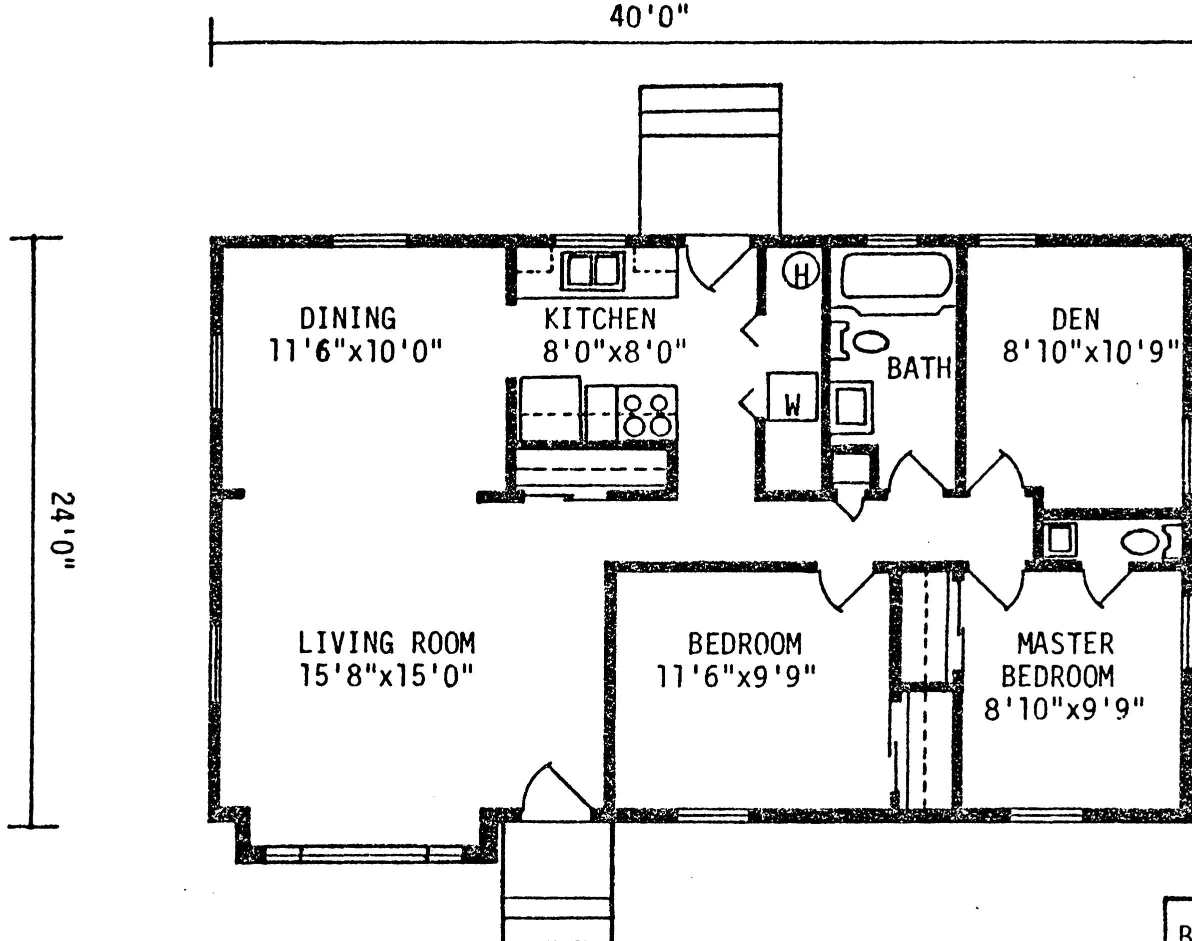

BENCHMARK: 11

SCALE: 1/8"=1'-0"

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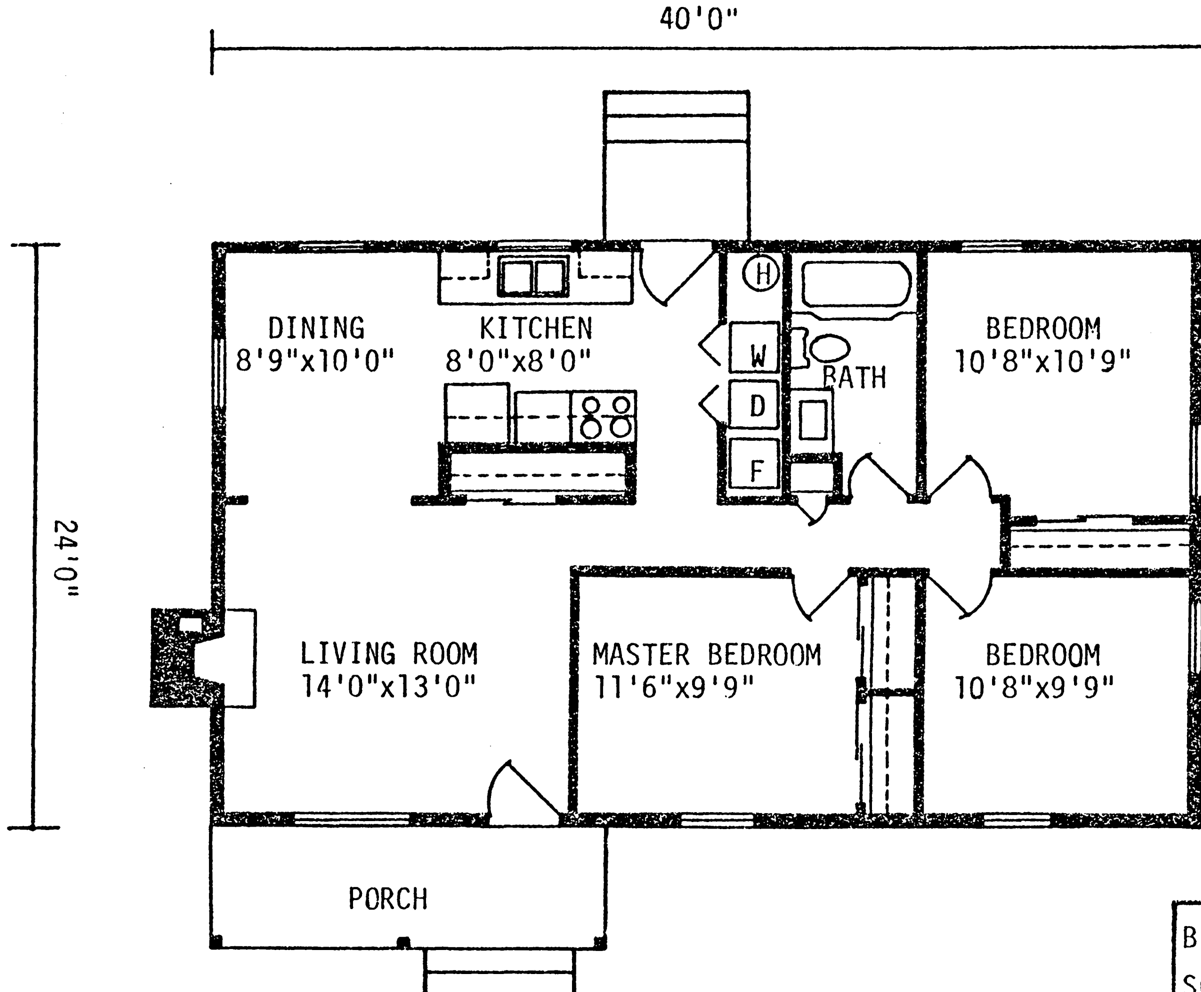

BENCHMARK: 12

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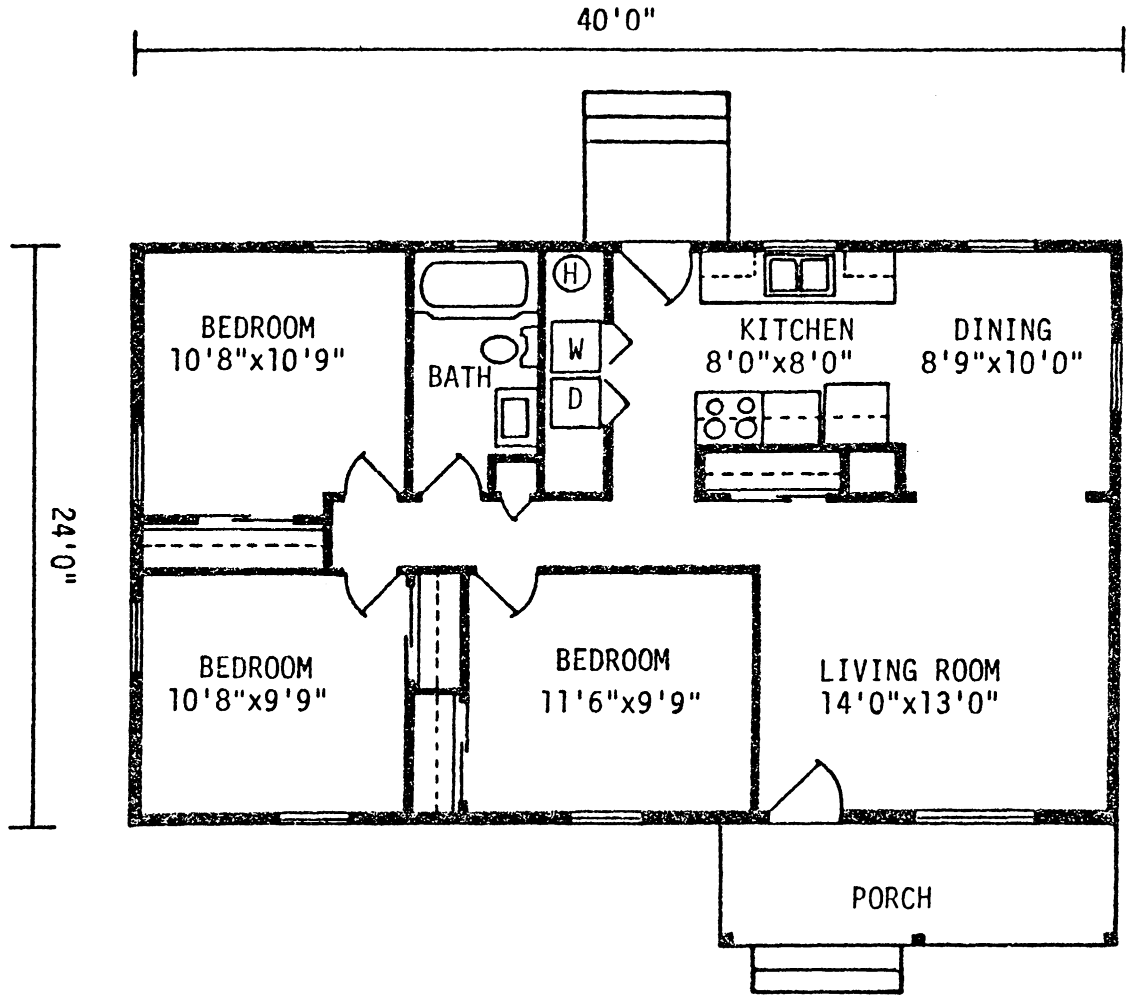

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SCALE: 1/8"=1'-0"

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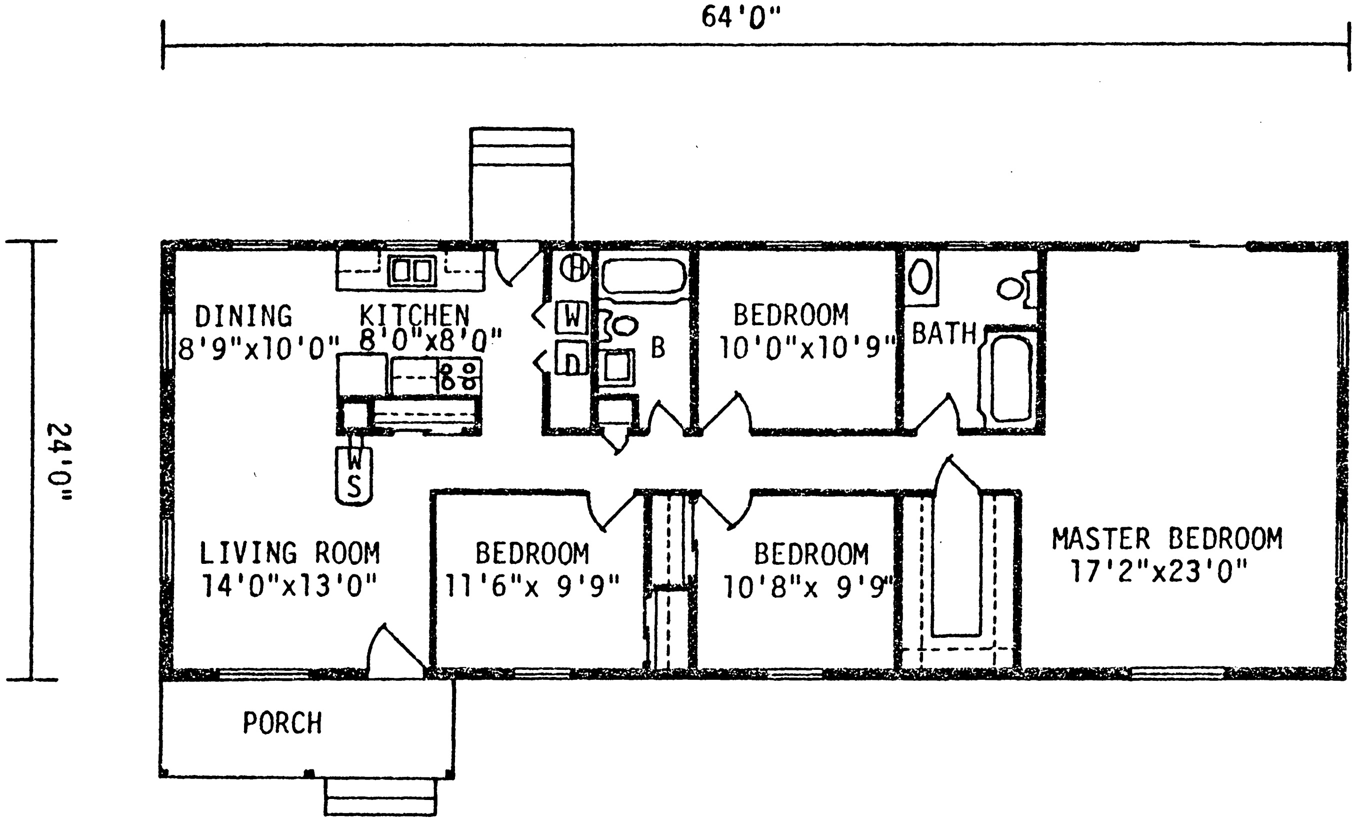

BENCHMARK: 14

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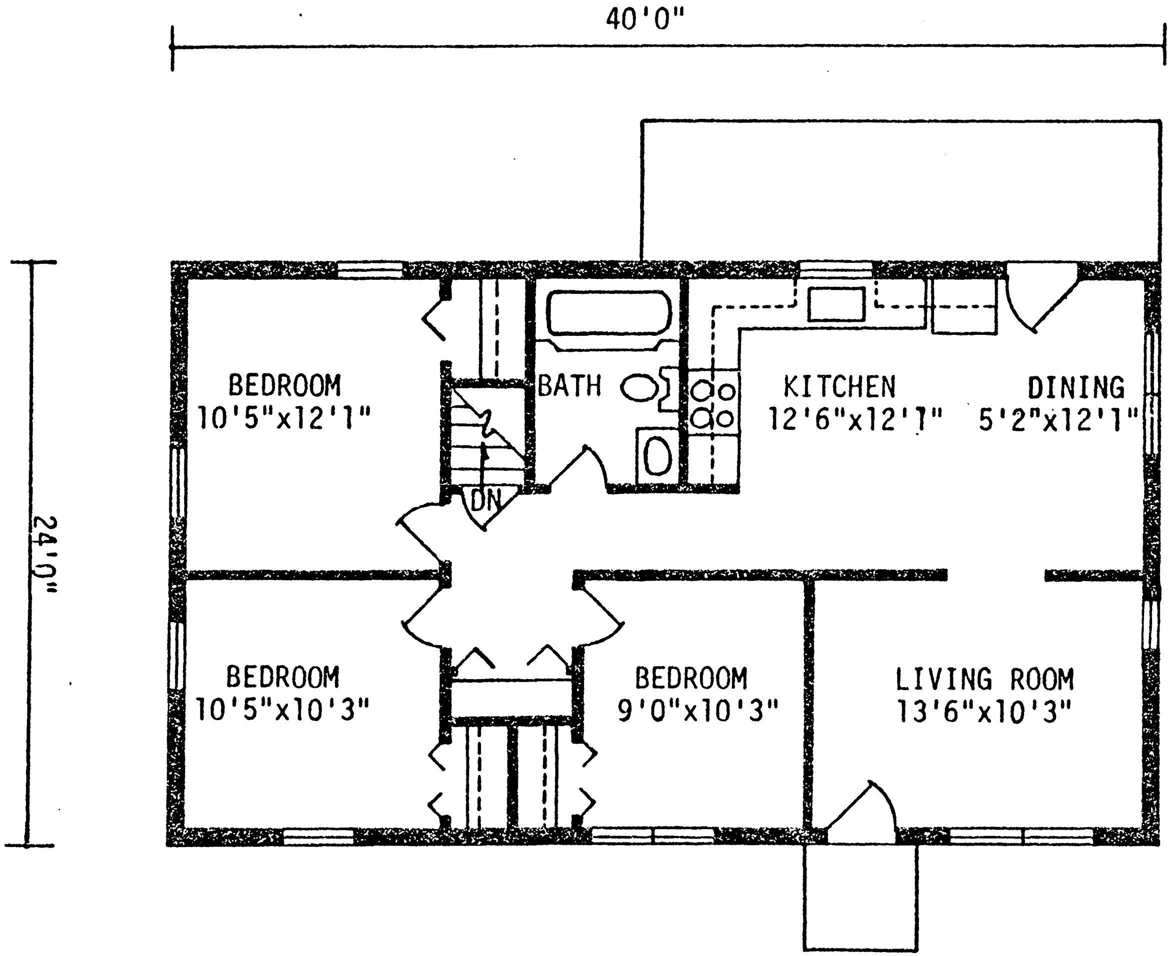

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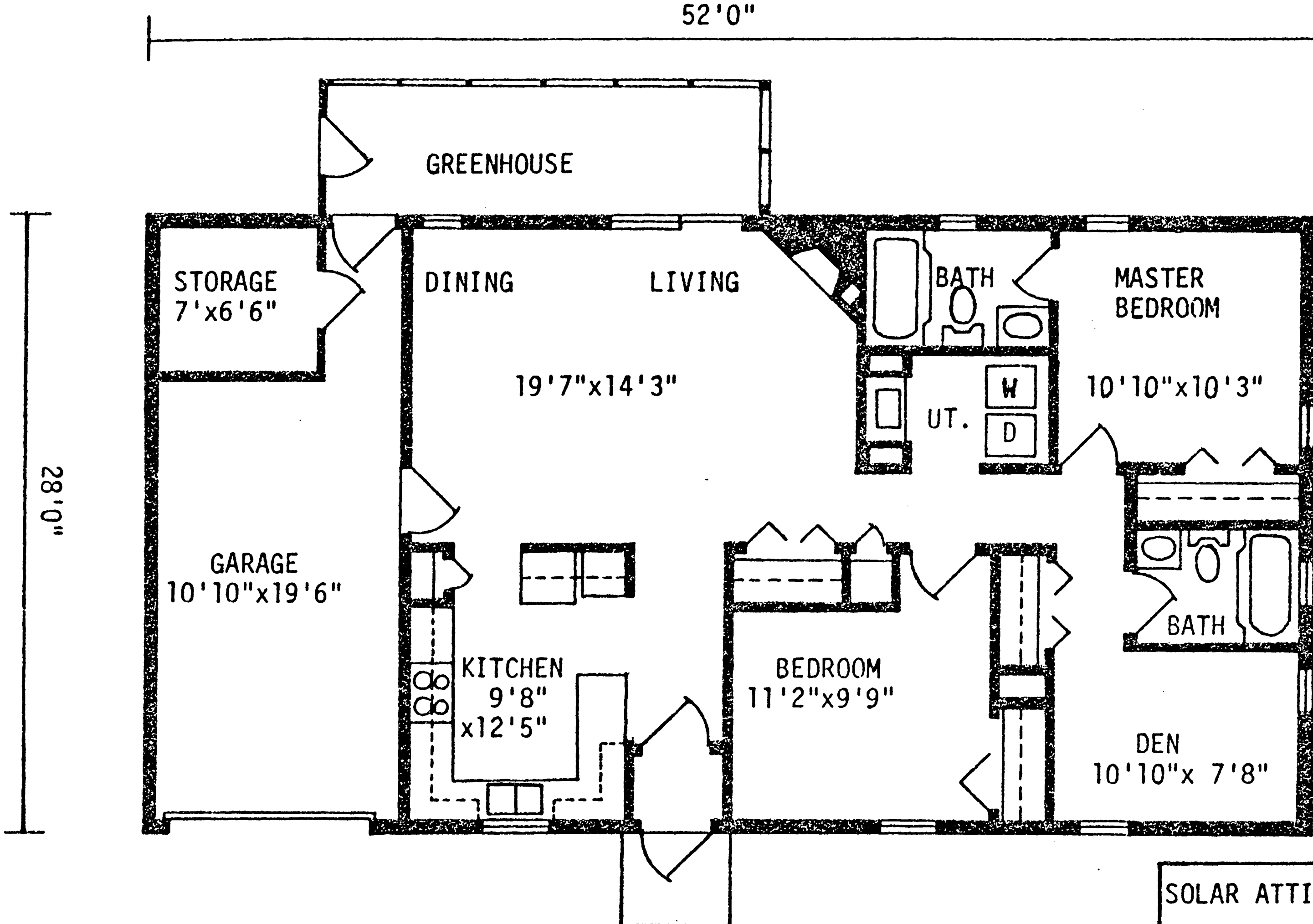
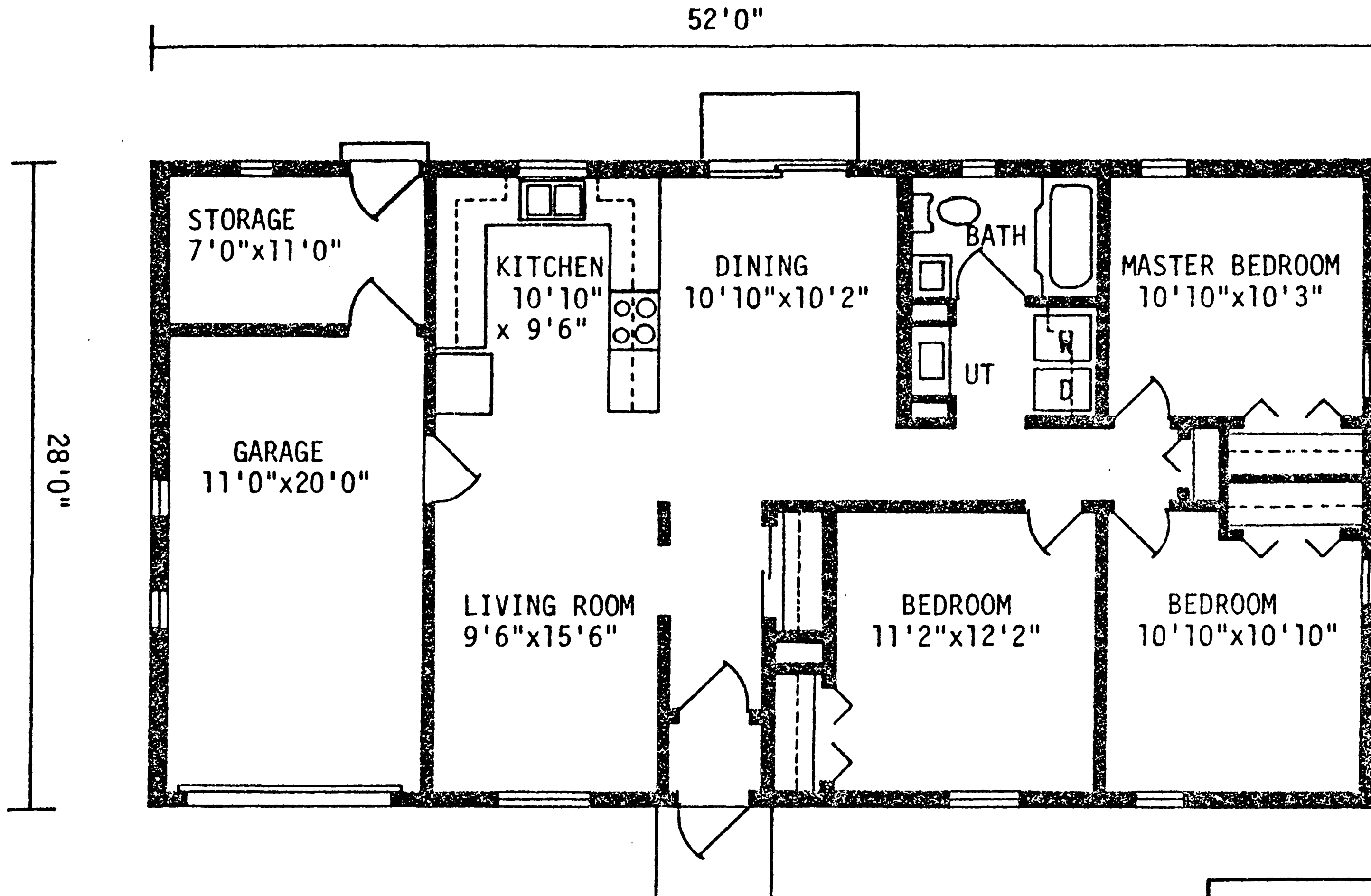


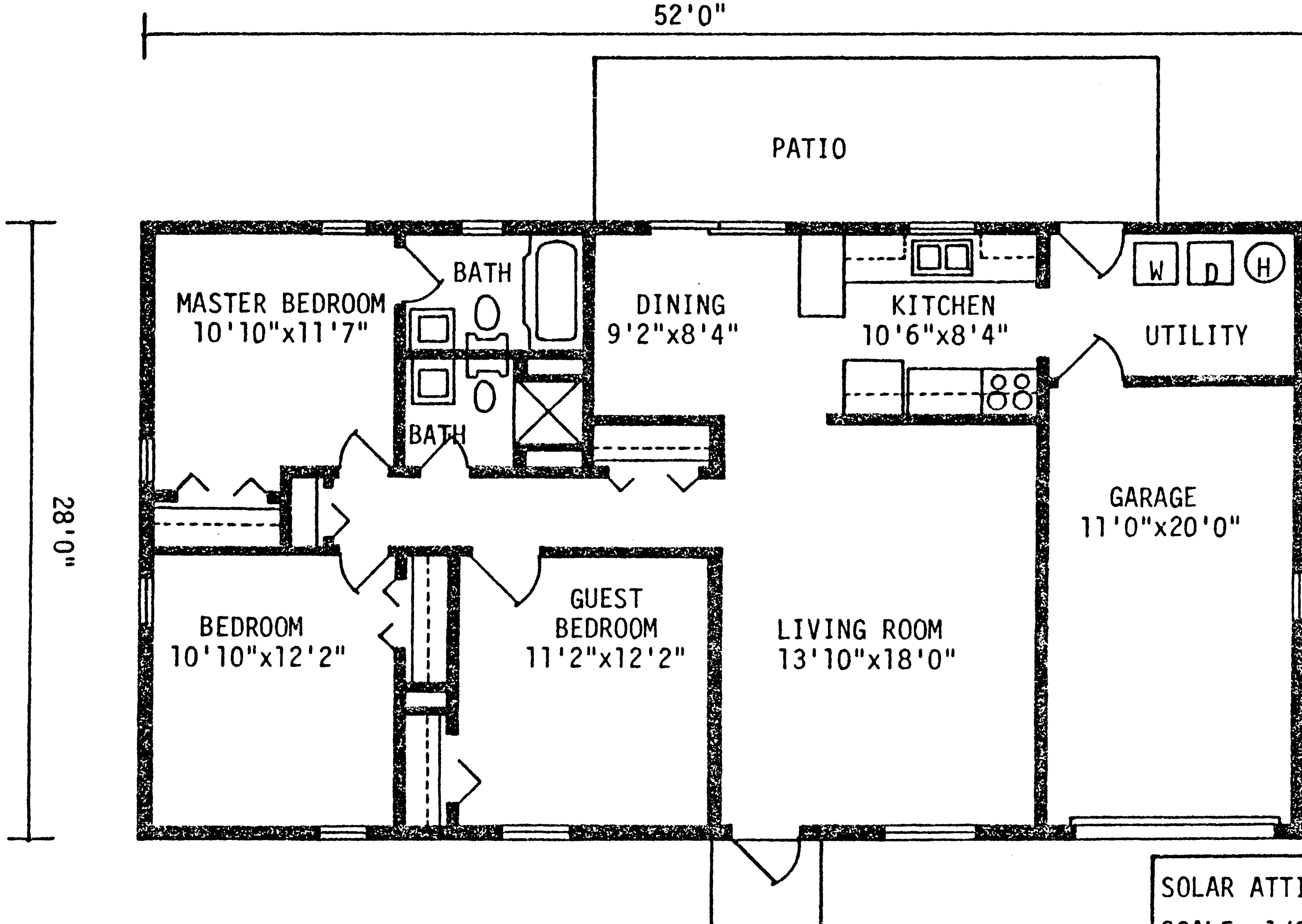
SOLAR ATTIC: 5
SCALE: 1/8"=1'-0"
DRAWN BY J.B.WALKER



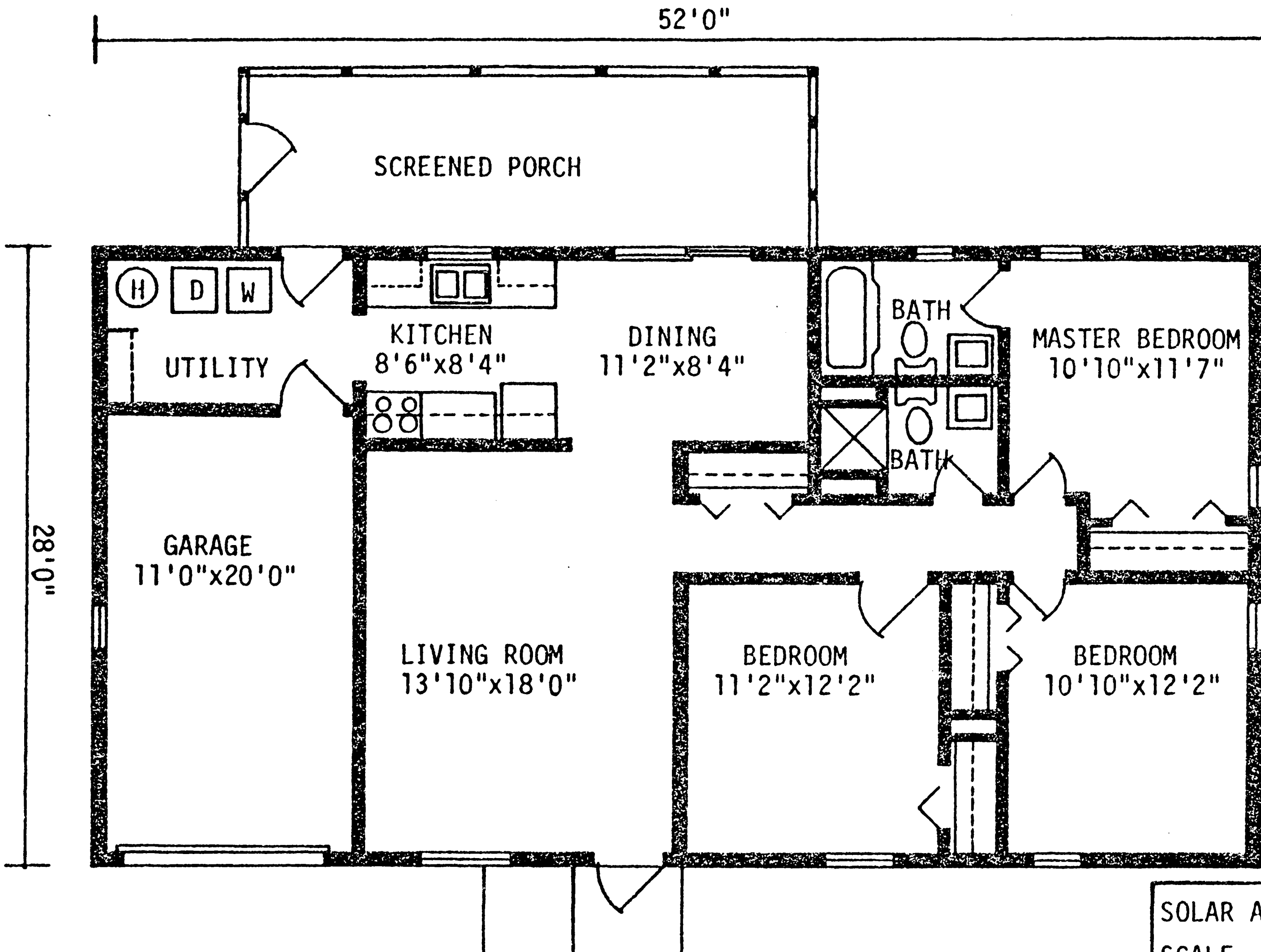
SOLAR ATTIC: 6

SCALE: 1/8"=1'-0"

DRAWN BY J.B.WALKER



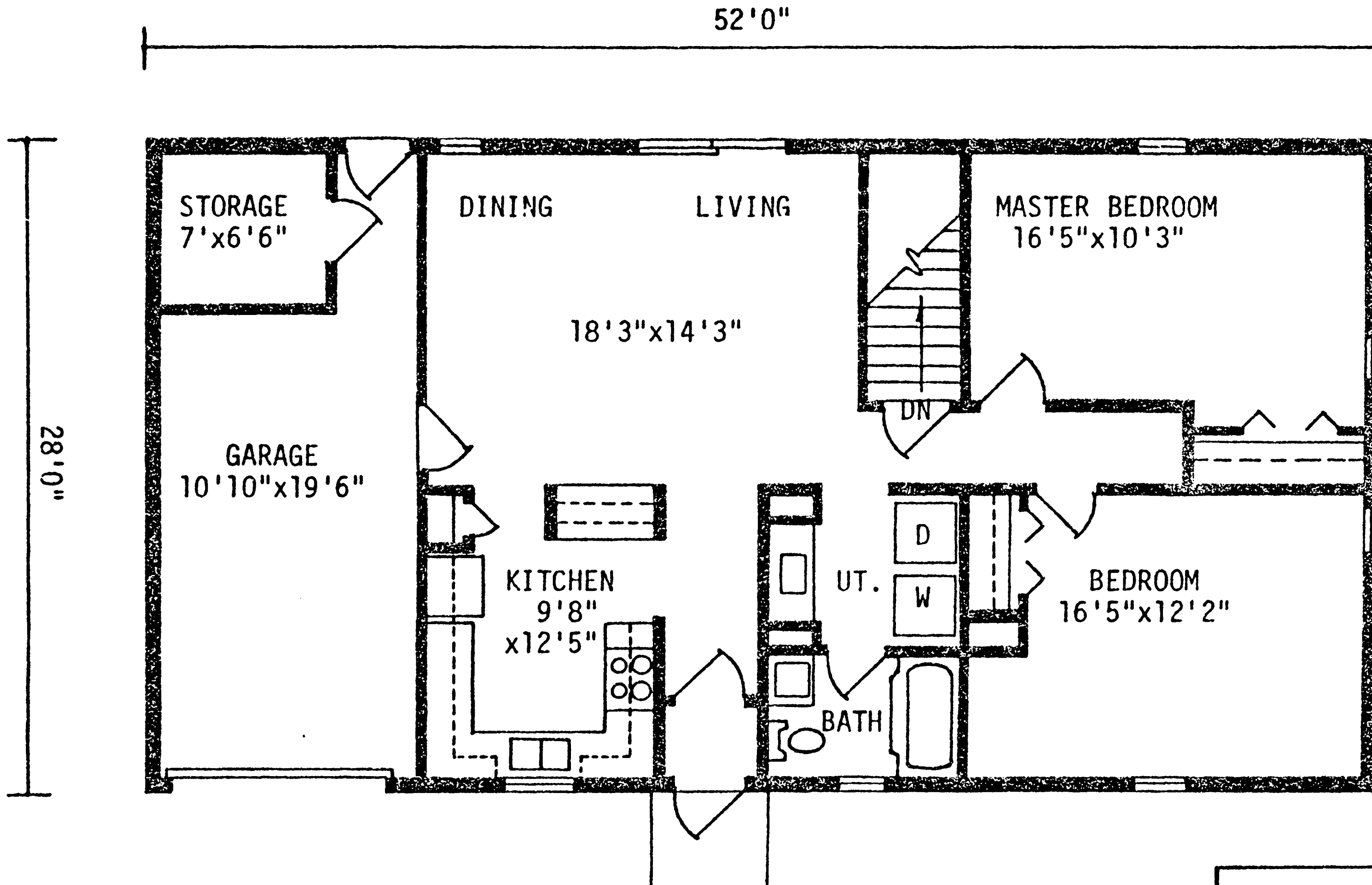
SOLAR ATTIC: 7
SCALE: 1/8"=1'-0"
DRAWN BY J.B.WALKER



SOLAR ATTIC: 8

SCALE: 1/8"=1'-0"

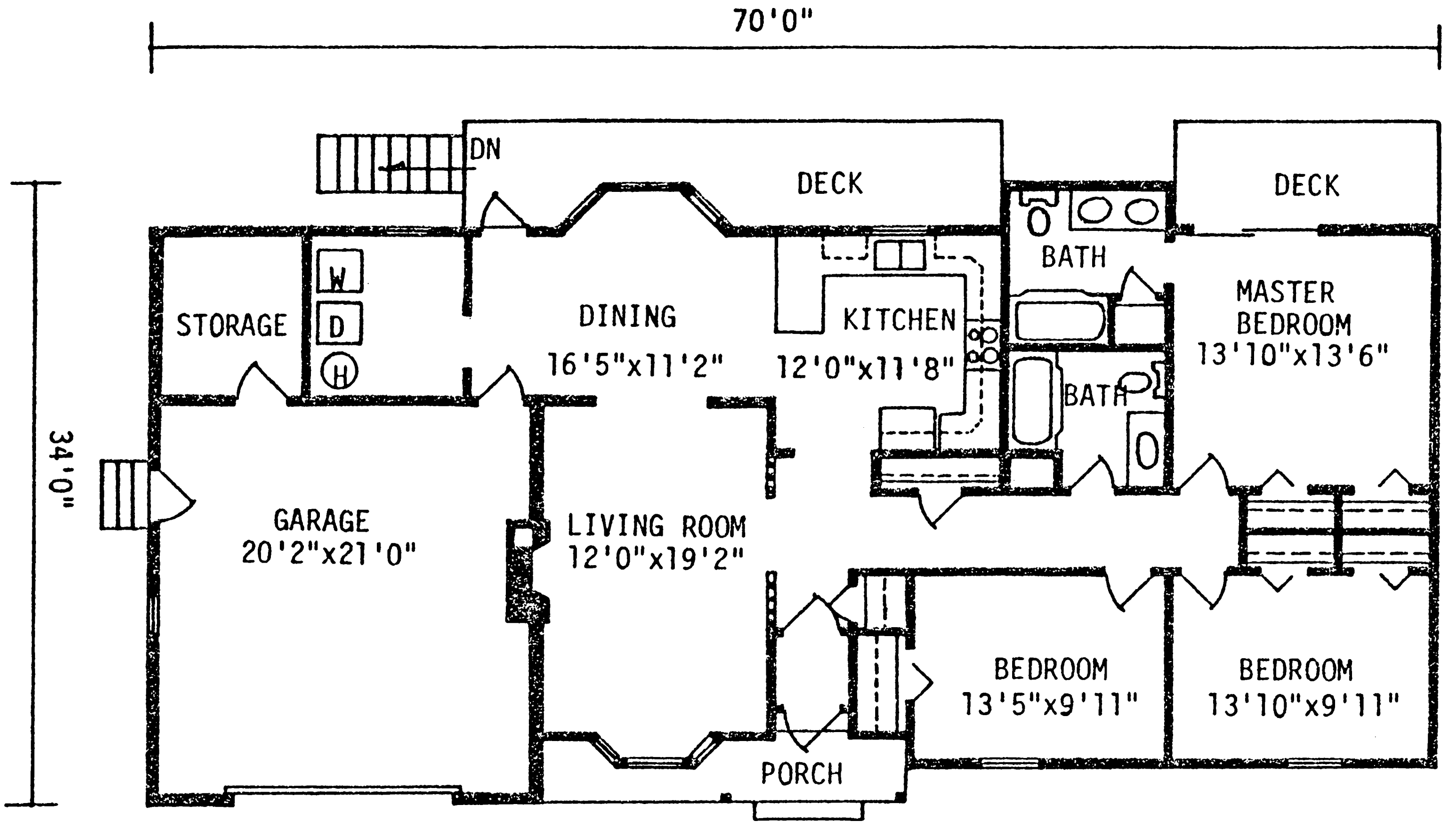
DRAWN BY J.B.WALKER



SOLAR ATTIC: 9

SCALE: 1/8"=1'-0"

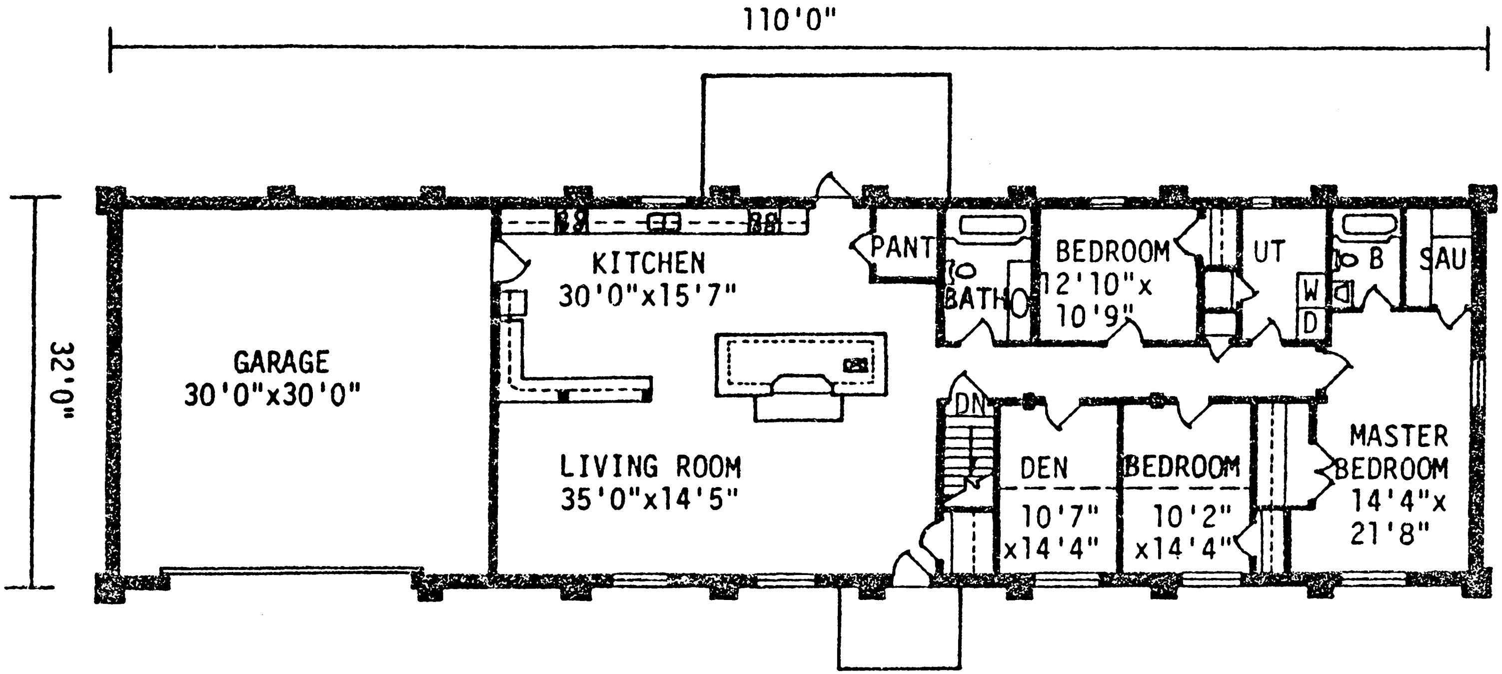
DRAWN BY J.B.WALKER



SOLAR ATTIC: 10

SCALE: 3/32"=1'-0"

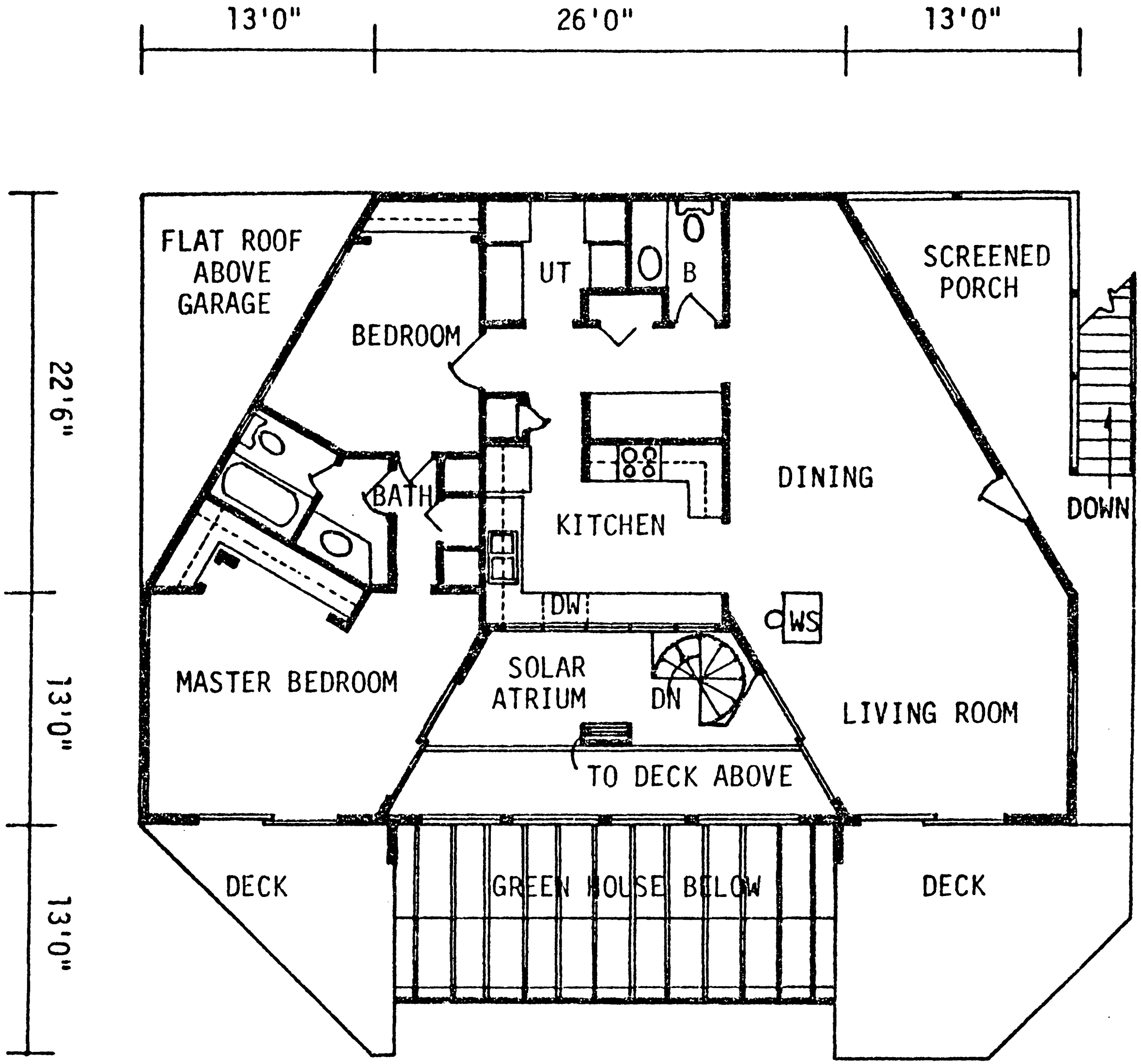
DRAWN BY J.B.WALKER



SOLAR ATTIC: 11

SCALE: 1/16"=1'-0"

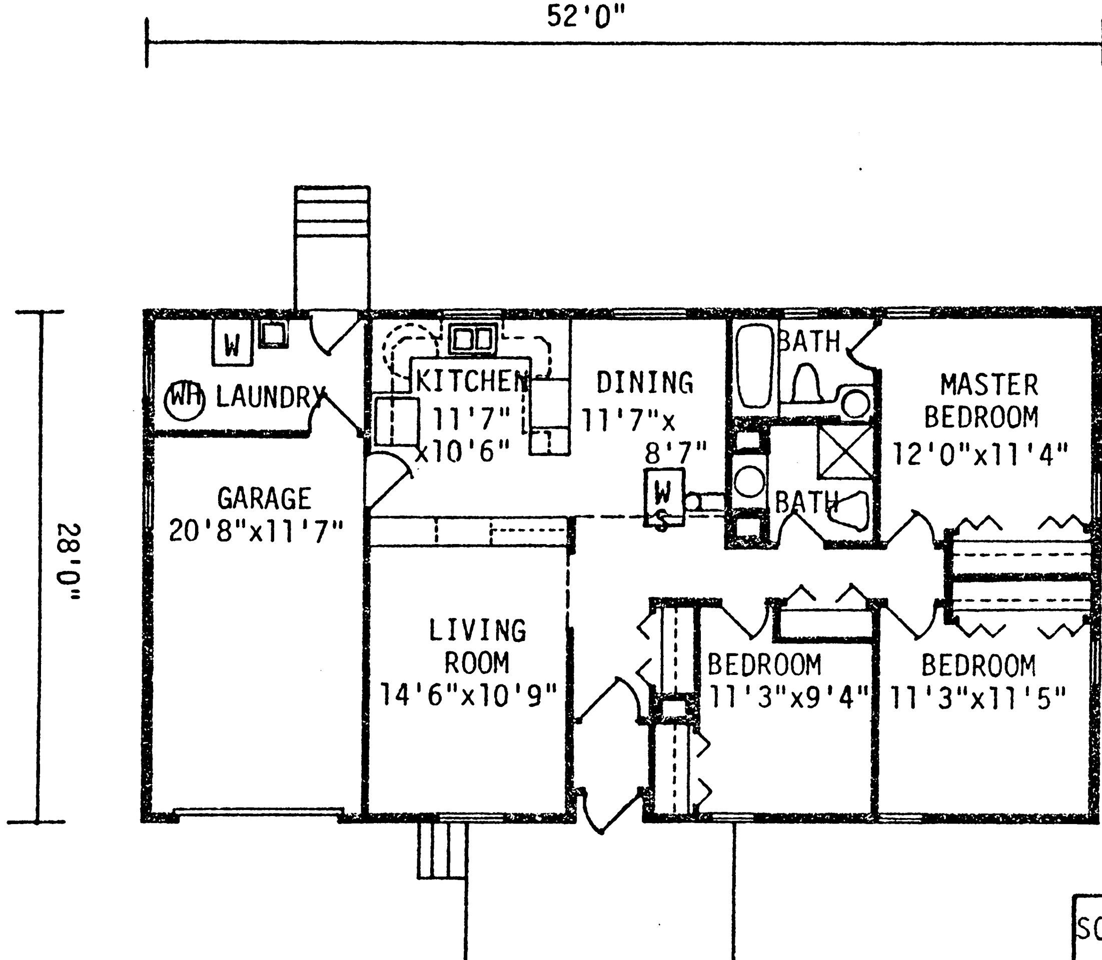
DRAWN BY J.B.WALKER



SOLAR ATTIC: 12
MAIN FLOOR

SCALE: 3/32"=1'-0"

DRAWN BY J.B.WALKER



SOLAR ATTIC: 13

SCALE: 3/32"=1'-0"

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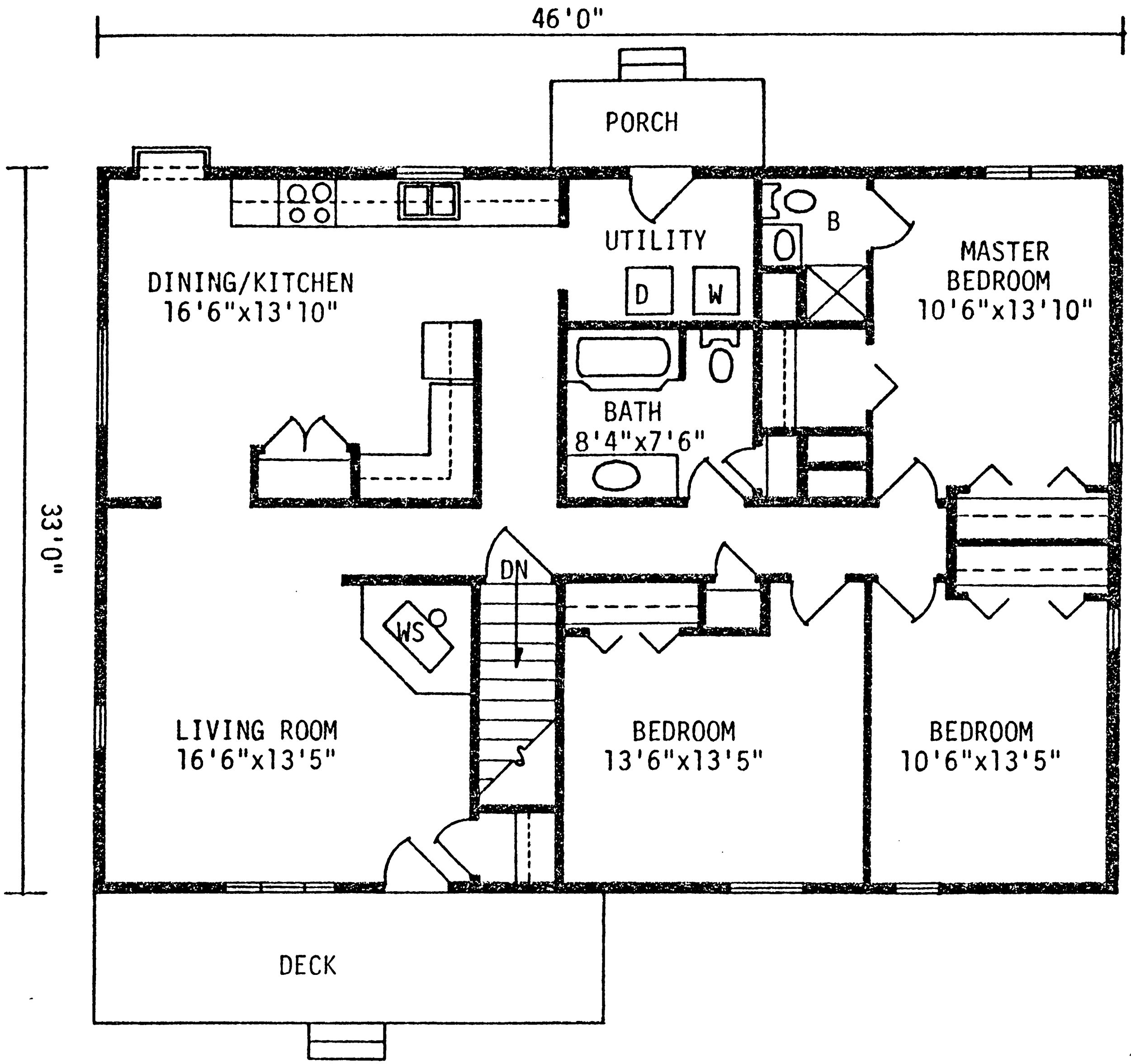

SOLAR ATTIC: 14

SCALE: 1/8"=1'-0"

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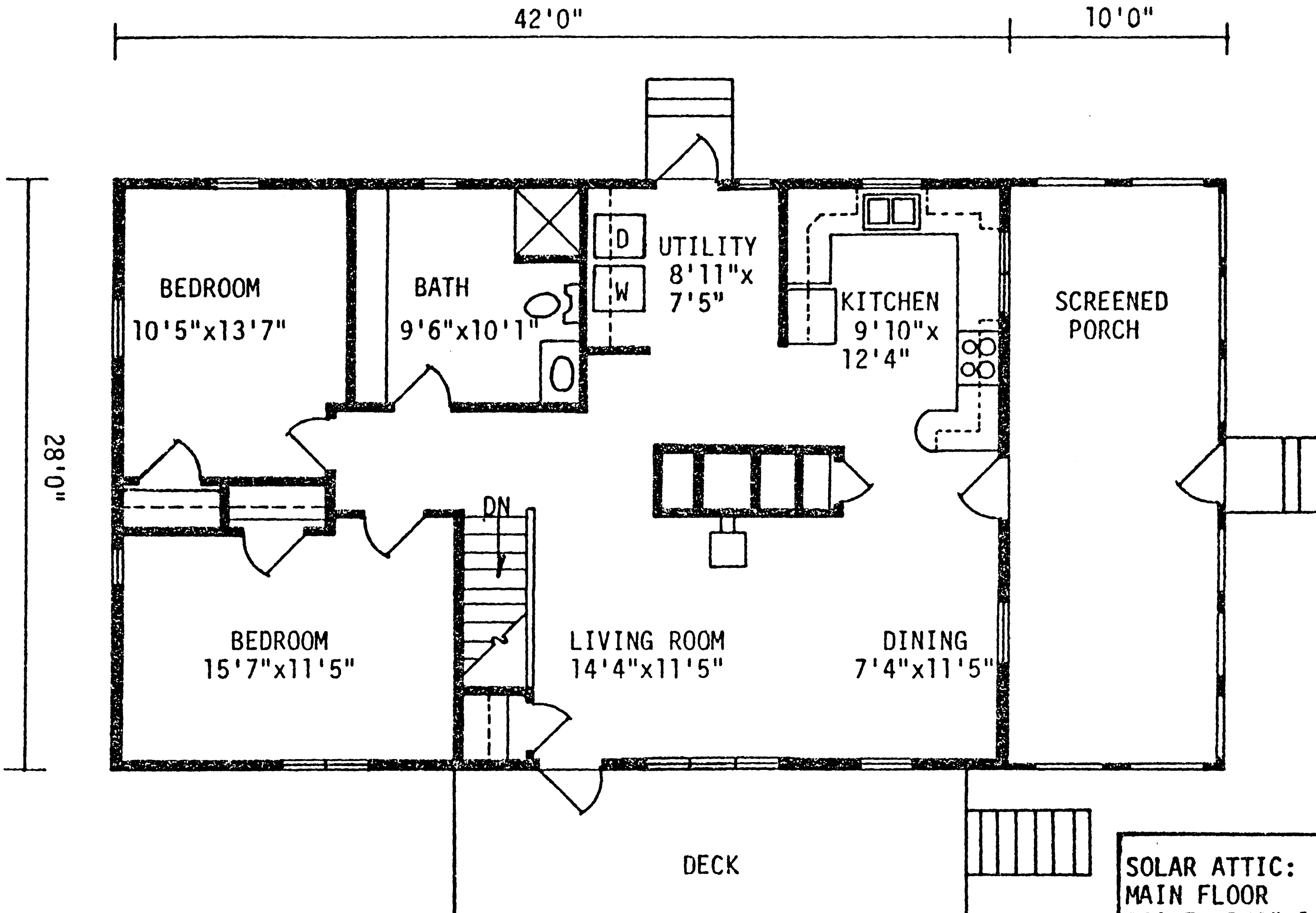
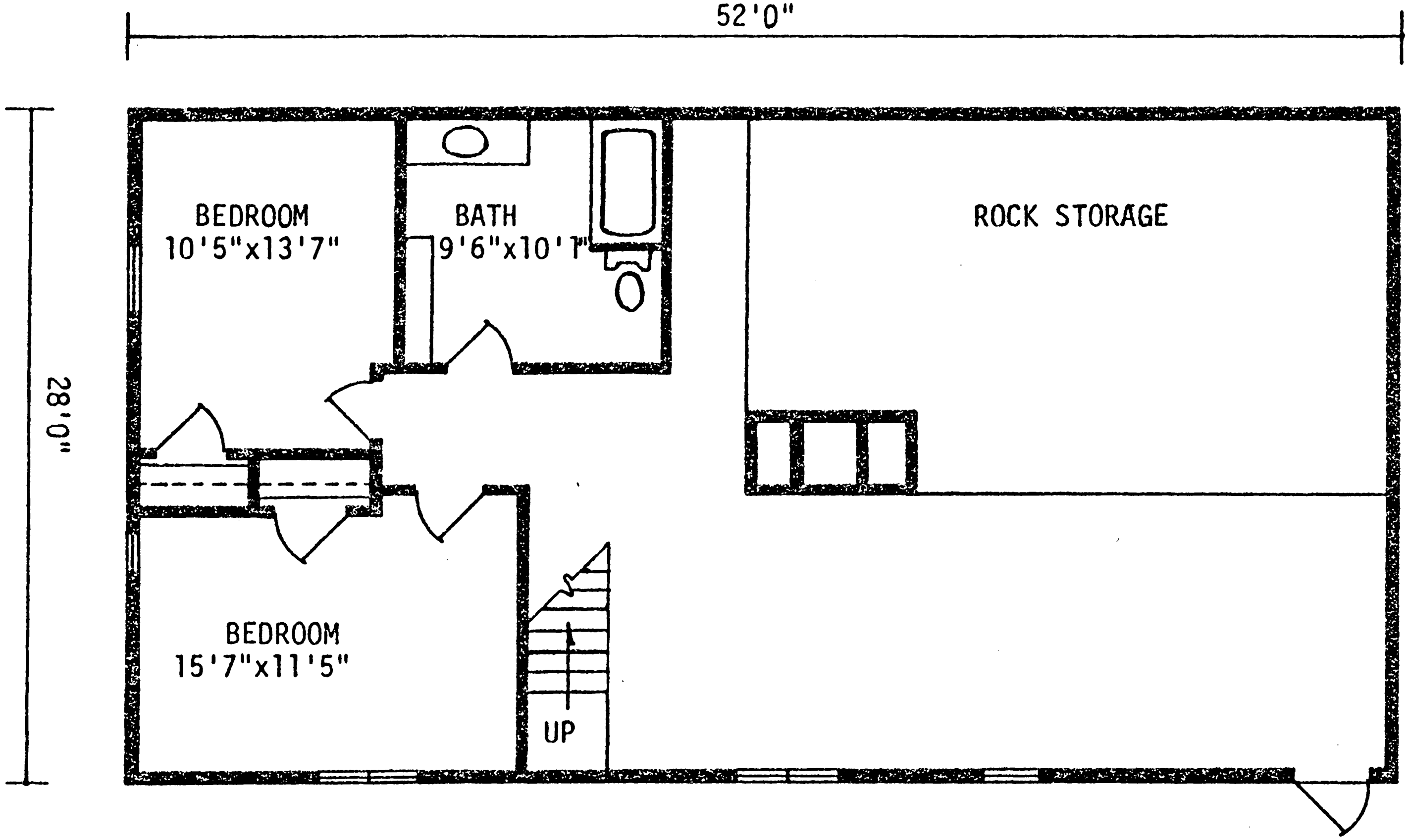


SOLAR ATTIC: 15
MAIN FLOOR
SCALE: 1/8"=1'-0"
DRAWN BY J.B.WALKER



SOLAR ATTIC: 15
BASEMENT
SCALE: 1/8"=1'-0"
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APPENDIX O

Weightings of Scores for Combined Satisfaction-Importance Items

Weightings of Scores for Combined Satisfaction-Importance Items *

		Very Unimportant 1	2	3	4	5	Very Important 6
Very Satisfied	6	11	12	13	15	16	17
	5	10	11	12	14	15	16
	4	9	10	11	13	14	15
	3	8	7	6	4	3	2
	2	7	6	5	3	2	1
Very Dissatisfied	1	6	5	4	2	1	0

* From Goss, R. C. Housing of the Appalachian coal miner: Conditions, satisfactions and aspirations. Unpublished doctoral dissertation, The Florida State University, 1982.

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