A LIFE CYCLE COST COMPARISON BETWEEN EARTH SHELTER AND CONVENTIONAL HOUSING IN OKLAHOMA

By

ALLEN DALE JONES

Bachelor of Science in Architectural Studies

Oklahoma State University

Stillwater, Oklahoma

1981

Submitted to the Faculty of the Graduate College
of the Oklahoma State University
in partial fulfillment of the requirements
for the Degree of
MASTER OF ARCHITECTURAL ENGINEERING
July, 1984

A LIFE CYCLE COST COMPARISON BETWEEN

EARTH SHELTER AND CONVENTIONAL

HOUSING IN OKLAHOMA

Thesis Approved:

Thesis Adviser

Dean of the Graduate College

PREFACE

Construction, operating, and maintenance costs for comparable earth sheltered and conventional housing were compiled and then used to perform a life cycle cost analysis (LCCA). The life cycle costs were used to predict the length of time required for earth sheltered housing to pay back its usual higher initial investment. The payback period was also compared to the average home tenure to find if an earth shelter would pay off for the average homeowner. From the LCCA the cost factors having the most substantial impact on the break-even period were identified and ranked.

Earth sheltered homes were found to have a favorable payback period under most circumstances. The earth shelters were found to not have the substantially higher first costs that other studies indicate. The often praised possible insurance reduction for earth shelters was found to be nearly non-existent. It also was found to be a very minor cost factor in determining the break-even period of an earth shelter. Relations of typical costs required for an earth shelter to be comparable to a conventional home were outlined.

I wish to express my sincere gratitude to all of the people who assisted me in this work both here at and away from Oklahoma State Universtiy, especially my principal advisor, Dr. Lester Boyer, and one of my committee members and instructor, Prof. Walter Grondzik. Their contributions to this paper were most appreciated, as was their guidance and diligence. I am also most thankful to my other committee member, Prof.

Alan Brunken, for his contributions, insight, and patience.

A special note of appreciation is also given to the professionals throughout the state whose responses to the questionnaire concerning building costs for both conventional and earth sheltered housing provided invaluable baseline cost information on which to base the life cycle cost analysis.

To my wife, Natalie, I owe immeasurable gratitude for her unending support and encouragement not only during this thesis work, but during my entire graduate studies.

Lastly, I owe much thanks to my mother and father, and to my sisters, Kari and Brenda, for their encouragement, moral support, and understanding; and a special thanks to my parents for their financial support through my extended stay at Oklahoma State.

TABLE OF CONTENTS

Chapter Page

Chapter Page

LIST OF TABLES

LIST OF FIGURES

NOMENCLATURE

AHT	average home tenure
AIA	American Institute of Architects
A/G	symbol for conventional above ground home
BLAST	building simulation computer program for energy consumption
CD	certificate of deposit
CNED	Center for Natural Energy Design
E/S	symbol for earth sheltered home
FHA	Federal Housing Administration
FNMA	Federal National Mortgage Administration
GAO	General Accounting Office
HUD	U.S. Department of Housing and Urban Development
HVAC	heating, ventilating, and air conditioning system
ins.	abbreviation for insurance
kWh	kilowatt-hour
LCCA	life cycle cost analysis
LOF	loan origination fee
MHFA	Minnesota Housing Finance Agency
mps	H.U.D. minimum property standards
OPEC	Organization of Petroleum Exporting Countries
opp cost	abbreviation for opportunity cost
ORNL	Oak Ridge National Laboratory
PITI	principal + interest + taxes + insurance
pmi	private mortgage insurance

POINTS	mortgage interest points
SOLEST	building simulation computer program for energy consumption
UTA	University of Texas at Arlington
VA	Veterans Administration

CHAPTER I

INTRODUCTION

Brief History of Energy Awareness

The dependency on fossil fuel by present-day society began around the turn of this century. Industry was rapidly expanding, the new automobile was quickly gaining popularity, and new uses for electricity were being developed. Fossil fuels were easily obtained and the reserves seemed almost infinite. Prior to the World War I era, people began developing an endless array of energy consuming lifestyle improvements.

The American society of the post World War II period was rapidly growing and becoming more affluent. Building mechanical systems capable of providing comfort in any ambient conditions were having a great impact on the architecture of this period. Buildings were designed with little or no concern for energy consumption. A mechanical system could usually be found that would provide comfort.

Residential structures reflected the carefree energy attitudes of the early twentieth century. Many homes were built without insulation, and homes that did have insulation usually did not have much. Very little effort was spent in making homes air tight. In the sun belt, reducing solar gain in the summer was mostly neglected; instead, larger air conditioning systems were utilized.

By the early 1970's, America was using far more fossil fuel than it was producing and the growing dependence on foreign oil, OPEC oil in

particular, was becoming substantial (see Figure 1) (1). The OPEC ministers decided they could command a much higher price for their oil if they cut production and in 1973 they did just that. Americans were sent reeling at the sudden impact of the oil embargo. Shortages of gasoline and fuel oil made headlines almost daily. The entire population was making a hasty scramble to reduce all areas of energy consumption. The national high-way speed limit was reduced to 55 mph and the President urged all Americans to roll back their thermostats to 68 degrees in the winter. Home insulation retrofit businesses were appearing everywhere.

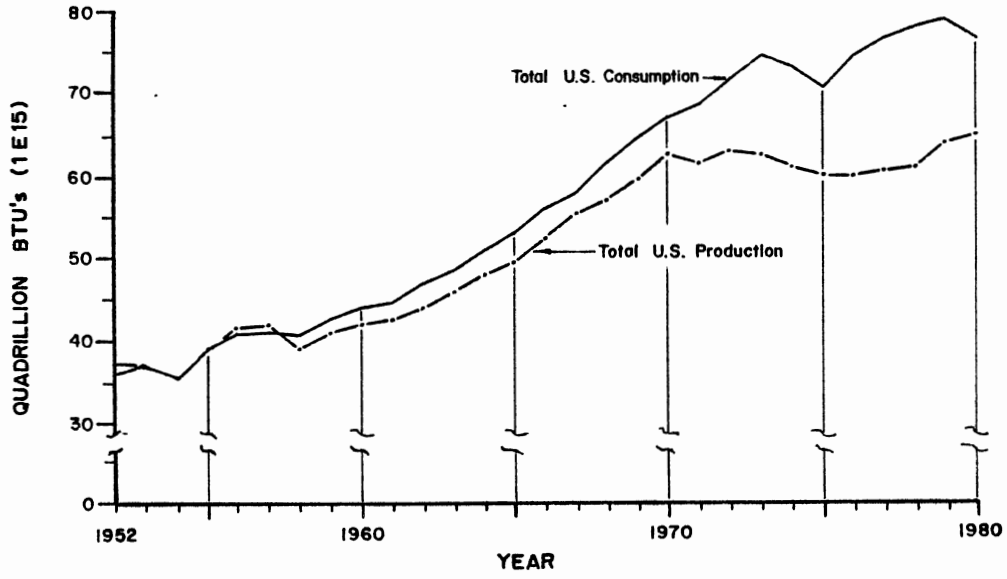


Figure 1. Graph of U.S. Energy Consumption Vs. Production.

Entrepreneurs were hawking "new" and "innovative" concepts for residential construction nationwide. Passive and active solar systems were being developed. Super-insulated designs, like the well publicized

"Arkansas House" (see detail, Figure 2) (2), and double envelope designs were also being brought onto the building scene. Finally, some enterprising people "discovered" that underground homes used less energy and could be used to beat the energy crunch.

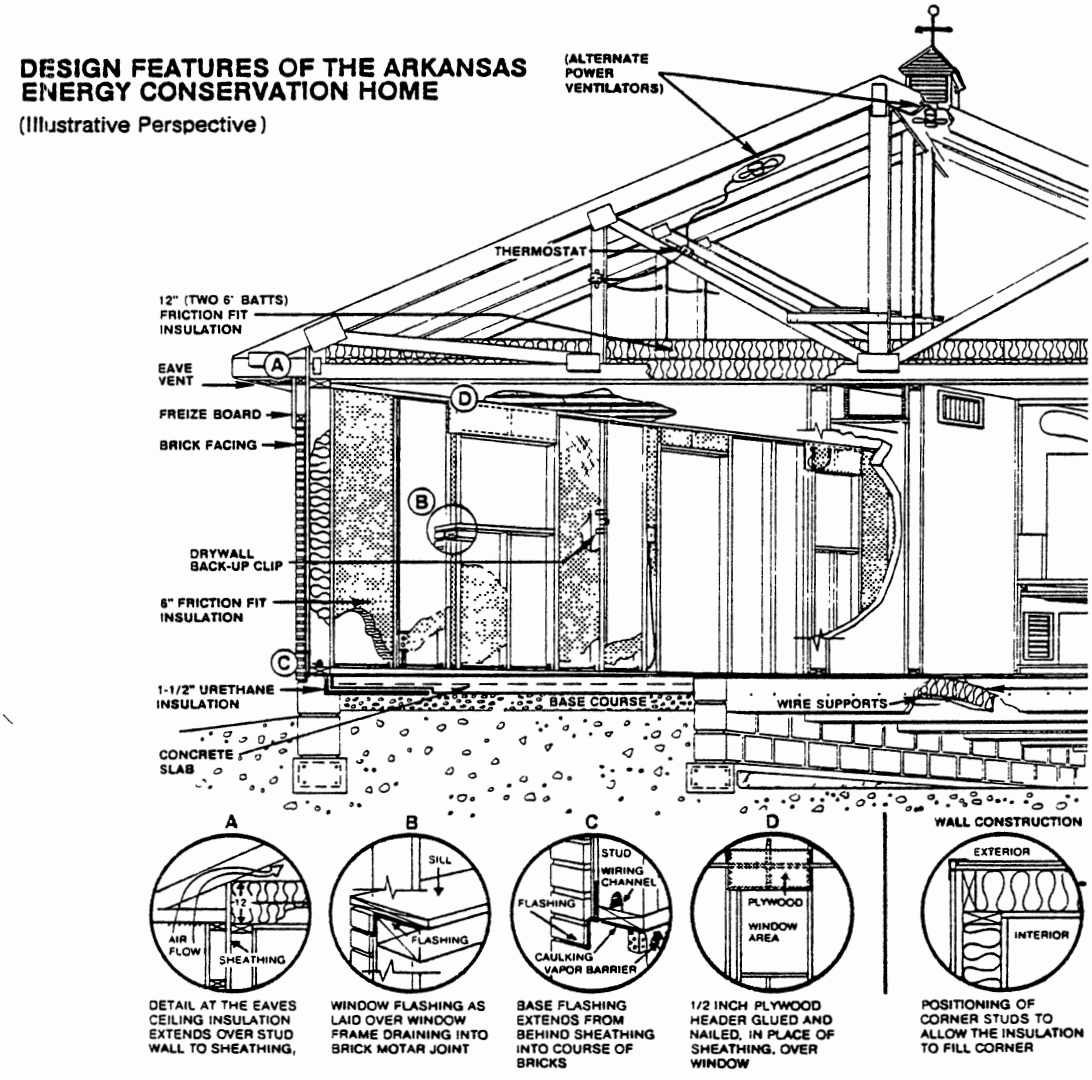


Figure 2. Details of the "Arkansas" Well Insulated Home.

Going Underground

Living in underground or earth sheltered space is not a new concept. In prehistoric times, man used caves for a home to protect him from the elements. The pioneers in this country, especially during the westward movement, often built sod houses as their first settlements. From the time of the western pioneers until the present, the use of partially or completely earth sheltered dwellings had not completely diminished. A few of today's most well known architects have been using some form of earth sheltering since long before the energy crises. Most of the pre-embargo uses of earth sheltering, however, were for aesthetic purposes, to preserve an existing site, or for protection from tornadoes or protection from nuclear attacks and after effects (3,4).

Energy Aspects

Since the oil embargo, most people who build earth sheltered homes primarily want to reduce their heating, ventilating, and air conditioning (HVAC) loads and costs (5). Studies indicate that a well built earth sheltered home typically uses substantially (commonly at least 50 percent) less energy than a similar conventional above ground home (6). The reduced energy consumption of an earth shelter is due to the substantially reduced heating and cooling loads imposed on the building (see Figure 3) (7). At the present time there is a very wide range of opinion as to just how great the energy savings may actually be for a given design. Some sources indicate possibilities of a nearly 90 percent energy savings over a conventional home (6,8). Others suggest that much lower, but still substantial, savings are to be expected (9).

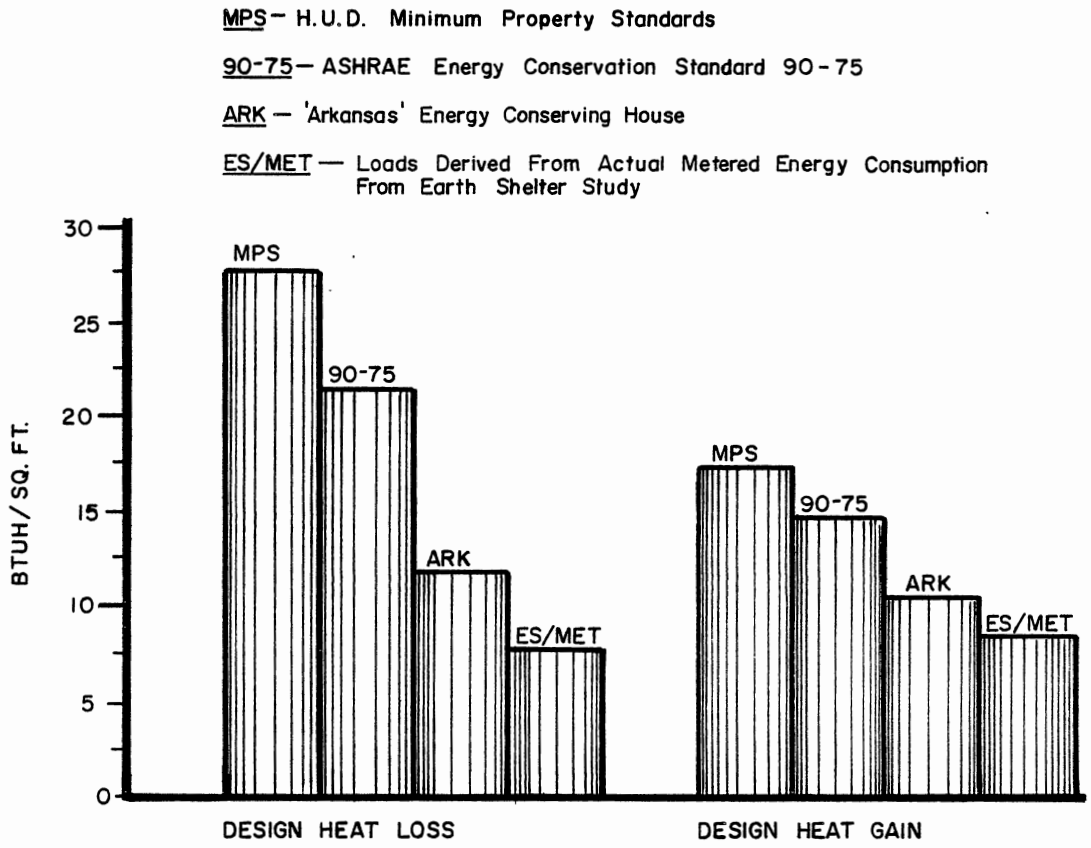


Figure 3. Design Heat Load Comparison.

This study does not attempt to prove or refute claims for either abundant or sparse energy savings by earth sheltering. Rather, this study makes use of the earth shelter energy savings commonly found today, as well as energy consumption data from conventional homes built in recent years. The primary reason for taking this approach is that while higher energy savings than commonly found may be realized, the cost of construction to obtain such increased energy savings could very well rise at a disproportionate rate, therefore, possibly making it uneconomical at this time to save the greater amount of energy (10). Presently,

there is very little known about the actual dollar cost of saving substantially more energy than is typically obtained with earth sheltering. In other words, there has not been enough experience gained in earth sheltering technology to know how much greater first cost would be required in order to obtain 10 percent more energy savings over conventional homes than is currently obtained with earth sheltering; it could take a five percent greater first cost or a 50 percent increase in first cost. With the current knowledge of costs of potential energy saving techniques, too little is known to make an assumption.

Economic Aspects

An inappropriately titled article about a United States Navy study reported that the Navy study revealed that earth covered buildings tend to cost more than either earth bermed or conventional buildings due to the added structural requirements (11). Well known earth shelter architect Malcolm Wells generally uses the rule-of-thumb that an underground building costs about 10 percent more than a comparable above ground building (12). Many advocates of earth sheltering argue that earth shelters actually cost less to build than conventional homes. However, in many of the examples that such advocates point out, the owner is usually also the builder and has not included the cost or value of his or her own time spent building the house (8). Such inaccuracies in reporting earth shelter building costs result in much less overall accuracy for earth shelter building costs than costs for conventional homes.

A study by the Underground Space Center revealed that earth sheltered homes, in the Minnesota area, had about the same cost per square foot as a well built custom conventional home. However, conventional

tract housing, for planned area development, was about 25 percent less than the earth shelters (13). From the information above, it seems that earth shelters are, on the whole, moderately more costly than conventional homes, only very rarely are they less costly.

To help offset the higher first cost of an earth shelter lower energy costs are a major factor. Some maintenance factors (such as exterior painting, HVAC equipment replacement, etc.) will help an earth shelter over a life cycle but the cost of these factors is relatively low compared to energy costs, and therefore they are less significant. Because of lower HVAC loads in an earth shelter, the homes typically have somewhat smaller HVAC systems. These smaller systems are usually figured into the first cost but they are an economic help when it is time to replace the system in the future. An earth shelter typically has somewhat less exterior area that requires painting and this will result in lower maintenance painting costs. Assuming that the earth shelter does not develop costly waterproofing problems (which are not common when proper techniques are used and careful construction practices are followed) it will not have the expensive roofing replacement costs of a conventional home.

Previous Studies

To date relatively few studies have been conducted in the area of life cycle cost comparisons of earth shelters and conventional homes. One of the larger scale studies was done by Hanna Shapira at Oak Ridge National Laboratory (ORNL) (8). An earlier study on the topic was done by Donald McWilliams and Stephen Findley at the University of Texas at Arlington (UTA) (14).

Oak Ridge National Laboratory Study

The ORNL group began their approach to the problem by dividing the country into geographic regions that had similar qualities. The six criteria used in creating these regions were: 1) heating degree days; 2) percent of time that cooling is required; 3) percent humidity; 4) solar energy available; 5) termite probability; and 6) wood decay probability. Originally ORNL's plan was to study all of the 15 defined regions, but budget shortfalls forced the selection of only 5 of the 15 regions for study (see Figure 4) (8). Four housing types in each region were to be studied originally. The four types were conventional, conventional with extra heat storing mass, extensively earth bermed, and earth covered (see Figure 5) (8). Again, budget shortfalls forced a cut back; the solution was to examine only conventional and earth covered homes. First the details of a "typical" house were reviewed for each of the five regions selected for study. Next, detailed plans and specifications were developed for both an earth shelter and a conventional house in each of the five regions selected.

To estimate the energy consumption of all the proposed houses, two building simulation programs were used by ORNL. The programs employed were BLAST, developed by the Army Corps of Engineers (15), and SOLEST, developed by Davis Alternative Technology Associates (8). Each of the earth shelters was analyzed using both programs. All above ground conventional homes were analyzed with SOLEST. ORNL also redesigned the conventional homes by adding extra insulation in both the roof and walls in a manner very similar to the approach taken in the "Arkansas House" study (2). This extra insulated house was called the "efficient" design and it was analyzed with BLAST (8).

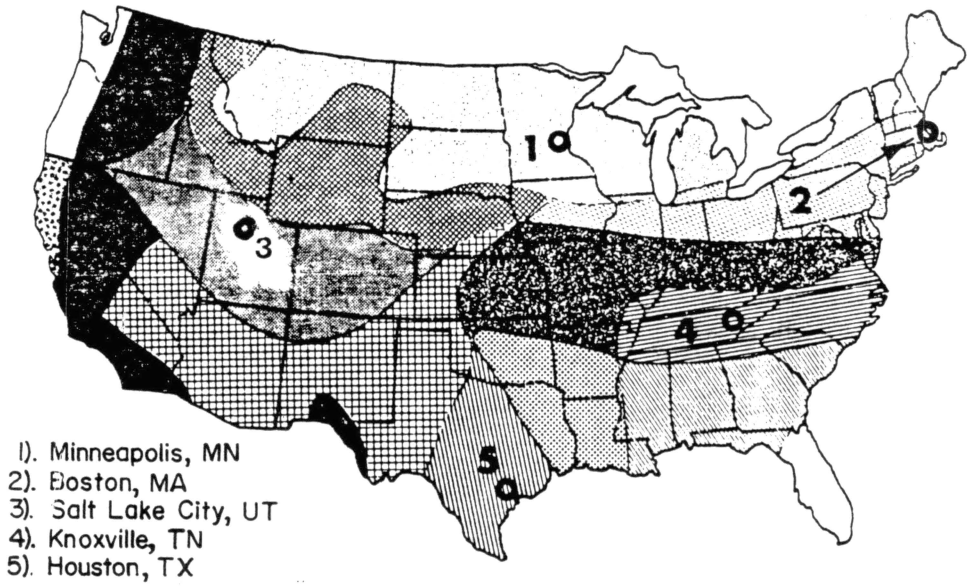


Figure 4. ORNL's Geographic Regions for Study.

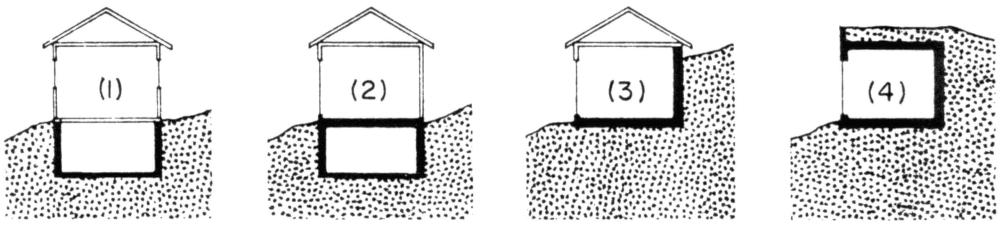


Figure 5. Four types of Homes for ORNL's Study.

The ORNL group seemed to bring factors into the study that either did not belong or unnecessarily complicated matters. For example, termite probability was included along with weather conditions in the

climatic region definitions. Termite probability has nothing to do with the amount of energy a home consumes, also with proper precautions, termites are not a major problem in homes built today. Also many of the 15 regions seem to be ill defined; the Arizona desert and southern Nebraska are in the same region. Most of Montana and Maine are also grouped together (see Figure 4) (8). A budget shortfall forced ORNL to only study 5 of the 15 climatic regions. Three of the five regions selected have virtually no known earth shelter activity. In fact, in one region studied, the Houston area, earth sheltering could be counter-productive if used for energy savings alone, not to mention major problems with the high water table common to the Houston area. Victor Olgyay, a climatic design pioneer, suggests virtually no thermal mass for a climate similar to Houston's (16).

Rather than have contractors in the selected regions actually bid on the very specific designs, drawings, and specifications that ORNL went to great effort to prepare, the authors instead hired one architectural firm to prepare all cost estimates for all homes and then individually adjusted the estimates for the cost of living indexes in each city. This method may be accurate enough, however, it eliminates the very important factor of local earth shelter experience. Since the local experience factor was neglected and very specific designs had been prepared, the estimates should at least have been spot checked for accuracy. For the energy analysis, the earth shelters were each analyzed by using both BLAST and SOLEST. Neither program was designed for primary use on earth sheltered buildings. The resultant outcome for each earth shelter was substantially different between the two programs. After observing such substantial differences in the output for the same house

from the two programs, the differences between the programs for both of the above ground cases should have been closely examined. Such substantial differences could mean a critical error in any of a number of areas, such as design assumptions, data input, weather information tapes, the copy of the program being used, or even in the program itself. Prudent judgement would call for carefully checking all possibilities.

In the life cycle cost analysis, the ORNL team utilized factors which seem unnecessary; most of the factors should be very similar for both cases. State and federal income taxes were figured by using the median per capita household income. Although one may realize some tax breaks for paying interest on a mortgage, there is really no way to say that a typical homeowner will have exactly the median income and will have other exact deductions in order to yield a value that is meaningful to the study and can be easily correlated to each case. Secondly, there seems to be little correlation between how close to the median income a family is and their interest in earth shelter. Sales tax was an included factor that bears little relevance to the life cycle cost analysis (LCCA). Carpeting and flooring replacement costs were also included in the study. Since the two types of houses are very nearly the same size (so that they are comparable) the areas of flooring should be nearly identical and the types of flooring should be similar, so that the study compares "apples to apples"; therefore, the flooring replacement costs should be very nearly identical. Texts on life cycle costing advise that when doing a comparative analysis, such as this type of study, costs that are the same for both cases should be identified but removed from the comparative analysis (17).

To summarize the ORNL study, it seems that the ORNL group began with very high goals, hopes, and ambitions. Along the way they tried to include every factor they could possibly identify, often without considering whether that factor was sufficiently relevant to be included. The ORNL group ended up swamping themselves with so many trivial factors that they got stalled by trying to pin down hundreds of inconsequential costs. This "trivial pursuit" ended with the group's budget running short and they had to cut their original output goals by 80 percent. Rather than attempting to find the average income tax paid per capita, they should have been more concerned with the substantial differences in energy estimations from the two separate simulation programs used.

University of Texas - Arlington Study

The University of Texas - Arlington study was on a much smaller scale than the ORNL study. However, an attempt was made to take the UTA study farther than most previous studies. The UTA group not only estimated all costs, but they also proceeded to actually build the two homes in order to more accurately study the costs. At the time of the UTA report (1978), the conventional house had been completed and the earth shelter was still under construction. Unfortunately, an update on this report has not become available.

The UTA study, which was done about three years before the ORNL study, was far less complex. The UTA group eliminated any costs that would be similar for the two types of houses. Eliminating these types of costs eliminated concern about most taxes, family incomes, and the cost of replacing carpet. Rather than use an extensive building simulation energy analysis program, the UTA group used actual energy costs for

conventional homes in the same area that were of a comparable size and also had comparable insulation values. They then derated the energy costs for the conventional home by a projected percentage for the earth shelter.

The UTA study did not have problems with unnecessary complexities as did the ORNL study. A major problem area is that the UTA group actually created a bias against the earth shelter while trying to eliminate any bias. A primary example is that they only estimated the earth shelter to use 25 percent less total energy than the conventional home. Twenty-five percent seems very low and directly conflicts with values typically found that are at least one and one-half (1-1/2) times this (6,18). Although there is some question about the values that the UTA study used, their approach seems rather sound.

Summary of Other Studies

Both of the other studies on this same issue followed a procedure similar to UTA's. The other studies generally examined a conventional and a below ground home, in one or more specific cities. One of the other studies utilized energy costs obtained by simulation programs and the other by a correlational method. Both of the studies consider personal income taxes and make an attempt to look at the houses as a prime investment. One took the point of view of looking at the basic purchasing and operating costs directly associated with the two types of homes and tried to directly compare only the homes, without looking at some very specific issues such as the income tax break that a person might realize with either home. The other followed some of the same "trivial pursuit" patterns as the ORNL study, however the meaningless costs that

it included were on a much smaller scale than the ORNL study (19,20).

Summary of Results of All Studies

Although all the previous studies use slightly different methods, they all arrive at the same basic conclusion; earth shelters do not pay off. All of the studies use earth shelter purchase prices that are at the very least 25 percent higher than the purchase price of a comparable conventional home, and some are as much as 80 percent higher. The most common mistake with respect to these costs is that most of the studies look at a conventional home which is basically a tract home, with all of the cost benefits of a tract home; while the earth shelter home is nearly always a custom home (with the lack of cost benefits gained with tract homes). These costs seem very much out of line when the growing popularity of earth shelters is considered. Earth shelters, while they are not taking the nation by storm, are steadily growing in popularity. If earth shelters actually cost about 50 percent more than a comparable conventional home, their popularity would probably be very much less than it is; most people do not have large amounts of money to throw away. By using these substantially higher costs for earth shelters all of the studies come to the conclusion that earth shelters take very long to pay for themselves, and some never do.

Another common mistake is that some small meaningless costs, which happen to be equal for both homes, have been identified and included in the previous studies. One study included the cost of garbage collection, which it found was the same for both types of homes. The same study also chose to include the cost of replacing major appliances (ovens, ranges, refrigerators, etc.). This cost factor is meaningless

to the difference between the two types of homes and it could be reasoned, possibly without any research, that it should be exactly the same for both types of homes. If the authors felt that these costs should be presented, they should have presented the costs but not included them in the actual analysis.

None of the studies gave serious concern to on the area of financing and downpayments. The values used were different for each study. One study used 80 percent financing for both homes, even though it is common for conventional homes to receive 90 or 95 percent financing. Another study did not indicate the financing rate used, but it seemed to be 100 percent, which is very rare. Still another study used the same dollar amount downpayment for both homes, although this led to the earth shelter receiving a higher financing rate than the conventional home. Most of the studies put the bulk of their life cycle cost analysis emphasis on the present value of all costs, rather than looking at the time required until the estimated lower operating costs of the earth shelter could offset its higher upfront costs. The study covering the widest scope, the ORNL study, did not even consider the break-even (or payback) period. None of the studies considered the possibility of a payback occurring if the home was sold after the "average home tenure" period (8,14,19,20).

The ORNL study came to the conclusion that "few owners can afford the luxury of choosing a building form because it 'seems like a nice idea'". This study also takes the same attitude, however, in this study it is felt that earth shelters do not cost 50 percent more than comparable conventional homes, and may not cost 25 percent more. Reasons for this stand are based on: 1) the number of people currently building

earth shelters; 2) statements by people who are active in the earth shelter area (such as earth shelter architect Malcolm Wells, mentioned earlier) who do not find such cost differences; and 3) common sense, which says that a large number of mostly middle class people would not be spending substantially more for a home that, according to these previous studies, probably will never pay off. Of course there are many other important costs besides the purchase price of the two types of homes and these are also explored in this study. This study will avoid costs which are the same for both home types and will attempt to focus on and study the basic issue - "do the presumed lower energy consumption and maintenance costs of an earth shelter offset the usually higher first costs early enough in an economic life cycle such as to make an earth shelter less costly, and more desirable economically, to the owner than a conventional home?"

CHAPTER II

PROBLEM STATEMENT

Purpose of Study

The purpose of this study is twofold. The first purpose is to quantify some of the major cost differences between conventional and earth sheltered housing. The second is to look at the cost differences between these two types of housing over a life cycle economic period. The primary intent of this study is to examine the results of a life cycle cost analysis (LCCA) and draw conclusions with respect to the basic issue of - "do the presumed lower energy consumption and maintenance costs of an earth shelter offset the usually higher first cost early enough in an economic life cycle such as to make an earth shelter less costly to the owner than a conventional home ?" As indicated in the first chapter, previous studies have had a similar objective. This study will, however, take a new and different approach to the problem. Studies up to this time have taken the approach of investigating a single pair of houses in a single city and evaluating the life cycle economics of that specific situation. The approach of this study is to generalize all data used in the life cycle analysis, for a region rather than a specific city. All cost data are presented as an expected range of values, rather than single specific values for one case. The results of the life cycle cost analysis are then presented in a graphic format,

from which the reader may draw conclusions based on his own specific conditions.

Goals and Objectives

This study addresses both cost differences between conventional and earth sheltered housing and how those cost differences affect the cost of ownership over an economic life cycle. Specific goals include quantifying the magnitude of cost differences between the two types of housing studied. The goals are as follows:

1). To suggest probable expected ranges for all major costs for both conventional and earth shelter homes.

2). To identify what cost ranges earth shelter homes will need to fall into in order to be comparable with, or possibly more favorable than, a conventional home in a life cycle cost analysis (LCCA).

3). To identify those cost factors that have the greatest impact on the outcome of the LCCA.

4). To identify desirable break-even periods between the two types of homes.

5). To identify the average home tenure in the region and show how the tenure period compares to the desirable break-even period.

The main objective of this study is to identify which of the two housing types is more economical over a life cycle, given current technologies in use and economic and market conditions. Personal goals for the author, in addition to those listed for the study, are to learn more about the advantages and disadvantages of earth sheltering as well as learning more about the techniques associated with both predicting and improving

the energy saving performance of earth shelters. In addition, the author hopes to learn more about the importance and techniques of life cycle cost analysis.

Scope, Limitations, and Base Assumptions

This study focuses on reasonable norms of building costs and energy consumption. No attempt is made to explore areas beyond such reasonable expectations. Construction costs and practices, energy consumption, and many of the other associated costs tend to be fairly consistent within a region. Therefore, this study only deals with Oklahoma, so that the study does not become so broad that its results become confusing and less certain. Oklahoma has been chosen because cost values are more easily obtained and more accurately verified, due to the study taking place in central Oklahoma. However, because cost ranges are used, the results of this study are not limited to Oklahoma. In fact, the results may be useful for regions that have similar economic and climatic conditions as Oklahoma, as long as prevailing costs for that region fall into cost ranges identified for this study. However, much discretion must be used in extrapolation of results from Oklahoma to other regions, due to differences in building conventions and climatic design features. This study is limited to conventional and earth covered homes only. For this study, earth sheltered means earth covered; any "earth sheltered" homes that are not earth covered are be referred to as earth bermed.

This study only includes clearly identifiable costs. Intangibles such as "an earth shelter is quieter than a conventional home" or "earth shelters offer a better sense of well being" are very difficult to define and even more difficult to apply a cost value. Also, the

importance of such intangibles to different people varies widely. The list of such environmental factors is long and is excluded from the cost comparison. The most identifiable factors on such a list are, however, covered briefly and the reader may draw his own conclusions about these factors.

To assure that the earth shelter and conventional homes are comparable, even in the market place, some assumptions must be made. Although earth shelters are becoming less of an oddity and are more commonly seen, they are still a relatively new housing type and their resale marketability on the open market has not been adequately tested. Because of this, many real estate lenders would tend to view an earth shelter as a somewhat riskier investment (21). Usually interest rates rise as the risk of an investment rises; the required down payment, as a percentage of total cost, also rises (less leverage is allowed) (22).

Although the financial environment at the time of this study is a "lenders" market, the assumption must be made that financing is available for both types of housing. If this assumption is not made, the study becomes meaningless because either one or both types of housing are not available to the average person. Another important point in comparing "comparable" homes is that they should be of the same housing class, that is both custom or both tract homes. Crossing the two classes of homes (ie., studying a custom conventional and a tract earth shelter, or vice versa) is not covered because it goes against human nature. For example, at this time virtually all earth shelters are custom homes. A person considering going to the trouble of investigating a custom earth shelter home would usually not be satisfied with a tract home. Also, crossing the housing classes could create a cost bias

against one of the types and would not be acceptable due to misleading results of the study. Taking both types of houses to be tract homes is also not covered; the reason being that there is very little tract earth shelter activity happening in the United States and no known activity in Oklahoma. Many feel that for earth shelter to make a substantial impact in the housing industry, earth shelters must do so in tract type housing. While this is not unrealistic, it is also not currently happening with much significance. Due to current policies on high risk speculative investment ventures and consumer attitudes, the author feels that it may be some time before tract earth shelters make a substantial impact in the housing market and by then the cost data in this study may be outdated. Therefore, earth shelters and conventional homes are compared only as custom class homes.

Income tax laws are very complex and very few people who have the same income end up paying the same amount of tax. For this reason, income and income taxes are not included in this study, unless there is a clear known cash value benefit. Property taxes also tend to vary widely between communities and are not included as a part of the study. Although the taxes themselves are not included, a reader who knows his tax position may be able to find, from the cost values presented, how his tax position may vary.

Many costs for the two types of homes are either very similar or may vary widely because they are a function of personal preferences or lifestyles and, therefore, are not included. One such cost is water consumption. Some people may want to pour large quantities of water on their lawn even through the very hot late summer months, while others may never water their lawns and do not care if the lawns live or die.

Some earth shelters use rooftop vegetation to help lower energy consumption (the energy consumption is lowered by reducing solar gain through the rooftop soil), in a case such as this the vegetation would usually require watering. However, many Oklahoma communities invoke a water rationing plan during the summer months which either partially or completely prohibits lawn watering, this would greatly affect the decision of using vegetation for energy aspects. Flooring replacement costs should be very similar if comparable flooring is used in both types of housing. If comparable flooring is not used in both, then the specific type used becomes a strong function of personal preference and it would be too confusing and meaningless (not to mention nearly impossible) to attempt to assign a cost estimate. Interior painting is another cost item that is deeply based on personal preference. Many times interior repainting is done more because a person is "tired of this color" than because the wall actually is in need of repainting. Small children equipped with crayons or markers are another highly variable cause for interior surface repainting.

The economic life cycle that is used for this study is a typical home mortgage life of 30 years. Thirty years is much longer than the desirable pay-back period of 5 to 10 years, which is the recommended period for a higher first cost home to be more appealing to the average consumer (9). A 30 year planning horizon is chosen over a much shorter planning horizon. This is done so that break-even points under most circumstances will be present somewhere on the planning horizon, even though some of them may be beyond a desirable break-even period. Those break-even points that are beyond the desired 10-year break-even period, but are still present on a 30-year planning horizon, are important to

identify factors which have the greatest effect on the pay-back period. Thirty years is, of course, much shorter than the potential life of an earth shelter. The added life of the earth shelter may be accounted for by a potentially higher salvage value (resale value) at the end of its mortgage life. This stand is justified by the fact that most middle income families are not greatly concerned if their house is still standing 50 years after they die. Also, an American Institute of Architects (AIA) publication on LCCA suggests that the expected building life span not be used as the economic planning horizon, especially for concrete structures (23).

CHAPTER III

OBJECTIVE AND SUBJECTIVE ASPECTS OF STUDY

General Statement

There is both an objective and a subjective aspect to this study. Both types of factors are very important, however, they are also very different from each other. The objective factors are more or less clear cut and have a definable economic value. The objective aspect is embodied in the actual life cycle cost analysis (LCCA) which yields a value or set of values that have a specific meaning. The subjective aspect is much less specific. By definition, a subjective factor has a different value to different persons. While the subjective factors are very important, they vary so widely between persons and cases that they cannot be included in a broad scoped study. An example would be: an earth shelter homeowner might say "My earth shelter is much quieter than my old conventional home, the quiet is worth a lot to me". While the noise reduction aspects of an earth shelter are important to this homeowner another may say "my home is in a very pleasant area and there is no noise problem". Both homeowners have perfectly valid arguments, but there is no way to apply either situation to a broad group of people. Therefore, this study does not attempt to quantify these subjective factors, but rather presents some of the more prominent subjective factors for the reader to be aware of and to asses as to the importance of each factor.

Objective Factor: LCCA

General History of LCCA

Although life cycle costing (life cycle cost analysis) seems to have come about since the energy crisis, it has actually been around much longer. The early history of life cycle costing is somewhat obscure. The first known text on the subject, "Principles of Engineering Economy", was written by Eugene L. Grant and published in 1930 (17). A few years later, in 1933, the U.S. General Accounting Office (GAO) began a policy that bids for the purchase of tractors for the government should include all costs associated with 8000 hours of use (17). The use of life cycle costing increased during the World War II era when many substitute materials and practices were being sought to help the war effort. In the early 1960's the military adopted a policy of life cycle cost comparison of purchases (24). Many large corporations use life cycle costing for most large investments or undertakings.

Life cycle cost analysis techniques are new in the housing industry. At present the LCCA is almost exclusively used in studies such as this, which compare a non-conventional house with a higher initial cost alternative housing design which has a lower energy consumption than typical conventional houses. Life cycle cost techniques are seldom used in the housing industry primarily because the federal financial mortgage assistance agencies, such as HUD, VA, FHA, FNMA, etc., are not actively updating their policies to allow for LCCA (21). These lending agencies are very slow to change their policy with the changing times. Before the rise in energy costs, the home which had the lower first cost was nearly always the better buy. Today, this direct correlation does not

always hold true. Many lending agencies have recognized the fact that higher utility bills decrease the percentage of income a person can use to make mortgage payments. Their recognition of this is reflected by being more conservative in cases where the borrower's PITI ratio (Principal + Interest + Taxes + Insurance) is very close to the allowable percentage of the borrower's income. However, many lending agencies have not recognized the reverse of this, they do not have any system for a borrower to finance a higher mortgage and have the somewhat higher payments offset by lower utility costs. Life cycle cost analysis could be used in this type of situation.

Purpose and Definition of LCCA

Life cycle cost analysis is any technique which allows assessment of a given solution among alternative solutions on the basis of considering all relevant economic consequences over a given period of time (24). Life cycle costing is not a given equation which will positively indicate which alternative to use. Rather, it is a procedure, a set of operations, or a methodology to be employed when economically evaluating a situation involving two or more alternatives.

A life cycle cost analysis is usually not an end in itself, but rather a tool to be used to help make the decision. Perhaps the reason that LCCA is not a final answer to a question is that the LCCA only considers objective factors in the economic analysis which may be given a fairly accurate monetary value. Subjective issues, which are very difficult to assign a monetary value, are generally left out of an LCCA simply because of the lack of accuracy of assigning a monetary value to them.

An LCCA is an objective appraisal of a group of alternatives, however, a decision usually also requires the inclusion of subjective factors. In this study, the LCCA is performed with objective cost factors. The subjective factors are presented later in this chapter as a separate issue from the LCCA. To make a more knowledgeable decision as to which is a better choice of homes, the reader should review the subjective factors as well as the objective factors and draw conclusions based on his or her own preferences.

Subjective Factors

The factors covered in this section are those subjective factors which are not to be included in any part of the LCCA. The reason for this approach being any of the following; 1) it is impossible to put a cost value on the factor; 2) it is impossible to judge the frequency of occurrence of the factor; or 3) it it impossible to accurately rate the importance of the factor to each person in a large random group. The factors are presented in no order of importance. Typically, any advantages of each factor are given first and the disadvantages second. This in no way is meant to indicate the importance or magnitude of the positive aspect over the negative aspect, of each factor, or vice versa.

Privacy and Protection Aspects

Windstorm and Nuclear Aspects. Virtually all storm and nuclear shelters are built underground; either a basement or a separate cellar is typically used. In most of Oklahoma it is not common to add a basement to a house; usually, doing so adds noticeably to the building cost of the house. An earth shelter (earth covered) may perform as a

windstorm shelter if it is designed with this aspect in mind. Although some earth shelter homes have been designed as nuclear shelters, most built today are not. However, most earth shelters could be much more readily, and less costly, converted to double duty as a nuclear shelter than most conventional homes.

Currently, earth sheltering typically costs somewhat more than conventional housing (see chapters I and V). Building a basement under a conventional home also costs somewhat more (no research has been found to relate the two costs). With a conventional home with a basement, additional living space is obtained for the extra cost as well as the storm sheltering aspects. The same space advantage would be gained with an earth sheltered house with a conventional house on top, but again there is the probability of a higher cost per unit area. Another option would be to get a ready-made cellar installed in the yard of a conventional home. Again, no research has been conducted into the cost comparisons.

Earthquake Problems and Protection. Although Oklahoma is not known for any current earthquake activity, building codes do have parts of Oklahoma in a seismic zone that is higher than "minimal" risk. Most earth shelter advocates state that an earth shelter is in no danger at all from an earthquake. This is not entirely true. If no precautions or proper design techniques are used, an earth shelter could be severely damaged or destroyed in a small earthquake. However, with proper design, most earth shelters can withstand rather harsh earthquakes.

The most severe, and possibly irreparable, damage that could occur is actual structural damage. Major cracks or even failure of walls and roof would be included in this category. This type of damage is easily

avoided for moderate earthquakes, by suitable design. A more likely damage is damage to the waterproofing. The waterproofing systems that are the most likely to withstand damage are the bentonite clay systems. Another type of damage could be the displacement of water or gas supply pipes and sewage discharge pipes. Although a damage of this sort is much less severe than structural damage, repair of these pipe systems would usually require excavation and would be costly.

Overall, earth shelters can provide more protection with respect to the structure, and to the occupants, if they are properly designed, than a typical above ground home. However, without correct design, which is typically inherent in a well designed and built earth shelter, an earth shelter can be less safe than other structures (28).

Vandalism and Burglary. Many earth shelter advocates state that an earth shelter is less susceptible to vandalism and burglary. Vandalism of homes typically includes damaging the exterior of the building, defacing the building, and defacing the property (damaging trees, shrubs, etc.). In crimes such as vandalism and burglary, it is best to remember the old adage "where there is a will there is a way". If a party wishes to vandalize or burglarize a home badly enough, no design short of Fort Knox will stop them. In some cases an earth shelter can decrease the will to burglarize or vandalize the home. Many earth shelters have the means of access (the doors and windows) on only one side of the home, and if that side is facing a street then the will to attack the home could possibly be reduced.

Possibly a more important aspect of how safe a home is, is the area in which it is located and the homeowner's own personal crime preventative measures. A possible reason that the vandalism and burglary

rate is lower for earth shelters than for conventional homes is that to date a large portion of earth shelters have been built in rural areas, and many of these homes cannot be seen from the road. This aspect of not knowing that the home is there is possibly as much of a deterrent as any other factor.

Added Privacy. An earth shelter can offer a person much more privacy than most other homes. There are many reasons for this. Probably the greatest reason is that the home is underground. If the home is built in a more or less secluded area, it can easily be completely hidden. Even if the home is built in a suburban setting, the design of underground homes can be such that it can be isolated from neighbors, who may be only a stone's throw away. Of course an earth shelter home can be designed that does not offer as much isolation, it can be as "unprivate" as desired.

Comfort Aspects

Earth Shelters are Quieter. Due to the large mass of earth that surrounds an earth shelter, very little sound penetrates into the house. In some cases this can be a real advantage. If the circumstances are right, a noisy parcel of land might be bought for much less than the normal cost of land and an earth shelter which would reduce or eliminate any noise problem could be built on it. The Minnesota Housing Finance Agency (MHFA), in cooperation with other agencies has built a series of earth sheltered projects. One of the projects, the Seward Townhomes, were built adjacent to a busy highway on a previously undesirable (due to the highway noise) parcel of land. Due to the soundproof characteristics of an earth shelter, the residents of the townhomes do not report

any problems with the highway noise.

The soundproof aspect can also be a disadvantage. Many earth shelter residents have found that the lack of exterior sound can be bothersome at times. Normal household sounds, which are either inaudible or easily ignored in a conventional home, become very "loud". A clock ticking while trying to sleep or the dishwasher running can be very distracting. Some earth shelter residents have found that they must keep a small fan running constantly to provide some "masking noise". Earth shelter residents with small children may find it impossible to "keep an eye" on the kids, when they are playing outdoors, just by listening to their activities.

Improved Thermal Comfort. There are several aspects of an earth shelter which lead to improved thermal comfort. Many of these aspects may also be approximated in a very well built conventional home. One factor which leads to increased comfort is the lack of drafts. Drafts are felt (and cause discomfort) when either (or both) the air normally circulating in a space is at a high enough velocity that it is noticed, or if the circulating air is at a temperature which is noticeably lower than the room temperature. Earth shelters, by their design, are usually of a "tighter" construction than above ground homes. The tighter construction greatly reduces drafts. With very careful construction practices, an above ground home may also be built very "tight". Although "tightness" does reduce drafts, it can also cause air quality problems, as discussed later. The large amount of thermal mass, due to the typically heavy construction of an earth shelter, as well as the capacitive insulative characteristics of the earth around an earth shelter, substantially increase the amount of time it takes for the

interior temperature to vary. The faster the temperature in a space changes, the more noticeable the temperature change becomes. When the temperature becomes noticeable and the change is away from a comfortable level then discomfort results. The time for temperature change is known as the "slope of drift" or the "rate of drift". A very well insulated conventional home can also have a very low rate of drift due to the resistive insulation slowing the rate of heat transfer to or from the house.

Earth shelters also offer added thermal comfort because of more comfortable radiant temperatures in rooms which have earth contact walls. For an example of how radiant effects can affect comfort, imagine sitting in front of a large window (or patio door) on a very cold day; the air temperature of the room may be very reasonable but heat is being radiated to the cold window and a person will "feel" as though it is cold in the room. With an earth shelter, the earth contact walls are cooler than most conventional walls in the summer; and warmer than most conventional walls in the winter. Many people who live in homes that are fully or partially earth sheltered have noticed this effect and are very aware of the added comfort from these conditions.

Glare Problems. Glare is normally experienced when a source of light in the field of vision is substantially brighter than the remainder of the area being viewed. The more substantial the difference, the worse the glare problem. The possibility of having a glare problem in an earth shelter may be greater than in a conventional home. Some reasons for this are that earth shelters typically only have windows on one or occasionally two sides of the house; also, the total number of windows is typically reduced while the size of each window is possibly

larger. The result is that due to all the natural lighting being brought into the house from a few windows on one wall, as opposed to many windows on several walls, the overall lighting in the house is very poorly distributed. This makes the ratio between the brightness of the windows and the brightness of the room more severe, therefore, glare results.

With proper attention, most glare problems can be taken care of in the design stage of a home by a knowledgeable designer. One of the first steps is to partially shade windows by overhangs, louvers, or vegetation so that the light being received is not as intense. However, this method also reduces interior light levels. The second important step is to use interior materials which have a high reflectance (light colored) in rooms with windows. This will tend to even out the distribution of light in the room and will also help the light to penetrate deeper into the room. Earth shelters typically experience glare problems due to poor or unknowledgeable design. With careful design, glare problems may possibly be avoided (29).

Feels Like Living in a Cave. One of the first questions people who live in earth shelters get asked is "isn't living in an earth shelter just like living in a cave? Don't you feel closed in and doesn't it get damp and musty in here?" Some earth shelters do have dampness and condensation problems. However, these are usually the poorly designed or built ones. If proper attention is not given to the areas where a thermal "wicking" effect could occur, then a good possibility exists for condensation and resultant dampness to occur. A well designed and built earth shelter should have eliminated problems such as thermal wicking

and, therefore, any condensation and resultant dampness problems should not exist.

Condensation and dampness problems besides those caused because of poor thermal breaks can also exist in earth shelters. These problems are due to the "tightness" of construction typical with an earth shelter. Other types of "tight" home construction are also somewhat susceptible to these problems. In tight construction, the humidity levels can be somewhat higher due to the very low air change rate and/or the greater attention to the design and installation of the vapor barrier typical of tight construction. As the humidity levels rise, so does the chance of condensation on surfaces which may be somewhat cool (they must be below the dew point). While condensation can occur on the refrigerator, cold water pipes, etc. in any home, the earth contact walls of an earth shelter are usually cooler than walls in a conventional home and are, therefore, more susceptible to condensation.

As for the closed-in feeling, it is hard to predict what a person's reaction will be. Most well designed earth shelters would not leave a person feeling closed-in. Some people who live in earth shelters are susceptible to claustrophobic effects, but they do not have any problems in their earth shelter home. Some people associate living in an earth shelter with going into an old cellar; they think living in an earth shelter would be cramped, cold, damp, dark, and musty. This is almost never true. Most people would not be able to tell that they were underground from the inside of a well designed earth shelter. Everyday people who had convinced themselves that even visiting an earth shelter would be a terrible experience are very surprised to find that it is indeed a very pleasant experience.

Personal Factors

Personal Liability. There seem to be an excess of underworked lawyers in today's society and some of them seem to have abandoned all cannons of ethics and have begun "ambulance chasing". The pendulum of personal liability is beginning to swing to the extreme. Today an individual can be sued for nearly anything. With an earth shelter, a homeowner could be held libel if somebody, whether they were trespassing or not, fell off of his roof-top yard. The surest way to avoid the problem is to put up adequate railings and/ or barriers around the perimeter of the rooftop "yard". These barriers, whether they are put in place when the house is built or as a retrofit still add an additional cost to the home.

Energy Independence. When most people say that they are concerned with the amount of fuel it takes to heat their home or the miles per gallon their car gets, what they actually mean is that they are concerned with how much that overall fuel consumption is costing them, in dollars. This particular aspect (the fuel cost) is included in the LCCA. Some people, currently a clear minority of Americans, feel that it is important, at least personally, to achieve "energy independence". These individuals want to "create" or satisfy all their energy needs with renewable resources, usually found "on-site". The overall plan for this energy independence first starts with a house requiring little or no non-renewable energy input for heating or cooling. The next step is that household electrical energy needs and hot water needs are reduced by self denial, and what needs there are taken care of by an alternate

energy method, such as wind generators, photovoltaics, solar water heating, etc.

All of these alternative energy sources can be utilized no matter what type of house is considered. The very low energy input requirements for heating and cooling are usually much better achieved by an earth shelter than a conventional home. In climates which are colder than Oklahoma, super-insulated homes have performed at least as well as earth shelters in the low energy requirements area. The value of super-insulation in hot climates is less substantial.

Better Living Feeling. This subjective factor may be one of the most undefinable of all. Some earth shelter residents claim that living in an earth shelter gives them a good feeling about themselves (a sense of well being) and their lifestyle. One reason may be that the people are living in a new home. However, most likely the reasons run deeper than that. Most earth shelter residents are excited to be living in a new type of home, sort of a pioneer spirit. Many are also excited that they are actually saving energy, some are excited much more about the energy savings than the money. Another big factor in Oklahoma is the storm protection that an earth shelter offers, it usually only takes one close call with a serious storm or tornado to really appreciate the security offered by an earth shelter.

One reason to build an earth shelter is to preserve an existing site. If the home is properly built on a beautiful site and blends the architecture with the land, then this would certainly give most people a much better feeling about their lifestyle.

Physical Factors

Water Leaks. The waterproofing system of an earth shelter is very important! Research has resulted in waterproofing systems today that are both effective and reliable. However, proper application of the system is essential, this includes proper techniques and care that must be followed during backfill operations to assure the integrity of the system. The consequences of not properly handling both phases could be very costly and disastrous. Most manufacturers are confident that today's earth shelter waterproofing systems will hold up over long periods of time, however, only the passage of time itself will substantiate these statements.

In a conventional home that develops a leak, the leak may often be pinpointed with little difficulty and repaired with either a few cents worth of sealer or a few dollars worth of shingle repair. Only rarely must a roofing leak be repaired by prematurely replacing the entire roofing assembly. Occasionally windstorms cause substantial damage to conventional roofs, however, such damage is often covered by homeowners insurance and although it is an inconvenience the cost of repair does not come out of the homeowners pocket. In an earth shelter a leak is typically more difficult to pinpoint and anytime the backfill or earth cover is removed, that means dollars.

Ventilation and Related Problems. "Tight" construction (construction which allows a small air change rate) has been known to lead to a variety of air quality problems in homes that do not take adequate ventilation procedures. Most conventional construction, even though it tends to be much "tighter" today than in the past, "leaks" enough air so

that ventilation requirements are taken care of naturally. Earth shelters, and above ground homes that are specifically built tight, fall into the class of construction that is susceptible to air quality problems if proper planning is not taken to assure proper ventilation. Indoor air contaminants generally fall into four categories: dust and particulates, toxic gases, formaldehyde and other organics, and radioactive substances. Although all categories present problems, formaldehyde and radioactive problems seem to have received the most attention, and can perhaps cause somewhat more serious problems.

Urea formaldehyde does not only come from foam insulation, but also from particle board, plywood, fabrics, and to a lesser extent combustion sources. Radon is potentially a greater problem in earth shelters than in conventional homes, because the major sources of radon gas are earth and concrete. Since radon and formaldehyde are both gases, proper ventilation can reduce or eliminate any problems (25, 26, 27).

CHAPTER IV

PROCEDURE

General Approach

The procedure developed for this study has three main steps, with each step having several sub-steps or tasks. The first main step is to identify and compile all cost and other pertinent data required to perform the life cycle cost analysis (LCCA). Tasks in this first step include identification of the data by three methods; one, a search of published literature on the subjects requiring cost data; two, personal contact with professionals in the various areas requiring cost data, such as insurance agents, etc.; and three, non-personal contact, by the use of a mailed questionnaire, for areas that may require a response from a wider cross section of professionals than is practical on a personal basis.

The second main step is to actually perform the LCCA. Although the LCCA could be done by hand, in order to speed up the analysis and to reduce the chance of error involved with lengthy hand calculations, a small, purely functional, computer program has been developed and utilized to assist the study. Because of the increased speed and accuracy available with computer assistance, a greater number of cases can be explored in the same time frame. The third main step of the study is to evaluate the LCCA, draw conclusions, and suggest recommendations.

A more in-depth discussion of the procedure for performing the

LCCA, as well as an example, is presented in subsequent sections in this chapter. The procedure for gathering the cost data is also given in a later section. The actual cost data, however, follows in a later chapter. Conclusions cannot be drawn and recommendations made until the analysis is complete. Therefore, all conclusions and recommendations and the procedure used to derive them will be covered in the final chapter.

LCCA Procedure

The procedure used for the life cycle cost analysis is a standard "textbook" procedure. The scope of the analysis required to perform this type of study falls well within the boundaries of commonly used and accepted life cycle costing techniques. It would therefore not be productive or appropriate to attempt to devise a new LCCA technique. The major thrust of the LCCA is to examine the break-even period of the earth shelter versus the conventional home. The definition of the payback (or break-even) period is: the length of time that is required to offset higher first costs with lower operating and energy costs.

The procedure is to use the cost data, outlined in a following chapter, to arrive at the pay back period. First, all costs must be assigned to the year (or years) in which they occur on the planning horizon. The financed portion of the first cost (the mortgage) is spread over all the years of the mortgage life by applying the interest rate and compounding period to the amount financed. To find the annual mortgage costs, the monthly payments are calculated as a sub-step and then summed into an annual total to match the annual format used for all other costs. Annually recurring costs, such as insurance and possibly

some maintenance costs, must be escalated by the appropriate rate, either general inflation or the estimated differential escalation rate for each cost. After the annual recurring costs have been escalated they are then summed with the annual mortgage cost.

The question of whether to show energy costs as a monthly or annually cash flow is a difficult one. Energy costs occur monthly, but then again so does the mortgage cost and the latter is nearly always figured into an LCCA as an annual cash flow for a long term planning horizon. There are many arguments for using a monthly and for using an annual approach, however, it is much more common to study all costs in an LCCA as annual costs. Therefore, for this study, all costs, including energy costs, will be presented and used as annual costs (except for those costs which occur less often than annually).

In cases where the downpayment and other first costs (such as closing costs, prepaid insurance, etc.) are larger for one home than the other, the difference is assessed an opportunity cost. The definition of an opportunity cost is: the cost of foregoing the opportunity to earn interest, or a return, on investment funds (30). In an LCCA, an opportunity cost is commonly used in cases like this study to represent the loss of potential interest earnings. In a case such as this study the downpayment and other first costs (upfront costs) typically come from money the home buyer has saved or has recently gained from a sale of other assets. In any case, the closing and other related first costs may not be included in the home mortgage under Oklahoma law. Although some prospective home buyers get a portion of their downpayment by borrowing from other sources, such as against a life insurance policy, it is more common that the cash for the upfront costs is "unattached" cash.

Under these circumstances, the opportunity cost becomes the lost dividend revenue from potential investments, rather than interest payments if the money were borrowed. Today's investment scene encompasses a number of "safe" investments such as money market plans, certificates of deposit (C.D.), etc. Due to the general nature and broad scope of this study it would be better to use a standard savings account, at six percent interest, for the investment opportunity of the differential monies from the upfront costs for two two types of homes. For this study, the opportunity cost is included as a positive cash flow (a cash flow to the homeowner) to the case which has the lower upfront costs. In most engineering economic analysis applications, the opportunity cost is assessed over the entire planning horizon. In a case such as this, there is no basis to assume that the homeowner that paid the lower upfront costs, would retain the differential amount in investment opportunities and not spend it over the planning horizon. A more fair, but somewhat arbitrary (since it would be impossible to accurately estimate the period) assessment would be to assess the opportunity cost for the first five years and then cancel it. This assessment allows the homeowner with the lower upfront costs to earn revenue from the opportunity cost principle, but does not unfairly penalize the higher upfront cost home over the entire life cycle. An alternate method of taking the opportunity cost into consideration would be to either (or both) invest the monies from the difference in first costs in a method of investment which yields more than six percent interest, or apply the opportunity cost over more than the first five years. Using an investment which yields a higher rate-of-return would account for those persons who are more willing than most people to invest in opportunities which have a

higher risk than the "safe" investments of savings accounts. Applying the opportunity cost over a longer period of time would account for the fact that the homeowner who paid the lower upfront costs will have a somewhat better style of living for more than five years because he was able to use the money saved on the upfront costs very effectively to better his style of living. The difference in the two methods is that when a greater return on invested monies is estimated or if the opportunity cost is applied over a longer period of time the result is that the length of time to the break-even point is slightly increased. The difference could be from a few months to a very few years, depending on how much higher the rate-of-return is and how much longer the opportunity cost is applied as opposed to the study parameters set forth above.

Some costs, like painting, HVAC equipment, and some maintenance, are non-annually recurring, but rather occur at a limited number of specific years in the future. These costs must either be of an identified magnitude at a future date, or they must be escalated from their present value by an escalation or inflation rate. After the cost value in question has been escalated for the future, it is added to the total cost in the year(s) in which it has been identified to occur. After all first costs and costs that occur within the planning horizon have been added to the years in which they occur, the salvage value (resale value) of the house is estimated by appreciating the first cost by the resale appreciation rate. The resale value is placed as a positive cash flow (cash flow to the owner) in the 30th year. An alternate situation is to place the resale value at the end of the average home tenure (AHT) and to eliminate all cash flows beyond the average home tenure year.

In both cases above (both the 30 year and the AHT planning horizon), the payback period for the two homes under each set of criteria is calculated in the same manner. The payback period is determined by summing the individual yearly costs of both housing types one year at a time until the year that the house with the higher upfront cost yields a cumulative cost which is either less than or equal to the cumulative cost for the house with the lower upfront cost. This is then the break-even year. In the second case, where the planning horizon is taken to be the average home tenure, if break-even has not occurred by the AHT year, both of the homes' resale values will be subtracted from their individual cumulative costs. If break-even then occurs with cash from the sale, the higher purchase cost home has indeed paid back the higher initial investment needed for it. If break-even does not occur upon the sale, the lower purchase cost home is the more economical option. At this point, it is speculated that all break-even periods will occur within the 30 year planning horizon; if they do not, then the same procedure as used in the AHT year is to used in the 30th year to determine if break-even occurs upon the sale at 30 years.

LCCA Example

In order to clarify the procedure used for the LCCA, a demonstrative example is presented in this section. The cost values used in this example are purely for demonstration purposes and are not meant to predict or replace the actual cost values used in this study. Throughout this example E/S represents the earth shelter home and A/G represents the conventional home. All values are rounded up to whole dollars. The cost parameters for this example are shown in Table I.

TABLE I

LCCA EXAMPLE: COST PARAMETERS

Cost Value	Earth Shelter	Conventional
Purchase Cost	$90,000	$85,000
Financing Ratio	80%	90%
Closing Costs	350.00	350.00
Closing Related Costs:		
Loan Origination Fee	1% of Loan	Same
Private Mortgage Insurance	none	1/2% down, 1/4% annually
Prepaid Homeowners Insurance	14 mo.	14 mo.
Mortgage Rate (fixed 30 year)	13.50 %	13.50 %
Points	2.00	1.50
Home Appreciation Rate	6%/yr. to 10 yrs.	Same
Annual Energy Cost	945.00	2100.00
Annual Homeowners Insurance	458.00	455.00
Exterior Painting @ 5 yr. int.	300.00	1000.00
HVAC Replacement @ 12 yr. int.	1800.00	2500.00
Inflation = 5% per year		
Energy Escalation Rate = 2-1/2% per year (separate from inflation)		

PMI is cancelled after principal is down to 80 percent of original home value.

The first step is to calculate the costs that must be paid upfront; these are 1) closing costs; 2) closing related costs (includes loan origination fee, private mortgage insurance, and prepaid homeowners insurance); 3) downpayment; and 4) points. The closing costs are as listed in Tables I and II; $350 for each home. The loan amount is figured by multiplying the purchase price (or value) of the home by the financing ratio (financing ratio is the percentage of the home value that the mortgage company will lend, the financing ratio is also known as the loan-to-value ratio). The loan origination fee (LOF) is simply one percent of the loan amount; for the E/S this is equal to ($90,000 X 80%) X 1% = $720; for the conventional home the LOF equals ($85,000 X

90%) X 1% = $765. The E/S requires no private mortgage insurance (PMI) since PMI is only required on any financing over 80 percent and after the principal is paid below the amount it would have been with 80 percent financing the PMI can be cancelled. The PMI for the A/G requires that 1/2 percent of the loan amount be paid upfront, or $383. Prepaid homeowners' insurance is 14 months at the regular rate, less a 15 percent discount for a brand new home. For the E/S the prepaid insurance is: (14/12)(458)(0.85)= $455; the A/G requires $452. The downpayment is very simply the purchase cost times one minus the financing ratio (the difference between the home value and the loan amount), for this example the downpayment for the E/S is $90,000(1-0.8)= $18,000, the A/G downpayment is $8500. Finally the points; (a point is 1 percent of the loan amount) the E/S has two points (or two percent of the loan amount) which equals $1440 and the A/G's points are $1148. A summary of all closing and upfront costs is presented in Table II.

TABLE II

LCCA EXAMPLE: CLOSING AND UPFRONT COSTS

Cost	Earth Shelter	Conventional
Closing Costs	$ 350	$ 350
Loan Origination Fee	720	765
Private Mortgage Insurance	none	383
Prepaid Homeowners Insurance	455	452
Points	1440	1148
Downpayment	18,000	8,500
Totals	$20,965	$11,598

The annual costs are broken into two parts, those that stay constant and those that escalate over time. The only cost value that remain constant is the mortgage amount. By using the tables in Appendix C, the monthly mortgage cost for the E/S is ($90,000 X 0.8) X 11.45 /1000 = $825, annually this relates to $9893. The A/G annual mortgage payment is $10,512.

The costs that escalate annually are also broken into two groups, those that escalate directly and those that escalate indirectly. Those that escalate directly are ones like energy, maintenance, and equipment replacement. These are figured quite simply by adding the escalation percentage to the previous year's cost. For example, the first year the E/S energy cost is $945, the second year it is two-and-one-half percent greater, or $967, the third year it is again two-and-one-half percent greater than the second year, or $993, and so on. At the 30th year the cost should be approximately $1,934 (if a person follows the example he may find that he is several dollars off, this is due to rounding error).

The only cost that escalates indirectly is the annual insurance cost. The insurance cost is linked to the homes' value and the cost goes up as the value of the home goes up, but not necessarily in a directly proportionate ratio. Appendix C includes a table of normalized insurance costs (these are discussed in Chapter 5 of this thesis), which reveal the annual insurance cost for a particular home value. For example, at the end of the first year the E/S home is worth six percent more than its original value (see Table I for home appreciation rate), this yields an insurance rate of $478. The second year the home has appreciated to $101,124 and the resultant insurance is approximately $502, and so on. A summary of the annual costs for the first 15 years of a 30

year life span is shown in Tables III and IV. Table V gives a summary of both the annual and running total costs for the two housing types, up to the break-even year.

As stated earlier, the numbers in this example are just for illustration purposes. Some of them are actual numbers but this is not meant to be a prelude to the results of the actual thesis analysis. As can be seen, the payback occurred in the sixth year of the life cycle in this example. The payback was determined by adding the additional incremental costs from each year into a total summation cost. When the total summation switches to being lowest for the home with the highest first cost, then payback is achieved.

TABLE III

LCCA EXAMPLE: ANNUAL COST SUMMARY FOR EARTH SHELTER

Year	Mortgage Payment	PMI	Annual Energy	Annual Insurance	Exterior Painting	HVAC Equip. Replacement
1	$9893	0	$945	$458	0	0
2	9893	0	969	478	0	0
3	9893	0	993	502	0	0
4	9893	0	1018	526	0	0
5	9893	0	1043	554	401	0
6	9893	0	1069	578	0	0
7	9893	0	1096	610	0	0
8	9893	0	1123	638	0	0
9	9893	0	1151	672	0	0
10	9893	0	1180	715	537	0
11	9893	0	1210	757	0	0
12	9893	0	1240	757	0	3622
13	9893	0	1271	757	0	0
14	9893	0	1303	757	0	0
15	9893	0	1335	757	719	0

TABLE IV

LCCA EXAMPLE: ANNUAL COST SUMMARY FOR CONVENTIONAL HOME

Year	Mortgage Payment	PMI	Annual Energy	Annual Insurance	Exterior Painting	HVAC Equip. Replacement	Opp. Cost
1	$10,512	191	$2100	$455	0	0	-562
2	10,512	191	2153	458	0	0	-562
3	10,512	191	2206	482	0	0	-562
4	10,512	191	2261	502	0	0	-562
5	10,512	191	2318	526	1338	0	-562
6	10,512	191	2376	554	0	0	
7	10,512	191	2435	582	0	0	
8	10,512	191	2496	610	0	0	
9	10,512	191	2559	638	0	0	
10	10,512	191	2623	677	1791	0	
11	10,512	191	2688	677	0	0	
12	10,512	191	2755	677	0	5030	
13	10,512	191	2824	677	0	0	
14	10,512	191	2895	677	0	0	
15	10,512	191	2967	677	2397	0	

Opp. Cost = Opportunity Cost

TABLE V

LCCA EXAMPLE: TOTAL COST SUMMARY

Year	Earth Shelter Incremental	Total	Conventional Incremental	Total
0	$20,965	$20,965	$11,598	$11,598
1	11,296	32,261	12,696	24,294
2	11,340	43,601	12,561	36,855
3	11,388	54,989	12,829	49,684
4	11,437	66,426	12,904	62,588
5	11,891	78,317	14,323	76,911
6 @@	11,540	89,857 @@	13,633	90,544 @@
7	11,599	101,456	13,720	104,264

@@ = Break-even year

Cost Compilation Procedure

The procedure used to compile cost data for the study is not nearly as structured as the one used for performing the LCCA. In fact, the procedure used for gathering the cost data began as a pursuit of a series of educated guesses as to where the data might be found and then following all of the leads connected with each source until the appropriate data were found. Although this procedure is mostly "unstructured", it does work rather well when an appropriate effort is put into the search. Also, this procedure is a very commonly used method that can be used for almost any type of information search.

For information that would likely be published, the search started in both Oklahoma State's main and architecture libraries. The search consisted primarily of looking through the periodical indexes, especially through the ones published in the last two years, to get the most current information. For information that does not change rapidly, mostly historical type information, the card catalog was checked under the appropriate headings and/or authors. This initial search through the libraries revealed what information would have to be gained through other sources and what information could be pursued in the library. Some of the information found in the initial search of the library can be used later to substantiate information gathered by other methods.

Cost data, such as insurance costs, etc., that were not likely to be published in a usable fashion, if at all, were found by approaching professionals in each particular field in which cost data were required. This method does have some drawbacks in that occasionally the professionals are somewhat wary of providing information in fear that the information they provide could somehow be legally binding. In this study,

all information gained through the help of professionals will remain anonymous in order to preserve the privacy of the individuals who provided information; also, so that they will not be put in the awkward position of having any specific information, which may have become outdated, binding. In this area of cost data gathering, some of the information found in the initial search helped by providing a sufficient background so that the proper questions could be asked in order to gain information that may ordinarily not be readily available.

Another part of the cost data that could not be found in a useable format in the library search was information on the building costs for both types of homes. For this type of cost, personally contacting professionals in the field, such as contractors and architects, simply was not time efficient. Instead, a questionnaire was distributed to a group of contractors who attended an earth shelter seminar hosted by Oklahoma State's Architectural Extension. Also, a questionnaire with the same content was mailed to architects and contractors who were recommended by Architectural Extension and faculty of the School of Architecture as having either interest or experience in building earth shelters and who could possibly furnish building cost information. This method worked moderately well, the largest single problem was a lack of response from the survey recipients. Those who did take the time to respond furnished valuable information.

By using these three types of gathering data; literature search, personal contact with professionals, and mailed survey, most all of the data needed to perform the LCCA were compiled. Any data that were not available through any of the three methods above were found by an alternate method. This alternate method was a very unstructured method of

simply asking questions, about the required area for which cost data were needed, of any person who either might know the answer or be able to provide further leads to track down the information.

CHAPTER V

QUANTIFICATION OF COST DATA

General Format

The cost data are broken down into four major sections for the two types of housing studied (both conventional and earth shelter). Each section relates to a different phase of home ownership and purchase. The first section is the purchase and financing section. This section is chosen as the first because of its position in the life of a home - the house must be purchased before it can have annual operating costs. The second section covers the largest factor of the annual operating costs - it is the annual energy costs. The energy costs are separated from the rest of the operating and maintenance costs because the energy costs tend to be more substantial than the other operating and maintenance costs and reduced energy costs are one of the largest factors that attract people to earth shelters over conventional homes. Third is the annual owning costs. Costs that fall into this category are costs such as mortgage payments, home insurance, and annual maintenance. Lastly maintenance and replacement costs that do not usually occur annually are presented. Costs that will typically be covered in this section are major equipment replacement, major maintenance, etc.

Purchase and Financing

The purchase and financing section includes all costs related to

the purchase of the two types of homes. Costs in this section include 1) typical total purchase price of the home; 2) down payment rate (financing ratio or leverage); 3) closing costs, prepaid insurance and related costs; 4) resale appreciation rate; 5) mortgage interest rates and discount points (mortgage interest points).

For this study a 1600 square foot home was chosen as the average size home on which to base all cost values. Although all costs are based on 1600 square feet, when the total costs are broken down to a "per square foot" cost they should remain fairly accurate for plus or minus 10 to 12 percent total square footage. The 1600 square foot basis was derived from a December 1983 article in U.S. News & World Report which listed the average home size for 1982-1983 to be about 1690 square feet and that the average size was decreasing somewhat. From the information given in this article, 1600 square feet seemed to be a good estimate for the coming several months (30). The value of 1600 square feet was also validated by interviewing a real estate broker, John Edmunds, in Tulsa. He said that the average size home currently being built in the Tulsa area (according to their research) was about 1400 square feet. However, that value included a recent burst of very small "starter homes", which fall into the 1000-1200 square foot range. Edmunds felt that if those very small homes were taken out of the picture the average would be about 1600 square feet. He also indicated that associates in the Oklahoma City area were reporting similar findings (32). The 1600 square foot size for the earth shelter is somewhat smaller than indicated by findings from the Center for Natural Energy Design (CNED); however, the average size of 2042 square feet found in CNED's survey may

have been skewed somewhat by a very few homes with as much as 5000 square feet (5).

Total Purchase Price

To find the typical purchase price of each type of home, a questionnaire was sent to various architects and contractors who had experience with both conventional and earth shelter building. The questionnaire and details of the results are too bulky to be included in the text and are, therefore, in Appendix B of this thesis. The results of this questionnaire are by no means "the definitive guide to home prices", however, they are good average numbers for a broad based study such as this. A list of the values for custom homes is given in Table VI (only custom homes are given here since they are the focus of the study rather than tract homes, for a complete listing of the results, see Appendix B).

TABLE VI

PURCHASE COST OF CUSTOM HOMES

Housing Type	Minimum Cost	Average Cost	Maximum Cost
Earth Shelter	$ 81,200	$ 90,960	$ 100,720
Conventional	$ 73,040	$ 84,000	$ 94,960

Broken into per square foot costs, the conventional homes range from a minimum of $45.65 to a maximum of $59.35 with the average at $52.50. The average cost relates very well to the estimated cost of approximately $45.00 per square foot for new conventional tract homes (32). From the survey (covered in Appendix B), custom homes average about 10 to 15 percent more than tract homes. This would place the $45.00 per square foot for tract homes very close to $51.00 to $52.00 per square foot for custom homes.

From the survey conducted for this thesis, the cost per square foot for an earth sheltered home was found to range from a minimum of $50.75 to a maximum of $62.95, with an average of $56.85. For comparison a project in the Denver area, being developed by Charles Lane, which was started in the winter of 1983-1984, includes duplex and 4-plex earth shelter tract homes which the developers plan to be able to sell for approximately $52.65 per square foot (33). If earth shelters achieve the same 10 percent advantage for tract homes as conventional homes exhibit, this would yield a cost of approximately $58.00 per square foot, which is slightly higher than the cost estimates from the survey done for this study. However, the project mentioned above is for the Denver area, which has a higher cost of living factor than does Oklahoma. Another project reported early in 1983 was a subdivision in Wisconsin, which had a restrictive covenant which required that every home built must be an earth shelter with at least 50 percent of the roof with earth cover. At the time of the report, the homes in the subdivision were being built for about $50.00 to $55.00 per square foot (34). Escalating these costs by inflation over the past year and allowing for the higher cost of

living in the Wisconsin area, these costs also fall very close to those found in the survey done for this study in Oklahoma.

Financing Ratio

With rapidly rising home costs and interest rates in the past years, financial lending institutions have devised a number of alternate financing schemes, such as adjustable rate mortgages, graduated payment plans, etc. All of these alternate plans are in addition to mortgage underwriting by the Veterans Administration (VA) and the Federal Housing Administration (FHA). For this study a standard conventional financing plan has been used for a number of reasons. According to recent reports, the standard conventional mortgage is still the most popular, although the alternate plans are beginning to be somewhat more accepted by wary homebuyers (31.32). Also, using a plan such as the VA for a study such as this would not be reasonable due to the restriction of having to be a veteran. A similar argument must be used against FHA financing. In order to get FHA to underwrite a mortgage, the home must be FHA approved. In the past FHA has been somewhat erratic about approving homes, and they have generally stayed away from anything that is a deviation from the norm, including some energy efficient above ground homes. Also FHA tends to be more aligned toward lower income (but not poverty level) and first time buyers, the lending ceilings that FHA has would not allow financing on some of the upper home values which are to be used in this thesis.

The financing ratio (sometimes called the loan-to-value ratio) for homes is usually determined by how easy it is for a lending institution to sell the mortgage to an underwriting agency. The easier it is for

the lending agency to sell the mortgage, the higher ratio of financing they will provide. Meaning, if they can sell a mortgage to a mortgage underwriting institution easily, then they will be much more willing to lend a greater amount toward the purchase price of the home, which means a smaller downpayment. For conventional loans on most new conventional housing, the financing ratio is usually more a function of the homeowner's financial position and credit rating than a function of the home. However, on non-conventional homes (which an earth shelter would definitely be classified as) the lending agencies look at the marketability of the property (both the land and home). If they think that they could easily regain their investment if the homebuyer were to default, then they would be willing to loan at a higher ratio than if they did not feel that they could easily regain their investment. The key word here is "easily", the lending institution is not in the real estate business, it is in the money business. If they have some property that they have had to repossess, they do not want to hold that property, but rather get rid of it very fast.

Until recently most of the traditional federal mortgage underwriting agencies have been very wary of and have tended to avoid, underground homes. Recently the Federal National Mortgage Association (FNMA) has broken tradition and has started buying loans secured by earth sheltered properties. The only restriction that FNMA has is that the financing ratio not be more than 80 percent (35). Earth sheltered homes are still fairly new on the housing scene and for most areas of the country (Oklahoma included) they have not been adequately tested on the resale market. This does not mean that it is impossible to obtain financing, in fact many earth shelter residents have not had any major trouble

obtaining financing, however, it does usually mean that the financing ratio (loan-to-value ratio) is lower. This means that an earth shelter is much more likely to only receive 80 percent financing rather than the 90 or 95 percent common to new conventional housing. Lending agencies are very conservative and no lender wants to be the first to start a new trend in lending, so for now most are content to wait until earth shelters have established themselves in the resale market before they start lending higher ratios.

In a recent earth shelter "speakout" (March 16-17, 1984), sponsored by Oklahoma State's Architectural Extension, Dottie Kasey from Liberty Federal Savings and Loan in Enid, the speaker on the financing of earth shelters, indicated that most lenders in Oklahoma tended to stay with the 80 percent lending rate for earth shelters. John Edmunds, a Tulsa real estate broker, said that he had not encountered any lenders that had any experience with earth shelters and that most lenders would probably stay with the 80 percent lending rate for non-market-tested housing. Edmunds said that currently, most people who can qualify for a mortgage on the home that they are trying to buy have no problem obtaining 90 or 95 percent financing, with 90 percent financing being slightly more popular. Edmunds also said that 100 percent financing is very rare for any type of mortgage (32). In summary, the primary financing ratios used for this study are 90 percent for the conventional house and 80 percent for the earth shelter.

Closing and Related Costs

The closing costs, prepaid insurance, and other related costs (these costs along with the downpayment and loan "points" are the

upfront costs) vary somewhat from area to area and also vary with different insurance companies and financing institutions. These costs can be (and have been) "generalized" fairly well by lending agencies and real estate companies. The actual prepaid insurance cost is presented in a later cost section, however the usual policy is that the amount is equal to 14 months at the normal rate (32). Typical closing costs for 80 and 90 percent conventional mortgages are as shown in Table VII.

TABLE VII

TYPICAL CLOSING COST SUMMARY

Buyers Closing Costs	80 percent financing	90 percent financing
Appraisal Fee	$150.00	$150.00
Credit Report	30.00	30.00
Survey	&	&
Recording Fee	18.00	18.00
Mortgagee's Title Ins.	30.00	30.00
Loan Origination Fee	1% of loan	same
Photographs	8.00	8.00
Amortization Schedule	2.00	2.00
Attorney Fees	75.00	75.00
Escrow Fee	30.00	30.00
Underwriting Fee	18.00	18.00
Private Mortgage Ins.	0	2% @
Totals	361.00 + LOF	361.00 + PMI + LOF

& - Normally the lender obtains a survey so there is no need for the homebuyer to also obtain one.
LOF - Loan origination fee.
PMI - Private mortgage insurance.
@ - Normally 1/2% of the loan amount is paid at closing and 1/4% annually.

Source: Reference (36)

Resale Appreciation Rate

The resale appreciation rate of real estate fluctuates with the economy. However, when the economy is in a depression period, real estate usually does not decline, but rather holds steady or increases very slowly. In the past decade, the annual appreciation rate on homes has reached as high as 10 to 12 percent, here in Oklahoma. This high point was only temporary and the current rate is back to a more normal 6 percent. A home will appreciate at this rate for about the first 10 years of its life. After the first 10 years, the appreciation is much more sporadic and relates strongly to the buy/sell activity and the current demand in the immediate area around a home. Looking ahead after 10 years of appreciation it becomes very difficult to predict with any accuracy the further appreciation rate of a home (32).

Mortgage Rates and Discount Points

Mortgage interest rates and discount points change constantly, usually they change every Thursday when the new rates on "T-bills" (U.S. treasury bills) come out. Mortgage rates a few years ago (October, 1981) reached an all time high of 17.5 percent. Since then mortgage rates reached a periodic low of 12.5 percent, for fixed rate federally insured mortgages, late in 1983 (31). Currently, the mortgage rates for FHA and VA are back up to 13.00 percent with 4.5 discount points. While fixed rate, 30 year conventional mortgages are currently running around 13.50 with only 1.5 to 2.0 points for 90 or 80 percent financing respectively. Edmunds reports also that most lenders are expecting that the Fed's (U.S. Federal Reserve Board) tight money policy is going to drive interest rates back up to 17 to 18 percent by the end of 1985. The

lenders are getting their information from the well known financial forcasters at places such as E. F. Hutton and Merrill Lynch (32). To back up these predictions of much higher interest rates, many economists, financial experts, and forecasters shown or interviewed on national nightly news programs are also predicting much higher interest rates by the end of 1985. These economists state both the Fed's tight money policy and the current estimated growing national debt as the prime reasons for the likely much higher interest rates.

Annual Energy Costs

To find the costs of energy consumption for the two types of homes, the first step was to look directly for information concerning the total energy costs for homes. This type of information is very rare and mostly incomplete. Part of the reason is the personal privacy issue, people just do not want their energy bills to be public information. An alternative to the method of using actual energy bills was chosen. It is relatively easy to obtain information concerning the total energy consumption of a selected home or group of homes and the rates that the utility companies charge is public knowledge by law.

About four years ago, the Center for Natural Energy Design (CNED) working in the College of Engineering, Architecture and Technology at Oklahoma State University surveyed persons in nine states, including Oklahoma and surrounding states, who either lived in earth shelters, were interested in building an earth shelter, or were currently building one. A part of this survey included obtaining permission for the local utility company to release information concerning the homes' energy consumption. Later an OSU graduate student, Lanny Seals, did his thesis in

an area which required more information about energy consumption for both earth shelters and conventional homes (40). The energy consumption values used in this thesis are derived from the research done by Seals and CNED. Although the research done by Seals and CNED covered nine states, only the information for Oklahoma is used, for reasons covered in the scope and limitations chapter.

The decision to use total energy consumption as opposed to only the energy consumption needed to condition the home was based on findings by CNED (in the survey mentioned above). CNED found that since most earth shelter residents have utility bills which are substantially lower than the ones for their previous conventional home they make little effort to utilize some of the many energy saving lifestyle modifications that most people who live in conventional homes practice (6). These modifications are ones such as keeping the home warmer than desired in the summer and cooler in the winter, using a limited number of rooms so that little conditioning is required for the non-used ones, etc.

The energy consumption data gained through the research by Seals and CNED took all energy from petroleum based fuels that was used on each site and converted it all into an electrical equivalent. Most of the houses in the study were either total electric or primarily electric. The finding for a typical modern, but not specially built, conventional home in Oklahoma was approximately 13.93 kWh per square foot per year, this relates to 22,285 kWh per year for the 1600 square foot home used in this study. At least 50 percent of the earth shelters were found to consume approximately 10.80 kWh per square foot per year (17,275 kWh per year) and nearly 16 percent of the homes consumed as little as 6.87 kWh per square foot per year (10,989 kWh per year), less

than one half that of the conventional home. Both the lower and higher values for the earth shelter are studied to find their relative effect on the overall life cycle payback.

Utility rates vary somewhat around the state, depending on which major utility company serves a particular area, if the local utility is a major utility (such as OG&E or PSO) or if the local utility buys electricity from a major utility and then adds a service charge to it. Another factor, which is impossible to predict, is the fuel adjustment charge. This charge is an adjustment factor for the varying price which the utility has to pay for natural gas. If the price of natural gas exceeds a limit set by the Oklahoma Corporation Commission, then the extra cost is passed on to the consumers via the fuel adjustment charge (if the price is lower it means a larger profit for the utility). Also, there are varying charges for summer and winter usage (on-peak and off-peak). Some utilities also have varying rates for varying consumptions, the more that is used, the less it costs per unit. Through an informal phone survey of some of the major utilities, an average cost of approximately five-and-one-half cents ($0.055) per kWh was determined. The $0.055 per kWh value is an average value and the actual cost in a particular case could be a few percent higher or lower. Using this cost per kWh yields annual energy costs for the conventional home to be about $1225 and for the earth shelter a range from $950 for a high down to $605 for a low.

Predicting the inflation of energy costs is a very uncertain task. Those people who have found that they can accurately predict the increase in prices are too busy becoming millionaires to tell what the price is going to do and those who only thought they could accurately

predict the price are in bankruptcy court. In Oklahoma, most electricity is generated in natural gas fired plants. The ongoing deregulation of natural gas could have a tremendous effect on the price of electricity. Forecasters tend to agree that the cost of energy is going to increase, however, they disagree on the rate by which it will increase. Some, such as Ulf Lantzke, head of the International Energy Agency, feel that with the recent weakening of OPEC, energy costs will keep pace with the general inflation rate and will only exceed it by a small amount, if at all (41). Others feel that the deregulation of natural gas will send energy costs in Oklahoma, "through the roof". Although much has been published on where energy costs have been, very little has been published on where they are going. For this study two stages of energy escalation will be studied; 1) energy escalation to be at the same rate as the prevailing general inflation rate (5.7 percent); and 2) energy escalation to be twice the general inflation rate.

Annual Owning Costs

Annual owning costs encompass such costs as the mortgage payments, insurance payments, and any annually recurring maintenance that may be substantially different for the two types of homes. The mortgage cost is purely a function of the following three factors: 1) the amount of the loan; 2) the mortgage interest rate; and 3) the life span (or term) of the mortgage. The first factor, the amount of the loan is simply the cost of the home less the downpayment, the amount of money that the mortgage company has loaned for the home. The second factor, the mortgage interest rate, is impossible to predict with accuracy because it varies from week to week (as covered in an earlier section in this

chapter). For this reason the interest rates used in this study cover a range from the current 13.50 percent up to the projected 17.0 to 18.0 percent by the end of 1985. The third factor is the life span (or term) of the mortgage, for this study the common 30 year mortgage has been. With the new and varied financing plans available today, new mortgage terms have come available also, such as a variable term (very similar to an adjustable interest rate mortgage except the payment stays constant but the term of the mortgage varies). However, the 30 year mortgage term is still the most popular by far. To calculate the annual mortgage payment requires a set of mortgage tables which lenders use, or the equation which all of those tables were derived from (the equation requires a calculator which will perform exponential calculations). The P+I (principal and interest) tables are bulky and are therefore given in Appendix C. The equation is as follows:

Monthly P+I = Loan Amount X ((i(1+i)^n)/(((1+i)^n)-1))

Where: i = the annual percentage rate divided by 12 months
n = term of the mortgage in years X 12 months per year
^ = symbol meaning "raise to the power of"

Note: The equation is normally rounded to the fourth significant digit.

Source: Reference (30).

Insurance costs are dependent on a wide variety of factors, such as the location of the home, type of finishes, exterior facade materials, the company's experience with a particular home type (when the home is a new type as is earth shelter), etc. Insurance companies base a large portion of their rate structure on the risk history of various conditions that affect a home. Insurance companies also are like lending institutions, in that they are very conservative and an individual

company does not want to be the first to set a new trend in establishing insurance rates and policies. Some earth shelter advocates state that an earth shelter home is so safe that it does not require any insurance at all. This type of thinking is not very wise. One reason is that if a mortgage company has a lien on the property, they usually require that the property be insured for at least the value of the mortgage and some require full replacement value to be carried. Another reason is that no matter how safe a home is, Murphy's Law of Trouble; "if anything can go wrong, it will at the most inappropriate time"; is almost always in effect. Why should anyone risk losing what is probably one's greatest investment and have no financial recourse to replace all one's belongings because there was not an insurance policy in effect? For this study, the option of the earth shelter not requiring any insurance is considered non-logical and a non-valid case and has not been considered as a factor.

As stated earlier, insurance rates vary depending on many factors. Insurance rates also vary depending on what company is chosen to do business with. When a lender checks a potential homebuyer out to see if he can qualify for a particular mortgage, the lender uses a normalized insurance schedule. This normalized insurance schedule is like an average of what rates can be expected; the actual rates may be slightly higher or lower, but they usually vary by only a few percent. These normalized rates will be used for the conventional home, since they are more constant than the almost infinite variety of actual rates that are available to a homeowner. A partial listing of the annual insurance costs is shown in Table VIII (for a complete listing see Appendix C). Most insurance agencies offer insurance discounts for new homes, through about

the first seven years. A list of common discounts for new homes is shown in Table IX (37).

TABLE VIII

NORMALIZED HOMEOWNER INSURANCE RATES

Home Value	Annual Premium	Home Value	Annual Premium	Home Value	Annual Premium
$70,000	$378	$74,000	$396	$90,000	$458
71,000	380	75,000	401	95,000	478
72,000	385	80,000	417	100,000	498
73,000	390	85,000	455	105,000	518

Source: Reference (36).

TABLE IX

NEW HOME INSURANCE DISCOUNT

Year	Discount	Year	Discount
New	15 %	4	8 %
1	10 %	5	6 %
2	10 %	6	4 %
3	10 %	7	2 %

Source: Reference (37).

Some earth shelter advocates claim that very substantial insurance savings may be gained with earth shelter homes. This is only true to a

certain degree. A recent study by Earth Shelter Living magazine revealed that some insurance companies do offer some discounts to earth shelters and other energy conserving designs. However, substantial is relative, the discounts range from 10 percent to 30 percent, with most falling more toward the lower end. The most important finding of this study is that most of these discounts are not automatic to an earth shelter, each individual case must be reviewed by the insurance inspectors and company to determine how much, if any, discount is to be applied. A full set of house plans with both a registered architect's and registered engineer's seals on them is mandatory for the evaluation. Another interesting aspect found in the Earth Shelter Living study was that most of the insurance companies listed as offering discounts are primarily located in the northeast part of the country and are virtually unknown here in the southwest (38).

The lack of published information on insurance discounts for earth shelters required that further study be done in this subject area. The most direct method of gathering information was chosen - go directly to the insurance companies and/or their representatives. For this phase of the study an interested insurance agent, Mary Edmunds of Broken Arrow, Oklahoma, was of great assistance. Many insurance agents, both company agents and independent agents, were contacted about any policy that their company (or companies) might have. The results were that in Oklahoma, there is almost no set policy toward discounts for earth shelters. The findings were that each case would have to be closely examined individually. Then there was no guarantee that an examined case would be granted a discount. Most representatives reported that the feelings of their company were that they (the company) did not have enough

experience in insuring earth shelters in order to have historical track record information on which to base a discount. Also they felt that if a discount was granted, it would likely not exceed 10 percent (37). Therefore, for this study, earth shelters are considered to only receive no discount to a maximum of a 10 percent discount over rates for the conventional home.

The primary factor in determining the escalation rate of insurance costs is related to the appreciation rate of the house. General rate increases come sporadically when the state board allows increases. To predict these increases is virtually impossible. In order to keep the cost data as accurate as possible, the only escalation considered here are the increases due to the property increasing in value and the coverage increasing correspondingly.

This study has not revealed any annual maintenance costs directly related to the homes that would be substantially different for the two types of homes. Some studies have identified HVAC equipment maintenance as a point of substantial difference (14), however the major cost item for most preventative maintenance programs is the labor cost of having a maintenance check performed; the actual parts costs are usually minor compared to the labor cost, except for when a major problem is discovered. Therefore, no annual maintenance cost will be included in the LCCA.

Non-Annual Maintenance

This section covers maintenance such as exterior painting, major equipment replacement, and roofing replacement. The maintenance and repair items in this list do not occur annually under normal conditions. As mentioned earlier in this study, maintenance and replacement for

items such as interior painting, flooring replacement, etc. are not included in this study for the reasons stated in the scope and limitations chapter. There are two different ways to examine the exterior painting costs and both are valid. One is the cost of the paint and miscellaneous supplies for the do-it-yourself job, and the other is the cost for a professional paint job. Both of these methods of house painting are commonly used, the major difference in the results is the effect the paint job has on a homeowner's bank account. For a conventional house, the do-it-yourself job can typically cost less than $100 and easily cost less than $200. To have the same house professionally done would easily cost five times that amount and maybe more. In an attempt to be practical about the painting issue in this study, a cost middle ground between a do-it-yourself and a professional job has been used. The reasoning is that in all except rare and isolated cases, the cost of painting will not be one of the primary reasons for selecting one type of home over the other, rather the cost of painting will normally either be an added benefit or an accepted burden. To help backup this stand, the cost of painting is small in relation to many of the other annual costs and only makes a difference of a very few months in the life cycle (quite possibly a difference of only one month). With the relative uncertainty and generalizations of many costs in this study a difference of one month should not be a deciding factor as to which house is actually better.

The University of Texas - Arlington (UTA) study gave average professional painting costs for the year that the study was done (1978) (14). By increasing those costs by the increase in the consumer price index from then to now (early 1984) a fairly accurate value should be obtained. From 1978 to late 1983 the consumer price index rose by a

factor of approximately 107 percent (39) while the average cost of building construction only rose 69.3 percent over the same period (42). Using this increase would yield painting costs of approximately $400 for the conventional house and approximately $70 for the earth shelter. By estimating costs for a do-it-yourself job to be $130 for the conventional, and the same ratio as the costs above for the earth shelter, or $23, and then averaging with the professional costs yields costs of $265 for the conventional and $47 for the earth shelter. The time frame of painting every five years, as researched in the UTA study, is very reasonable and has also been used in this study (14).

The UTA study also researched the average life of a typical HVAC system and the cost of replacing a system (14). The typical life span that UTA arrived at was 10 years, which has been used for this study. The costs found by UTA have been increased by the Means building cost index increase over the time period from the UTA study to present. As mentioned above, the Means cost index increased 69.3 percent over this period. There was no appreciable difference in the increase of cost indices between Oklahoma and Texas, therefore the 69.3 percent increase was applied directly to the cost value given in UTA's study. By applying this increase factor to UTA's findings the following costs for HVAC replacement are found: $1120 for a conventional home and $450 for an earth shelter.

The question of roofing replacement is a very difficult one. Actually it is simple for the conventional home, roofs are known to last only a certain number of years on the average and replacement costs are reasonably consistent within a region. For the earth shelter the question is not so simple. The correlating aspect to the conventional house

would be the "roof's" waterproofing system on an earth shelter. The waterproofing systems presently on the market that are performing best are for the most part not tested over long periods of time, mainly because earth sheltering is relatively new. These waterproofing systems are thought to be very good and reliable and to have extended life spans. However, they have not been field tested over a long period of time and there is a question of how long they really last. It has been decided for this study that this question will remain not fully answered. This study's primary focus is on the first years of the life cycle and a factor that will only affect the life cycle costs very late in the life cycle will have no effect on the early year's results and should not warrant extended study. This is not to say that the aspect of possible future waterproofing repairs are not important in the decision of which home is economically better, but rather that it is out of the scope of this study.

The UTA study handled the question of the longevity of waterproofing systems in a very similar manner as chosen for this study. UTA's approach was to estimate that, at the same time interval for conventional roofing replacement, the earth shelter would also need some repair that would not require major removal of earth cover. The costs that UTA assigned each situation were $3000 for a conventional roof and $600 for an earth shelter (14). However, the house used in the UTA study was 50 percent larger than the house size used in this study. Most roofing companies base their price for roofing replacement solely on the total roof area. Therefore the costs from the UTA study should be reduced by correspondingly for the conventional home and also for the earth shelter. Raising the reduced costs by the Means building cost index results

in approximately $3575 for the conventional and $720 for the earth shelter. The cost for the conventional home seems in line with current costs for roofing replacement. The average roofing replacement schedule for roofing is about 15 years (14).

All of the non-annual costs must be escalated by either a general inflation rate or an escalation rate for each specific cost. Since no information is available as to what the specific escalation rates may be, the general economic inflation rate is used. Recently (1980), inflation has reached as high as 12 percent. Most international analysts are predicting a 5 percent inflation rate for the industrialized nations over the next five years (1984-1988), with the United States being somewhat higher at 5.7 percent (41).

CHAPTER VI

SENSITIVITY ANALYSIS

Purpose of Sensitivity Analysis

A sensitivity analysis is used in this study in order to identify those cost factors that have the greatest impact on the life cycle cost analysis (LCCA). The cost factors in this study that have been identified as the most likely to significantly alter the results of the LCCA are as follows: 1) purchase price of the homes; 2) financing ratio (loan-to-value ratio); 3) mortgage interest rate; 4) mortgage 'points'; 5) possible insurance reduction for earth shelters; 6) total energy costs; 7) exterior painting costs; 8) roofing maintenance, repair and replacement costs; 9) real estate appreciation rate; 10) general inflation; and 11) inflation of energy costs (which is studied separately from the general inflation rate).

In order to examine the effects of varying the previously mentioned factors, each factor was first assigned a baseline value. These baseline values were mostly derived from the actual cost values which are used in this study and are covered in Chapter V. The baseline values for purchase price are the only ones which do not match the values given in Chapter V. The reason for this was that there was a need to examine a wider range of purchase price differentials than those found in Chapter V.

Basically, the sensitivity analysis consists of varying each cost

value for each type of home (one at a time) by a magnitude which is reasonable and anticipated to be realistic. Next, an observation of the effect that varying each value has on the break-even period, as compared to the break-even period resulting from the base-line parameters, is made. For this study most of the baseline values that were varied were the values for the earth shelter, the reason being that most of the cost variables (such as purchase price of the home, energy costs, etc.) listed above are somewhat less certain for earth shelters than for conventional homes. Some variables (such as the interest rate, mortgage 'points', etc.) may change as the economy changes, and may also vary between housing types, therefore, both situations were studied. Variables such as inflation rate and energy cost escalation rate are functions of the economy and will always vary by the same magnitude for each type of home. The baseline values used for the sensitivity analysis are shown in Table X.

The procedure for performing each case of the sensitivity analysis is exactly the same as studying a case in an LCCA. The procedure is explained and an example is worked in Chapter IV. Since the sensitivity analysis procedure calls for varying only one cost factor at a time and leaving all other factors at their respective baseline values, it does not make any difference in what order the cost factor variables are examined. The cost variables are not examined in any order of importance here. A complete breakdown and summary of the annual totals and total-to-date costs for each case is given in Appendix D. Each particular case is identified by a case number specified when that case is being discussed. The reader may consult Appendix D for details of each particular case.

TABLE X

BASELINE VALUES FOR SENSITIVITY ANALYSIS

Cost Variable	Conventional	Earth Shelter	
First Cost	$ 85,000	$ 93,500	
Financing Ratio	90%	80%	
Mortgage Interest Rate	13.5%	13.5%	
Mortgage Points	1.5	2.0	
Annual Energy Cost	$ 1225	$ 950	
E/S Insurance Reduction	-	0	
Basic Closing Costs	361	361	
Exterior Painting	265	47	
Roof Repair/Replacement	3575	720	
HVAC Equipment Replacement	1120	450	
General Inflation			5.7%
Energy Cost Escalation: (not including general inflation)			5.7%
Real Estate Appreciation Rate			6%

Results of the Sensitivity Analysis

Baseline Case

The baseline values (case number 1) result in break-even occurring in the 15th year. At this point in the analysis a 15 year break-even period is not considered either good or bad, it is simply the break-even period resulting from the baseline values and is, therefore, the base by which all other results of the sensitivity analysis are judged.

First Cost

The first parameter to be tested for sensitivity was the first cost (or purchase price) of the home. By lowering the cost of the earth shelter from $93,500 (which is the often quoted 10 percent higher than

the cost for the conventional home) to the same ($85,000) as the conventional home (case number 2), the break-even period was reduced from 15 to 7 years, a very substantial reduction. When the cost of the earth shelter was increased to 20 percent higher than the conventional (or $102,000) (case number 3) the break-even period increased from 15 to 30 years, also a very substantial change. From this observation, the purchase price of the home appears to be a very powerful factor in determining the break-even period of the LCCA and could have a very significant effect on whether or not the earth shelter is economically better than the conventional home.

Financing Ratio

The second cost parameter examined was the variance of the financing ratio (the loan-to-value ratio). The financing ratio for the conventional home remained constant in this case, because it is very common for a homebuyer to receive 90 percent financing on a conventional home. The financing ratio for the earth shelter was varied, because earth shelters are not well established on the resale market and there is a greater chance for the financing ratio to vary. The results of this case were quite different than expected. When the financing ratio for the earth shelter was reduced to 70 percent (case number 4) from the base of 80 percent, the break-even period was reduced from 15 to 12 years. In this case the total upfront cost for the earth shelter was almost three times that of the conventional home, but the annual mortgage cost of the earth shelter was reduced by 12.5 percent, which made the difference.

The next case looked at increasing the financing ratio for the

earth shelter to 90 percent (case number 5), the same as for the conventional home. Increasing the financing ratio of the earth shelter to 90 percent pushed the break-even period all the way to the 30th year. This was not expected, since the upfront costs for the earth shelter were only slightly over $1000 more than for the conventional home. The reason for the substantially increased break-even period in this case is that the mortgage payment for the earth shelter was greater than for the conventional home. To explain this case, when the earth shelter has a higher purchase price than the conventional home, then the amount being financed for the earth shelter is greater. By financing a greater amount, the mortgage payment is higher and it takes much longer for the reduced operating costs to make up the difference. This particular situation (case number 5) is somewhat different when the first costs are the same. As the purchase price of the earth shelter approaches that of the conventional home, the undesirable effects of the 90 percent financing ratio are reduced.

Mortgage Interest Rate

The influence of varying the mortgage interest rates was examined by first lowering the interest rate for both homes to 12 percent, from 13.5 percent (case number 6). Lowering the interest rate the same amount for both homes slightly increased the break-even period, however it still occurred in the 15th year. The only difference was that mortgage payments for both homes were reduced proportionately. When the interest rate was raised to 18 percent for both homes (case number 7) the break-even period dropped slightly, to the end of the 14th year. Although this case did have a reduction in the break-even year, the

change was again only a few months. The total change of the break-even period for varying the mortgage interest rate from 12 to 18 percent was less than 12 months. Although the total change in the break-even period was very small, it was strange that the lower interest rate caused a longer break-even period and vice versa. No logical explanation could be found.

When the interest rate for the earth shelter was raised to two percent higher than the interest rate for the conventional home, 12 vs 14 and 18 vs 20 percent (case numbers 8 and 9, respectively), the break-even period increased all the way to the 30th year, assuming a sale of the homes at that time. This is very significant in that the interest rate for an earth shelter must be virtually the same as for the conventional home if the earth shelter is to compete with the conventional home. In this section the mortgage interest rate was examined only for one cost differential and one financing ratio. In the next chapter the LCCA will examine the mortgage interest rate more thoroughly, through varying cost differentials and financing ratios.

Mortgage Points

The fourth cost parameter to be examined was the mortgage points. Varying the points will affect the upfront costs which may affect the break-even period. In the first situation used to examine the sensitivity of the mortgage points, the points were held equal for both types of homes. In the first case the points were reduced to 1.0 for both types of homes (case number 10), the second case raised the points for both types of homes to 4.0 (case number 11). For both cases, holding the

points equal for both types of homes, whether the points are lowered or raised, has no affect on the break-even period.

A second situation, where the points are much higher for the earth shelter, was analyzed. The points for the conventional home were held at 1.5, while the points for the earth shelter were raised to 4.0 (case number 12). This case showed only a few months difference in the break-even period, the actual break-even year did not change. While increasing the points for the earth shelter do not substantially affect the break-even year, it does add a few thousand dollars to the upfront costs of the earth shelter. The reason that the break-even period does not show any significant change is the the annual costs of both homes are into the tens-of-thousands dollar range and after a few years the impact of paying 2 or 3 thousand dollars extra upfront is lessened. Although the break-even period is not significantly altered by increasing the points for the earth shelter only, the added upfront costs could have a substantial impact on whether a home buyer could afford the upfront costs.

Insurance Reduction

The next cost parameter to be examined was the possibility of an insurance reduction for the earth shelter. In the first case analyzed the insurance for the earth shelter was reduced by 10 percent (case number 13). A 10 percent reduction had a very small effect on the break-even period, the break-even period was reduced by only a few months, from the 15th year to very late in the 14th year. The second case was to apply a 25 percent discount to the insurance costs for the earth shelter (case number 14). This greater reduction had a larger impact on

the break-even period; however, it still did not cause a major shift. The break-even period was reduced by just more than a year from the 10 percent reduction, or to late in the 13th year.

The insurance cost reduction for the earth shelter does have an effect on the break-even period; however, it does not seem to have the magnitude of impact that one would expect, considering the attention that a possible insurance discount receives from strong earth shelter advocates. If all other conditions were such that the break-even period was very close to a desirable length, the insurance cost could possibly affect the decision to go with the earth shelter rather than the conventional, but the possible insurance reduction will not produce enough of an effect by itself if the other cost factors are not favorable to the earth shelter.

Energy Costs

The sixth cost parameter examined was energy costs. The only variation explored was a reduction of the base annual energy cost for the earth shelter from the high value of $950 given in Chapter V, to the lower value of $605 (case number 15). Reducing the annual energy cost for the earth shelter to this lower amount reduced the break-even period from 15 years, for the baseline cost parameters, to 10 years. The $605 value represents a cost which is 49 percent of the energy cost for the conventional home. This finding is notable, it shows that the energy savings afforded by an earth shelter are very important in the results of the LCCA.

Non-Annual Maintenance Costs

The next two cost parameters examined were non-annual maintenance costs. The first was the exterior painting cost. The exterior painting values were held constant for the conventional home and were varied from no cost for the earth shelter (case number 16), to $200 (case number 17) which represents an amount over four times greater than the baseline value. The results, which were as expected, for both of these cases were that the costs involved did not cause any substantial change in the break-even period. The reason for this is that the non-annual costs make up only a small portion of the cumulative annual costs and, therefore, varying them produces only small effects.

The second non-annual maintenance cost parameter examined was the roofing repair cost. This cost, like the exterior painting, was not expected to have a major impact on the break-even period. The two cases examined ranged from no roofing maintenance cost for the earth shelter (case number 18), to $2000 at the normal 15 year interval (case number 19). The results were just as expected, varying this parameter was not enough to alter the break-even period from the 15 years obtained from the baseline parameters.

General Economy Factors

The next three cost parameters examined were those which are not specific to a housing type, but rather vary due to variations in the general economy, alone. They are the real estate appreciation rate, general inflation, and energy cost escalation (which is considered separately from general inflation). The real estate appreciation rate was raised from 6 percent annually to 10 percent annually (case number 20).

Raising the real estate appreciation rate had no effect on the break-even period. The only change in the annual costs was the insurance costs, which are tied to the appreciation rate for home replacement value. Next, the general inflation rate was doubled from 5.7 percent to 11.4 percent (case number 21), a position it has held until recently. Raising the general inflation rate had a small impact on the break-even period, it was reduced by only a few months to the 14th year. The reason for this small impact is that the general operating and maintenance costs for the earth shelter are less than those for the conventional home. When the costs are escalated over time by the inflation rate, the lower costs for the earth shelter remain lower. Since the inflation rate has a compounding effect, the difference between the higher and lower costs becomes greater than if the costs are escalated linearly.

Lastly, the energy cost escalation was also raised from 5.7 percent to 11.4 percent (case number 22), a position that it has also held until recently (the energy escalation rate does not include the general inflation rate, they are completely independent from one another in this study). Raising the rate by which energy costs rise affects another important aspect of the desirability of earth shelters. Since earth shelters typically use less energy, the compounding effect of the energy cost escalation makes the difference between the cost for the earth shelter and the cost for the conventional home even greater. The impact on the break-even period was notable, the break-even period was reduced from 15 years to late in the 12th year. The energy cost escalation factor, tied to the overall energy cost factor, can make a very significant impact on the break-even period. Both the energy escalation and general inflation rates are examined in more detail in the LCCA.

Conclusions From Sensitivity Analysis

From the results of the sensitivity analysis, the most significant factors seem to be: 1) the difference in the purchase price of the two types of homes; 2) difference in energy costs between the two types of homes; 3) energy cost escalation rate; and 4) financing ratio. Any of these four costs can substantially affect the decision as to which type of house is economically preferred. Costs which had a noticeable effect on the break-even period, but by themselves probably could not substantially affect the decision as to which type of house is economically preferred, include; 1) insurance reduction for the earth shelter; and 2) general inflation. The remainder of the cost factors examined had very small impacts on the break-even period. These latter factors probably could not have any substantial impact on the economic decision, but could only offer a slight reward or penalty, depending on which type house is chosen. One factor, the mortgage interest rate, fell into two categories, depending on how it was varied. If the interest rate is the same for both types of homes, very little effect is seen regardless whether the rate goes up or down. However, if the rate is higher for the earth shelter, the break-even period quickly extends well beyond a length of time which would be favorable to the earth shelter, either with or without a higher purchase cost than the conventional home.

The factors which have shown an ability to significantly affect the LCCA are varied for actual study analysis in the next chapter. Those factors which have virtually no effect on the break-even period are only varied for purposes of examining the minimum and maximum break-even periods. At all other times they are held at the median levels described in Chapter V and shown in Table X in this chapter.

CHAPTER VII

LIFE CYCLE COST ANALYSIS

Analysis Approach

The basic approach taken in this chapter was to put the findings of the previous sensitivity analysis chapter to use, to find both practical expected payback periods and the minimum and maximum payback periods for the cost values described in Chapter V. Specific points addressed in this chapter include; 1) the minimum and maximum expected payback periods for the cost data found and used in this study; 2) how the payback periods compare with the average home tenure; 3) some typical payback periods; 4) desirable cost relations between the two types of homes; and 5) example cases that differ from the parameters set in Chapter V.

Minimum and Maximum Break-even Periods

The expected minimum and maximum break-even periods were found by setting all cost factors at their minimum and maximum expected extremes, respectively. The expected minimum was found by using the following parameters (also see Table XI): 1) the corresponding purchase prices for earth sheltered and conventional homes with the lowest comparative percentage differential in price (see Table VI, Chapter V); 2) all non-annual maintenance costs were taken to be zero for the earth shelter; 3) the energy costs were taken at the lower value (an annual base rate of

$605); 4) the energy escalation was taken to be the highest value (11.4 percent, twice the general inflation rate); and 5) a full 10 percent insurance reduction was applied to the earth shelter. In summary, all cost factors were taken to be those most favorable to the earth shelter. The minimum break-even period was found to be seven years. For a detailed printout of all life cycle costs for the minimum break-even period analysis, see Appendix E, case number "CASE NUMBER: MN".

TABLE XI

COST VALUES FOR MINIMUM BREAK-EVEN PERIOD

Cost Variable	Conventional	Earth Shelter	
First Cost	$ 94,960	$100,720	
Financing Ratio	90%	80%	
Mortgage Interest Rate	13.5%	13.5%	
Mortgage Points	1.5	2.0	
Annual Energy Cost	$ 1225	$ 605	
E/S Insurance Reduction	-	10%	
Basic Closing Costs	361	361	
Exterior Painting	265	0	
Roof Repair/Replacement	3575	0	
HVAC Equipment Replacement	1120	0	
General Inflation			5.7%
Energy Cost Escalation: (not including general inflation)			11.4%
Real Estate Appreciation Rate			6%

To find the maximum expected payback period, all costs were taken to be those least beneficial to the earth shelter (see Table XII). The parameters used were as follows: 1) the purchase prices of the homes

with the greatest percentage difference between the two types of homes were chosen; 2) no special insurance reduction for the earth shelter was assumed; 3) all non-annual maintenance costs for the earth shelter were taken to be more than twice as much as the base rate; 4) the energy cost, for the earth shelter, was the higher value covered in Chapter V (a $950 annual base rate); and 5) the energy escalation was chosen to be the same as general inflation (5.7 percent annually). For this case the payback period varied from 13 to 15 to 30 years by using financing ratios for the earth shelter of 70, 80, and 90 percent respectively.

TABLE XII

COST VALUES FOR MAXIMUM BREAK-EVEN PERIOD

Cost Variable	Conventional	Earth Shelter	
First Cost	$ 73,040	$ 81,200	
Financing Ratio	90%	varied	
Mortgage Interest Rate	13.5%	13.5%	
Mortgage Points	1.5	2.0	
Annual Energy Cost	$ 1225	$ 950	
E/S Insurance Reduction	-	0	
Basic Closing Costs	361	361	
Exterior Painting	265	125	
Roof Repair/Replacement	3575	1700	
HVAC Equipment Replacement	1120	850	
General Inflation			5.7%
Energy Cost Escalation: (not including general inflation)			5.7%
Real Estate Appreciation Rate			6%

Results of the LCCA

To perform the LCCA, the five cost factors which were found by the sensitivity analysis to have the greatest effect on the outcome on the life cycle cost analysis (LCCA) were varied and studied. Those variables were 1) the purchase price for each of the two types of homes; 2) energy costs for the two types of homes; 3) energy cost escalation rate; 4) financing ratio; and 5) insurance costs for both homes. An exception to varying only these five variables occurred when the minimum and maximum break-even periods were found. Another exception occurred when it was necessary to study other variables besides the five listed above in order to help show either the lack of significant effects or unusual effects by the other variables.

From observing the results of several cases in the LCCA, it was found that for the typical costs outlined in Chapter V, the percent difference of purchase price for the earth shelter over the conventional home was more accurate than the absolute difference between the two types of homes when to showing the effect of the cost differential on the break-even period. For example, it was found that when the homes were in the $70,000 range and the absolute differential was $5000, the results were quite different than when the homes were in the $100,000 range with the same absolute differential. However, it was found that when the homes were in the $70,000 range and the percent differential was, for example five percent, the results were the same as when the homes were in the $100,000 range and the percent differential was the same, five percent. To find the percent differential, the following equation (on the next page) is used:

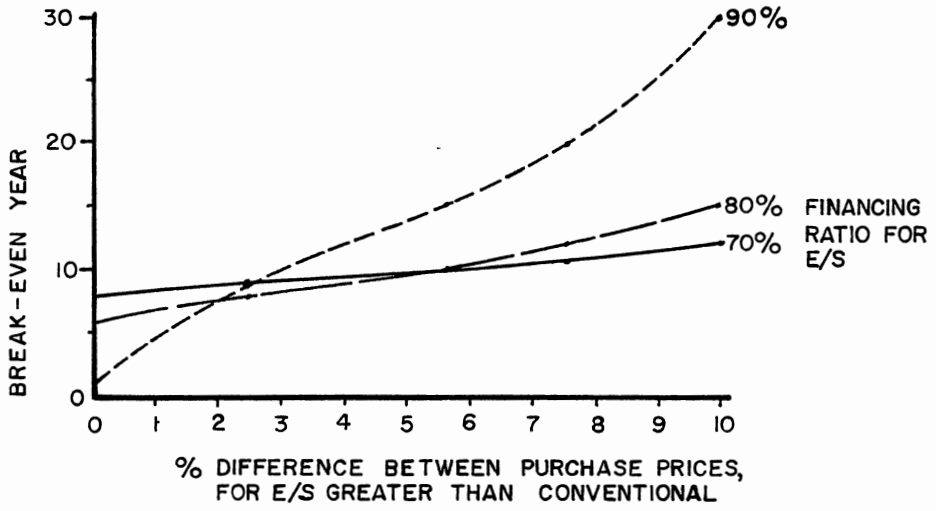
$$(1-(A/B)) \times 100 = \text{percent differential}$$

Where A = lowest purchase price
B = highest purchase price

To further explain the reasoning for using a percentage differential rather than an absolute differential, two examples are shown here. For the first example, take a situation where the conventional home has a purchase price of $70,000 and the earth shelter $77,000. The earth shelter costs 10 percent more than the conventional home and the absolute difference is $7000. For the second example, the conventional home costs $100,000 and the earth shelter costs $110,000. Again the earth shelter has a 10 percent higher purchase price than the conventional home, but in this case the absolute difference is $10,000 as opposed to $7000 in the previous case. For these two cases, each was examined using several different sets of fixed cost parameters. Other cases were also examined using the same sets of parameters. These other situations included cases where 1) the absolute differential was the same for both homes and the percent differential was different and 2) the percent differential was smaller than the 10 percent described above. The results were essentially the same for all cases studied, the percent differential in costs was a more accurate indicator of the break-even period than the absolute differential for the cost ranges used in this study. For this reason, the next several figures in this chapter (concerning how the break-even period varies with both the cost differential and another variable) all describe the cost differential as a percent differential as opposed to an absolute differential.

Factors with the Greatest Influence

The life cycle cost analysis demonstrated that the difference in purchase price of the homes was the most significant factor controlling the break-even period. No matter how the other costs were varied, the break-even period always increased as the percent difference of the purchase price of the earth shelter over the conventional home increased. The financing ratio was also found to be very important. In cases where the earth shelter had a financing ratio of 90 percent and the earth shelter's purchase price was more than about three percent higher than for the conventional home, the effects of the difference in purchase price were greatly magnified (see Figure 6).



All other variables are held at the base levels given in Table X, Chapter VI.

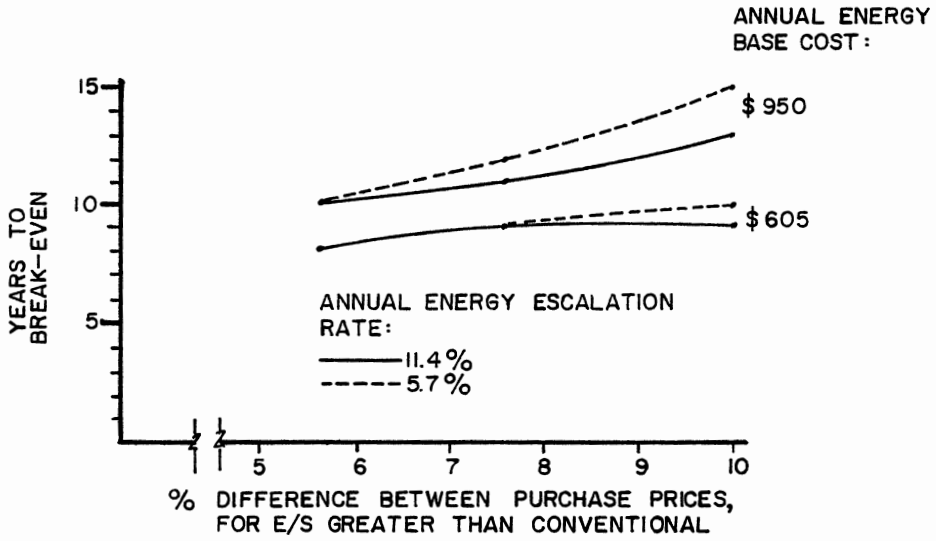
Figure 6. Effect of Financing Ratio and Purchase Cost differential on the Break-even Period

In this range (earth shelter purchase costs more than three percent higher than for the conventional home) the financing ratio was found to be more favorable (yielded a lower break-even period) to the earth shelter when it is either 70 or 80 percent, than when it is 90 percent. A drawback with using the lower ratio (70 percent) is that a prospective home buyer may not be able to afford the larger downpayment which results from the lower financing ratio, especially as the prices of both homes rise. As the percent cost differential between the two homes approaches zero, the 90 percent financing ratio increasingly becomes more favorable for the earth shelter than either the 70 or 80 percent ratio. All of the cases above assume a 90 percent financing ratio for the conventional home.

The third most significant factor was found to be the energy costs. As the percent difference in purchase price of the earth shelter over the conventional home increases, it becomes increasingly more important to achieve lower energy costs for the earth shelter in order for it to break-even in a timely manner (see Figure 7). When the percent difference in purchase price of the two types of homes is high the energy escalation rate is a close fourth behind the energy costs. The importance of the energy escalation rate drops somewhat as the percent difference in the purchase prices decreases (see Figure 7 for energy effects).

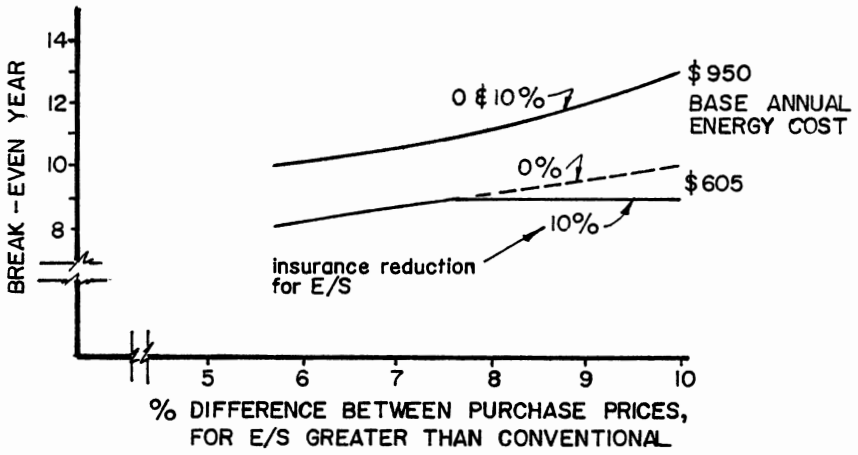
The reduction in insurance costs by 10 percent for the earth shelter was found to have little effect on the break-even period. In fact, noticeable changes in the break-even period, when the insurance reduction was applied, were observed only when both the cost differential of the earth shelter over the conventional home was the greatest and the annual energy cost for the earth shelter was at its lowest base value

(see Figure 8). In other words the insurance reduction has the most effect when 1) an earth shelter has an increasingly higher first cost compared to a conventional home and, therefore, a cost reduction in any annual cost will help; and 2) energy costs are low. To explain this second reason, when the energy costs for the earth shelter are at a higher level they are more powerful than most other factors in keeping the break-even period high. The energy costs become a dominant force in controlling the break-even period, which is evident from Figure 7. When the energy costs are lower their power to control the break-even period drops. This allows other annual costs to become more important in controlling the break-even period.



All other variables are held at the base levels given in Table X, Chapter VI.

Figure 7. Energy Cost and Energy Cost Escalation Effects on the Break-even Period



All other variables are held at the base levels given in Table X, Chapter VI.

Figure 8. Effects of an Insurance Reduction for the Earth Shelter on the Break-even Period

The results of varying the five most important factors are summarized in Table XIII. Although this table is somewhat difficult to read and understand, the reader should be able to see trends develop as each variable changes. The information contained in this table is the source of data used to develop Figures 7 and 8. The basic format of Table XIII is such that there are three main sections from left to right, the sections represent the lowest percent purchase price differential at the left to the highest at the right. Within each main section there are four categories from left to right (A to D) which are given in order of decreasing importance left to right. Following down the rows in each main section, the values in each category change systematically (the arrangement of values B, C, and D are the same in all three main sections across a row). As the more important categories change values, a difference in the break-even (payback) period can be observed.

TABLE XIII

SUMMARY OF LCCA CASE STUDIES

LOWEST COST DIFF.						MIDDLE COST DIFF.						HIGHEST COST DIFF.					
CASE NO.	CATEGORY A	B	C	D	PAY-BACK	CASE NO.	CATEGORY A	B	C	D	PAY-BACK	CASE NO.	CATEGORY A	B	C	D	PAY-BACK
1	1	0	1	1	8	9	2	0	1	1	9	17	3	0	1	1	9
2	1	0	0	1	8	10	2	0	0	1	9	18	3	0	0	1	10
3	1	0	1	0	8	11	2	0	1	0	9	19	3	0	1	0	10
4	1	0	0	0	9	12	2	0	0	0	10	20	3	0	0	0	10
5	1	1	1	1	10	13	2	1	1	1	11	21	3	1	1	1	13
6	1	1	0	1	10	14	2	1	0	1	12	22	3	1	0	1	15
7	1	1	1	0	10	15	2	1	1	0	11	23	3	1	1	0	13
8	1	1	0	0	10	16	2	1	0	0	12	24	3	1	0	0	15

For details of each case no. refer to the printouts in Appendix E.
NOTE: do not confuse these cases with those from Chapter VI.

KEY: Category A: purchase price differential: 1 = lowest
(see Table VI, Chapter V) 2 = middle
3 = highest

Category B: earth shelter base annual energy cost: 0 = $605
1 = $950

Category C: energy escalation rate: 0 = 5.7 annually
1 = 11.4 annually

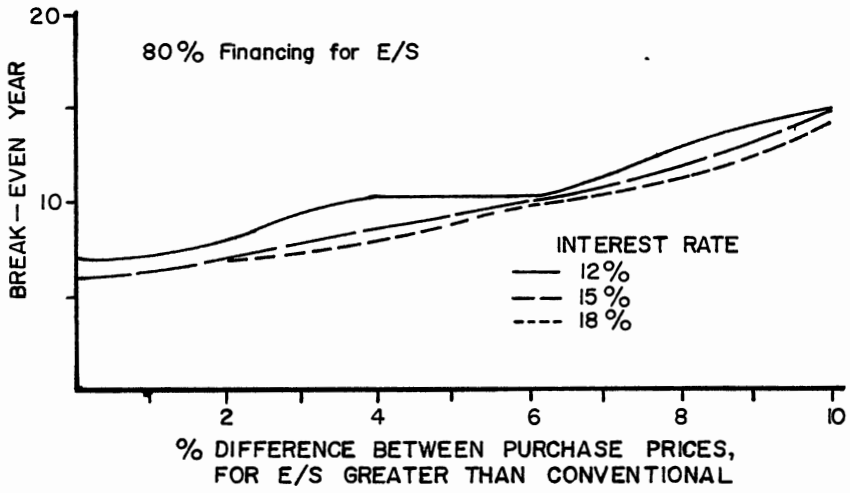
Category D: insurance reduction: 0 = no reduction
1 = 10 percent reduction

Factors with a Lesser Influence

In the last chapter, the results of the sensitivity analysis revealed that for the one price range and one financing ratio studied, the interest rate had little impact on the break-even period. In this section of the LCCA, the effect of varying the interest rate was evaluated by varying a range of interest rates through a wide range of percent

cost differentials and two financing ratios for the earth shelter. To examine these effects, the procedure used was like the one for the sensitivity analysis in that all variables not being studied were held at the base values given in Table X. The difference between this part of the study of the interest rates and the study done in the sensitivity analysis is that three variables, and their interactions, rather than one variable are being varied and studied. The results of this analysis were so strange that several of the cases were re-worked by hand in order to verify the computer program being used. The hand worked cases showed that there was no error in the computer program, the cases were in fact correct.

The interest rates used to examine the effect of varying the interest rate, were 12, 15, and 18 percent. The financing ratio for the conventional home was held at the 90 percent base for all cases and the financing ratio for the earth shelter was varied between 80 and 90 percent. The 80 percent financing ratio is shown in Figure 9 and the 90 percent ratio is shown in Figure 10. The graphs follow very irregular trends. Part of the odd fluctuations shown in the graphs is easily explained, while some of it is nearly impossible to explain. The 80 percent financing figure (Figure 9) shows a general upward slope of the curves from the lowest to highest percent cost differential (left to right). This is a reflection of the fact that as the purchase price of the earth shelter increases in relation the purchase price for the conventional home, the mortgage payments for the earth shelter increase and tend to negate the savings from lower energy and other reduced cost factors for the earth shelter.

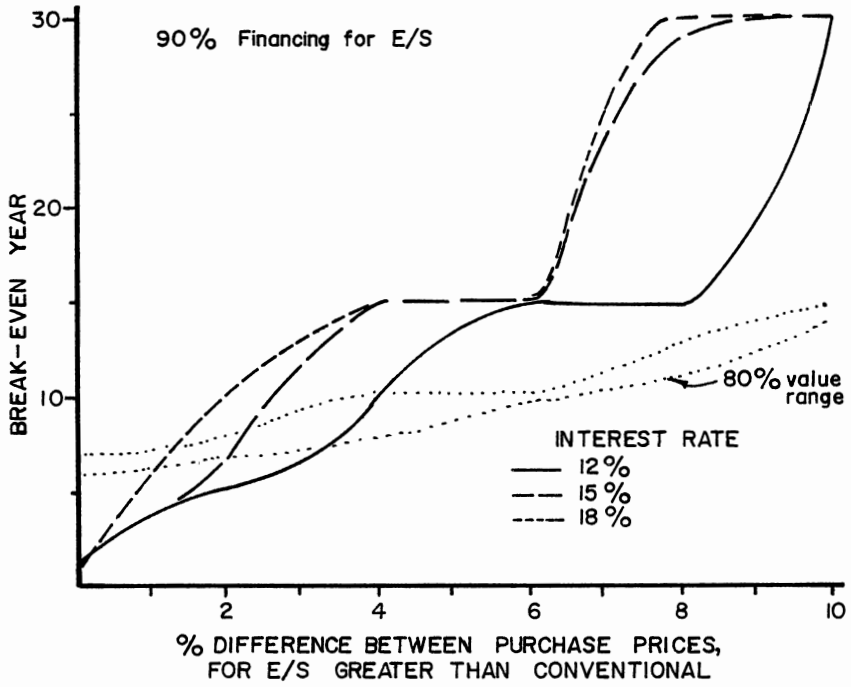


All other variables are held at the base levels given in Table X, Chapter VI.

Figure 9. Effect of Interest Rate and Purchase Cost Differential on the Break-even Period (part 1)

For 90 percent financing (Figure 10) the same reasoning for the trend toward an upward slope from left to right is also true. For 90 percent financing (for the earth shelter) this trend is amplified by the fact that with the greater percent financing, more money is being borrowed and financed than with 80 percent financing, which tends to greatly extend the break-even period. As the percent difference in purchase price drops toward zero, the performance of the 90 percent financing gets better than the 80 percent financing. This is because with the higher financing ratio at higher cost differentials the mortgage payment for the earth shelter is greater than for the conventional home. The higher mortgage payment takes away some or all of the cost saving advantages of the earth shelter. As the percent purchase price differential drops toward zero the difference in mortgage payments also drops until

the mortgage payments of the earth shelter are equal to or less than those for the conventional home. At this time the cost saving aspects of the earth shelter begin having a greater influence on the break-even period than the mortgage costs and the savings force the break-even period downward.



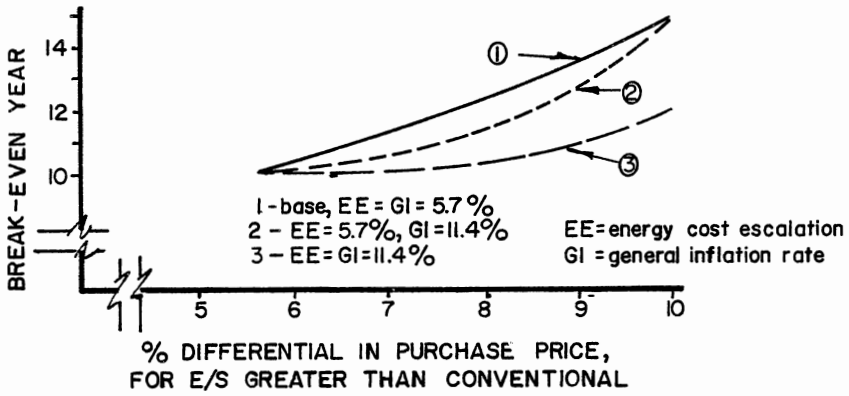
All other variables are held at the base levels given in Table X, Chapter VI.

Figure 10. Effect of Interest Rate and Purchase Cost Differential on the Break-even Period (part 2)

An aspect which cannot be explained is why the 18 percent interest rate is slightly better (leads to a shorter break-even period) for the

80 percent financing than the lower interest rates and the opposite is true for 90 percent financing. One would expect that for any case, if one interest rate were better than the others, it would be a lower rate. Another aspect for which there is no explanation is that the curves do not follow smooth and logical trends, but rather they tend to vary widely at some points and are nearly equal in others. The curves also have more than one inflection point (change in direction). Both aspects are especially true for the 90 percent financing graph. Such irregular and unpredictable trends tend to make predicting a general case, with any accuracy at all, virtually impossible. Only the 80 and 90 percent financing ratios were studied, by no means were all possible cases examined, from Figure 6 it is also evident that the 70 percent financing ratio becomes the least desirable for optimum break-even period as the percent cost differential approaches zero.

Another cost factor which was found in the sensitivity analysis to have little effect on the break-even period was the general inflation rate. The general inflation rate was checked through a wider range of conditions here in the LCCA. Two cases were examined. In the first case, the general inflation rate was raised to twice its predicted value of 5.7 percent annually (see Chapter V), or to 11.4 percent, while the energy cost escalation rate was held to 5.7 percent annually. In the second case the energy cost escalation rate was also raised to 11.4 percent annually. The results of both of these cases, along with a base case where all values are held to the values shown in Table X, are shown in Figure 11.



All other variables are held at the base levels given in Table X, Chapter VI.

Figure 11. Effect of General Inflation Rate and Energy Cost Escalation Rate on the Break-even Period

Average Home Tenure

The average home tenure (AHT) is the the length of time that the average homeowner lives in one home before moving to another. This value varies due to a large number of factors, mostly economic. In Oklahoma the range has historically been from 5 to 10 years. With Oklahoma's fluctuating population in recent years, the AHT has dropped slightly. Part of this is due to the oil boom and bust and corresponding trend of people migrating into and out of the state. The most recent reports show the AHT to be in the range of 6 to 8 years (32). For this part of the study a value of eight years was chosen in order to reflect the likely trend of the AHT increasing back to its historic value due to a somewhat more stable economy.

As covered in Chapter III, the method used to find whether the earth shelter home would pay back its higher initial investment within

the AHT is to sum all cumulative costs up to the AHT year. Next the estimated value of each home at the AHT year, less the remaining loan principal (assuming no prepayment penalty), is subtracted from the cumulative costs for each home. The estimated value of the home represents the future sale price of the home. For the cases studied in the LCCA, only the practical minimum case achieved break-even before the AHT year. However, all achieved break-even upon the sale of the home at the AHT year. This is due in part to the fact that the earth shelter typically had a higher initial purchase price than the conventional home. When the higher initial price for the earth shelter is compounded by the real estate appreciation rate, the market value of the earth shelter becomes increasingly higher than the conventional home.

A drawback to this increasingly higher market value is that if the demand for earth shelter homes does not grow at a fast enough rate (no information is available as to what the rate must be), the market value for the earth shelter may be higher than a homeowner could realistically expect to obtain by selling the home. This would mean that the "actual" value of the home is in fact less than (maybe even much less) what is projected here and the result would be that the earth shelter may not break-even after the sale of the home in the AHT year. If the opposite is true, that is the demand for earth shelter homes grows at a higher rate than necessary for the value of the homes to keep even with the real estate appreciation rate, earth shelters will be undervalued and the homeowner could expect to obtain more for his home. At this point it is impossible to predict which case will be true. If earth shelters do appreciate at the rate used in this study (6 percent annually for the first 10 years) and the other cost parameters, especially the percent

first cost differentials, hold true, it could in fact be economical for a family planning to only live in a home for the AHT period (approximately eight years) to purchase an earth shelter which would be predicted to not break-even until after the AHT year.

Desirable Break-even Periods

One of the goals set forth for this study was to find if the earth shelter achieved break-even early enough in its life cycle such as to be more desirable to a home owner than a conventional home. Of course the answer to this question must be tempered by the subjective factors covered in Chapter III. There is not a single definitive answer to this question, but rather the answer depends upon what the prospective home buyer is looking for.

If the prospective home buyer is looking for a prime investment, one which will pay off in a very short number of years, (probably less than three years) then the earth shelter option, when considering the cost factors found in this study to be average, would not be a good choice. If the prospective home buyer is an average home buyer and will be in the home approximately the AHT number of years (8), then by economics alone the earth shelter could very well be a good choice, assuming of course the prospective home buyer had also considered the subjective factors to be favorable to the earth shelter. Of course it would be essential to fully analyze the decision by taking the individual's own personal tax position into consideration, and also considering the long term capital gains tax upon the sale of the home, as well as local property taxes. Since these taxes vary widely from person to

person and area to area, it was decided that it would not be practical to include them in the study.

If the prospective home buyer is very interested in earth shelters and is planning to own the home for much longer than the AHT, possibly the rest of his life, then the earth shelter option should be considered. In a case such as this, the earth shelter would not have to be capable of breaking even in the first few years. The important point here is that if the earth shelter does not break-even in a relatively short time period (the earth shelter must, however, break-even in a length of time which is reasonable to the home buyer) the home buyer must be willing and able to; 1) spend the higher amount of money required for the upfront costs, 2) forego possible short term earnings on the additional upfront money, and 3) wait several years before he is paid back by cost savings from the lower operating costs. The two main concerns in a case such as this are that the mortgage payment for the earth shelter must be nearly equal, or less than, the one for the conventional home and the earth shelter must be well built so that the maintenance costs and energy costs will likely be considerably less than those for the conventional home.

Desirable Cost Relations

An effort has been made to obtain costs, for use in this study, which are average costs for earth shelters and conventional homes. However, for any specific case the cost values will likely vary somewhat. For this reason some desirable cost relations are presented here so that a prospective home buyer will know what to look for when considering an earth shelter.

The first concern should be the purchase price of both homes. If the purchase price of the earth shelter is more than 10 or 12 percent higher than the conventional home the chances of the earth shelter paying off decrease rapidly. Cases where the purchase price of the earth shelter is more than 10 to 12 percent higher than the conventional home can pay off if all other costs are very beneficial to the earth shelter, but the break-even period becomes very long and would be undesirable to most people. If the purchase price of the earth shelter is in the range of 3 to 10 percent higher than the conventional home then a financing ratio of 70 or 80 percent is the most desirable, which should be no problem since 90 percent financing is usually not available for an earth shelter. As an earth shelter approaches the same price as a conventional home, the home buyer has a choice of trying to receive 90 percent financing and paying nearly the same upfront and very little more for the mortgage payments than for the conventional home; or taking a lower financing ratio and paying more upfront but with lower mortgage payments for the next 30 years.

Since 90 percent financing for the earth shelter will probably not even be available, the interest rate makes little difference. However, the interest rate must be the same for both homes (unless it is lower for the earth shelter, which would be much better). The mortgage points also do not make much difference as to how the two homes compare. However, if the mortgage points are more for the earth shelter than the conventional home it means that even more must be paid upfront for the earth shelter, and this may eliminate some prospective home buyers who cannot afford the higher upfront costs.

The earth shelter must be capable of achieving an energy savings

over the conventional home. The larger the energy savings the shorter the break-even period will be (and the bank account will also be better off). A question which might arise here is "don't earth shelters automatically have better energy performance than conventional homes?" The answer is no. While most earth shelters do achieve much better energy performance than conventional homes, an earth shelter which is either poorly built or was built by an unknowledgeable builder can use more energy than a comparable well built conventional home. In most situations this problem will not arise, however, an earth sheltered home should be designed and built by reputable architects, engineers, and contractors.

If an insurance reduction is available for the earth shelter, then take it, providing that a lower priced policy does not leave out any important coverage. If a reduction is not available, there should not be a major impact on the break-even period. Even though fire is less of a possibility in an earth shelter, it can still happen very easily and although the structure of the home may not be damaged, the furnishings and belongings may be completely destroyed. Personal liability insurance becomes more important in an earth shelter due to the reasons given in the subjective factors section.

If the earth sheltered home is well built and cared for the non-annual maintenance and replacement costs should fall into place and be no more costly than for a conventional home, and quite possibly most of them will be somewhat less.

The home buyer cannot control the inflation costs. If either the energy escalation rate or the general inflation rate are going to go up the earth shelter will be slightly better off than the conventional

home. However, this advantage is not enough on which to base the decision of which type of home to buy.

If the home buyer is not planning to own the earth shelter for an extended period and there is a possibility that the demand for earth shelters is not going to grow, there is a possibility that the appreciation rate for earth shelters will not be the same as for other real property. In this case careful consideration should be given to the decision as to which home to buy. If the homeowner sells before the earth shelter's break-even period and the demand for earth shelters is low, the homeowner may end up losing money on the deal because the earth shelter did not pay off.

Example Case Studies

The reader may find that for his specific case some of the "typical" cost factors set forth in Chapter V may not match the values for his specific circumstances. Five example case studies are covered here to show how cost values could realistically differ from the "typical" values found for this study. Also, some cost parameters are varied in a manner which may not be totally realistic, but which reflects the feelings of some people. The cost parameters for each case are presented here in the text, however, detailed printouts of all cost factors studied for the 30 year planning horizon for both types of homes are presented in Appendix F.

Case Number 1

A prospective homebuyer has found an earth shelter which will only cost five percent more than a conventional home. He feels that he

can receive a much larger insurance reduction than the 10 percent used in this study and he feels that the energy costs for the earth shelter will only be about one-third of those for the conventional home (see Table XIV for all cost factors). This prospective homebuyer has some viewpoints, on where inflation and energy cost escalation rates, that differ from those presented in this study. Also the prospective homebuyer feels that the earth shelter he is considering will have no painting or roofing expense. While these values, do not match the "typical" values used in this study, they are values which could be encountered. The resultant break-even period for this example case is six years, which is of course slightly shorter than the minimum break-even period found using the costs in Chapter V. For the detailed printout for this example see Appendix F.

TABLE XIV

COST VALUES FOR EXAMPLE CASE NUMBER ONE

Cost Variable	Conventional	Earth Shelter	
First Cost	$ 80,000	$ 84,000	
Financing Ratio	90%	80%	
Mortgage Interest Rate	13.5%	13.5%	
Mortgage Points	1.5	2.0	
Annual Energy Cost	$ 1200	$ 400	
E/S Insurance Reduction	-	25%	
Basic Closing Costs	361	361	
Exterior Painting	200	0	
Roof Repair/Replacement	3500	0	
HVAC Equipment Replacement	1000	750	
General Inflation			6.0%
Energy Cost Escalation: (not including general inflation)			14.0%
Real Estate Appreciation Rate			6%

Case Number 2

For the second case study, the earth shelter costs 12 percent more than the conventional home. Many of the non-annual maintenance costs for the earth shelter are nearly the same as for the conventional home. However, the energy cost for the earth shelter is only 45 percent of that for the conventional home (see Table XV for all cost parameters for this example). Besides the much higher purchase price for the earth shelter, this prospective homebuyer feels that the non-annual maintenance costs for the earth shelter are going to be close to those for the conventional home. This prospective homebuyer also feels that rate of increase in energy costs has peaked and they will increase at a rate lower than general inflation for a while. For this example the break-even period is 14 years. The home also broke even by the AHT year. Although this particular case is not the most desirable a home buyer could hope for, the earth shelter does pay for its higher initial cost and would deserve a prospective home buyers' consideration.

Case Number 3

The third case is much simpler than the first two. In this example the prospective home buyer will do some of the work of one of the subcontractors if he chooses the earth shelter and he expects that the two types of homes should compare equally in first cost (see Table XVI for all cost parameters). Although the two homes have equal first costs, the financing rate for the earth shelter is still 80 percent, which means a higher downpayment, but that the earth shelter has lower mortgage payments. The break-even period for this case is six years. See Appendix F for detailed costs over the planning horizon for this case.

TABLE XV

COST VALUES FOR EXAMPLE CASE NUMBER TWO

Cost Variable	Conventional	Earth Shelter	
First Cost	$ 90,000	$100,800	
Financing Ratio	90%	80%	
Mortgage Interest Rate	13.5%	13.5%	
Mortgage Points	1.5	2.0	
Annual Energy Cost	$ 1000	$ 450	
E/S Insurance Reduction	-	15%	
Basic Closing Costs	361	361	
Exterior Painting	600	400	
Roof Repair/Replacement	4000	3000	
HVAC Equipment Replacement	1200	1000	
General Inflation			5.7%
Energy Cost Escalation: (not including general inflation)			5.0%
Real Estate Appreciation Rate			6%

TABLE XVI

COST VALUES FOR EXAMPLE CASE NUMBER THREE

Cost Variable	Conventional	Earth Shelter	
First Cost	$ 85,000	$ 85,000	
Financing Ratio	90%	80%	
Mortgage Interest Rate	13.5%	13.5%	
Mortgage Points	1.5	2.0	
Annual Energy Cost	$ 1225	$ 605	
E/S Insurance Reduction	-	0	
Basic Closing Costs	361	361	
Exterior Painting	265	47	
Roof Repair/Replacement	3575	720	
HVAC Equipment Replacement	1120	450	
General Inflation			5.7%
Energy Cost Escalation: (not including general inflation)			5.7%
Real Estate Appreciation Rate			6%

Case Number 4

For the fourth example assume that money is getting tight and, therefore, interest rates are rising. The prospective homebuyer decides that if he chooses the earth shelter he will put a lot of free labor into it to help reduce the first cost. Many of the other costs for the earth shelter are projected to be much lower than for the conventional home (see Table XVII for all cost parameters). The break-even period for this example is three years. An interesting note about this case is that if 90 percent financing was available for the earth shelter the break-even period would be immediate, but the annual mortgage payments would be $1200 more than with 80 percent financing.

TABLE XVII

COST VALUES FOR EXAMPLE CASE NUMBER FOUR

Cost Variable	Conventional	Earth Shelter	
First Cost	$ 85,000	$ 80,000	
Financing Ratio	90%	80%	
Mortgage Interest Rate	15.0%	15.0%	
Mortgage Points	1.5	3.0	
Annual Energy Cost	$ 1225	$ 200	
E/S Insurance Reduction	-	25%	
Basic Closing Costs	361	361	
Exterior Painting	265	0	
Roof Repair/Replacement	3575	300	
HVAC Equipment Replacement	1120	450	
General Inflation			12.0%
Energy Cost Escalation: (not including general inflation)			12.0%
Real Estate Appreciation Rate			6%

Case Number 5

For the fifth case the home buyer has decided that he really wants an earth shelter and will act as general contractor to substantially reduce the first cost of the home. He also feels that his energy costs will only be about 12 percent of what they would be with a conventional home. He is planning to not have any exterior surfaces that require painting on the earth shelter and he does not expect to ever have to repair the waterproofing system (see Table XVIII for all cost parameters). The break-even period for this example is the lowest yet at two years, however, it would also break-even immediately if 90 percent financing was obtained for the earth shelter.

TABLE XVIII

COST VALUES FOR EXAMPLE CASE NUMBER FIVE

Cost Variable	Conventional	Earth Shelter	
First Cost	$ 85,000	$ 75,000	
Financing Ratio	90%	80%	
Mortgage Interest Rate	14.0%	14.0%	
Mortgage Points	1.5	3.0	
Annual Energy Cost	$ 1225	$ 150	
E/S Insurance Reduction	-	25%	
Basic Closing Costs	361	361	
Exterior Painting	265	0	
Roof Repair/Replacement	3575	0	
HVAC Equipment Replacement	1120	450	
General Inflation			10.0%
Energy Cost Escalation: (not including general inflation)			10.0%
Real Estate Appreciation Rate			6%

While the costs in this example may be possible, it would require input in the building phase of the home that most home buyers are not qualified to perform. It would also probably require much personal sacrifice in order to get the energy costs as low as 12 percent of the conventional home costs. Also, if a homebuyer was to analyze the two homes assuming a large input of personal labor, then both homes should be assumed to receive that input or the results will be skewed.

For special cases which do not fall into the parameters outlined and studied in this thesis, the reader will need to analyze each specific case individually. A case may be analyzed by using the procedure covered in Chapter IV (the example also given in Chapter IV should be of assistance). A simple shortcut method of predicting the break-even period for any case was not developed. The primary reason being that with the large number of potentially different variables possible (28 were identified for this study) and the number of these variables which have a substantial impact on the break-even period (11 were identified), it was felt that a shortcut method would have little accuracy and could in fact be quite misleading. Another important reason that a shortcut method was not developed is the strange effects that some variables had on the break-even period were not predictable. Also the effect that some of the variables had on the break-even period was sometimes linked to how another variable changed. Overall it was decided that a shortcut method would be inaccurate and, therefore, misleading.

Advantages and Disadvantages of the Break-even Period Type of LCCA

There are several types of LCCA such as equivalent first cost, equivalent future cost, equivalent equal annual cost, years to

break-even, etc. The years to break-even type of analysis was chosen for two primary reasons. One reason is that two different planning horizons were considered in this study and a break-even type of analysis was better suited to handle both planning horizons with the least change in procedure. Another reason that a break-even type of analysis was chosen was for the readers' benefit. For a reader who wishes to analyze a special case for his own use, the procedure for a break-even type of analysis is by far simpler than the other types of LCCA. Advantages of the break-even type of analysis are that; 1) it is easy to understand and use; and 2) it is well suited to the requirements of the study.

A disadvantage of the break-even type of analysis is that it does not clearly suggest what happens after the break-even year if the analysis is not continued past that year. Since this type of analysis is relatively simple to use a person could easily continue the analysis past the break-even year to the end of the planning horizon, assuming of course that there was a break-even before the end of the planning horizon. A general observation about this aspect is that in the cases studied for this thesis, the earlier the earth shelter broke even, the lower its total cumulative cost relative to the conventional home was in the 30th year.

CHAPTER VIII

CONCLUSIONS AND RECOMMENDATIONS

Summary of Procedure

The first step in performing this study was to identify the cost values that would be required in order to complete the study. This step included separating relevant from non-relevant cost factors. The next step, following the identification of the relevant cost factors, was the difficult task of determining average values for the relevant cost factors. This was done by three methods: 1) a literature search of recent journals, etc.; 2) personal contact with professionals in the fields in which the cost factors fell; and 3) non-personal contact, via a mailed questionnaire, with a wider number of professionals in the area of housing design and construction.

After values for all cost factors were compiled, a sensitivity analysis was performed to determine which of the cost factors had the most influence on the break-even period. The most influential cost factors found by the sensitivity analysis were studied in more detail in the life cycle cost analysis (LCCA). Some of the cost factors with a lesser influence on the break-even period were also studied in more detail in the LCCA. From the LCCA the most influential factors were ranked according to their individual influence on the break-even period. The LCCA was also used to find realistic minimum and maximum break-even periods from the "average" cost values found in the study, as well as

required cost relations between earth shelters and conventional homes in order for earth shelters to be economically competitive.

Conclusions

The sensitivity analysis revealed that the following cost factors (ranked in no particular order) were the most influential factors of those identified and evaluated in this study: 1) percent differential between purchase prices; 2) mortgage financing ratio; 3) energy costs for the two types of homes; and 4) the energy cost escalation rate (inflation rate of energy costs). The next factors had some influence on the break-even period but the influence was substantially less than that for the factors above: 1) possible insurance reduction for the earth shelter and 2) the general economy inflation rate. The effect from all other factors studied in the sensitivity analysis was very small and, in many instances, negligible.

The LCCA expanded on the results of the sensitivity analysis and ranked the factors in order of importance. The most important cost factors, in order of decreasing importance, are as follows: 1) percent differential between the purchase prices of the homes; 2) the financing ratio for the two types of homes; 3) energy costs for the two types of homes; 4) energy cost escalation rate; 5) possible insurance reduction for the earth shelter; and 6) general economy inflation rate. The amount by which each factor is less influential on the break-even period than the factor immediately before it is not constant.

The LCCA revealed that the minimum expected break-even period with the average cost factors used in this study was seven years. The maximum period could be as long as being dependent upon the sale of the home

at the 30th year, or as short as the 13th year, depending on which financing ratio was chosen for the earth shelter. By using realistic factors that differ from the average ones used here, it was found that the earth shelter could break-even immediately on the purchase of the home. However, such cases would normally require substantial labor and/or materials input from the home buyer that are not considered in the cost of the earth shelter. Also these materials or labor would normally have to be available only to the earth shelter and not to the conventional home. Such cases would definitely have to be classified as "exceptions to the rule".

It was found that for a person looking for a prime investment, one which would pay off in a short period of time (probably less than three years), an earth shelter, assuming the cost factors used in this study, would not be a good choice. If a person was looking for a home for the average home tenure period (currently approximately eight years) and was considering the possibility of an earth shelter, the earth shelter could be better economically than a conventional home. Of course, a full analysis of the prospective homebuyer's tax position and specific cost situation would be required to make a final statement about the economics of the possibility. If a person was considering earth sheltering and was planning to live in the home for a very long period of time (much longer than the AHT) the earth shelter would, under most circumstances, be more economical for him. Of course any decision would have to be carefully analyzed economically.

The Oak Ridge study and others found that earth shelters were not competitive with conventional homes. These other studies blamed the poor performance of earth shelters on their findings; 1) that earth

shelters cost as much 50 percent more than comparable conventional homes and 2) high interest rates. From the findings of this study, it is believed that an earth shelter does not typically cost anywhere near 50 percent more than comparable conventional homes. In fact, some builders are boasting that they can actually build an earth shelter for slightly less than a comparable conventional home. The problem with such homes is that they are usually extremely modular and are sometimes not aesthetically pleasing. In fact, to some people, this type of earth shelters may confirm their worst fears about how living in an earth shelter could be. Of course not all of these "modular" earth shelters are of a bad design, construction, or displeasing, but they tend to be the same to earth shelters as tract homes are to conventional housing - you get what you pay for. The building costs of earth shelters here in Oklahoma may never be equal to those for conventional homes due to high clay content of the soils, requiring special structural and backfill considerations. However, the costs found in this study show that the gap is closing and the costs are becoming comparable.

The findings of the LCCA in this study revealed that even though the effects of the mortgage interest rate were mostly unpredictable, high interest rates could not be solely blamed for the poor performance of earth shelters in other studies. In fact, for the cost values used in this study, when realistic financing ratios of 80 percent for the earth shelter and 90 percent for the conventional home were used, higher interest rates were slightly more favorable to earth shelters than lower interest rates. Of course, no matter how much money is saved on operating costs, high interest rates could make any higher cost home impossible for a homeowner to afford.

Overall conclusion - earth shelters can under many circumstances be more economical than a comparable conventional home. However, each case must be carefully analyzed before a decision is made.

Recommendations

This study did not include superinsulated or double envelope designs in the comparisons. These variations of energy conserving conventional homes are nearly identical in appearance to conventional homes. Their energy performance is reputedly much better than that of a conventional home, but their other operating and maintenance costs would be nearly identical to a comparable conventional home. It would be very useful for a study to be done that also compared these variations on conventional homes to standard conventional homes, as well as energy saving homes such as earth shelters and passive solar homes.

The study from which the energy consumption information used in this study was obtained recommended that further study be done in the area of finding average energy consumption for both earth shelters and conventional homes. For an LCCA, most of the cost data used will be estimated. For this reason, better and simpler energy consumption estimation procedures would noticeably improve the accuracy of an LCCA.

SELECTED BIBLIOGRAPHY

(1) Department of Energy, Energy Information Administration: Report to Congress, (1980).

(2) McGuinness, William J., Benjamin Stein, and John S. Reynolds. Mechanical and Electrical Equipment for Buildings: Sixth Ed. New York: John Wiley and Sons (1980).

(3) Underground Space Center. Earth Sheltered Homes: Plans and Designs. University of Minnesota. New York: Van Nostrand Reinhold Company (1981).

(4) Vadnais, Kathleen. "Multi-Unit Survival Community Marketed." Earth Shelter Digest & Energy Report. No. 16 (July/August), (1981), pp. 4-7.

(5) Rivers, W. Joel, William D. Warde, and Bob Helm. "A Comparison of Assessments By Above Ground and Earth Shelter Occupants." Earth Shelter Performance and Evaluation Proceedings. L. L. Boyer (ed.), Stillwater, Oklahoma: Oklahoma State University (1981), pp. 245-257.

(6) Boyer, Lester L. "Earth Shelter Trends in the South Central Plains." The Potential of Earth Sheltered and Underground Space: Proceedings. T. L. Holthusen (ed.), New York: Pergamon Press (1981), pp. 135-148.

(7) Bice, Thomas N. "Energy Analysis of Earth Sheltered Dwellings." (Master's Thesis in Architectural Engineering, Oklahoma State University, 1978).

(8) Shapira, Hanna B., George A. Cristy, Steve E. Brite, and Michael B. Yost. "Cost and Energy Comparison Study of Above- and Below-Ground Dwellings." Underground Space, Vol. 7, No. 6, (1983), pp. 362-371.

(9) Wendt, Robert L. "The Energy Conservation Potential of Earth-Sheltered Housing." Underground Space, Vol. 7, No. 6, (1983), pp. 372-380.

(10) Patterson, Walt. "The High Cost of Saving Energy." Alternatives in Habitat: The Use of Earth Covered Settlements Proceedings. F. L. Moreland (ed.), Fort Worth, Texas: University of Texas at Arlington (1978), Report for Department of Energy, pp. 42-43.

(11) "Study Shows Lower Energy and Construction Costs From Earth Sheltering." Underground Space, Vol. 5, No. 4, (1981), pp. 197-198.

(12) Wells, Malcolm. Underground Designs. Cherry Hill, New Jersey, now at Box 1149, Brewster, Massachusetts 02631, (1977).

(13) Underground Space Center. Cost and Code Study of Underground Buildings. University of Minnesota. Washington, D. C.: U. S. Department of Housing and Urban Development (1978).

(14) McWilliams, Donald B. and Stephen M. Findley. "A Life Cycle Cost Comparison between a Conventional and Earth Covered Home." Alternatives in Habitat: The Use of Earth Covered Settlements Proceedings. F. L. Moreland (ed.), Fort Worth, Texas: University of Texas at Arlington (1978), Report for Department of Energy, pp. 94-107.

(15) Fraker, Harrison and Lawrence Lindsey. "Energy Design Aids." Progressive Architecture, Vol. 63, No. 4, (April) (1982), pp. 116-121.

(16) Olgyay, Victor. Design With Climate: A Bio-Climatic Approach to Architectural Regionalism. Princeton, New Jersey: Princeton University Press, (1967).

(17) Dell'Isola, Alphonse J. and Stephen J. Kirk. Life Cycle Costing For Design Professionals. New York: McGraw-Hill Book Company (1981).

(18) Grondzik, Walter T., Lester L. Boyer, and John W. Zang. "Analysis of Utility Billings for 55 Earth Sheltered Projects." Earth Shelter Performance and Evaluation Proceedings. L. L. Boyer (ed.), Stillwater, Oklahoma: Oklahoma State University (1981), pp. 177-184.

(19) Behr, Richard A. "Life Cycle Cost Performance of Flat Site Earth Sheltered Design." Earth Shelter Performance and Evaluation: Proceedings. L. L. Boyer (ed.), Stillwater, Oklahoma: Oklahoma State University (1981), pp. 287-296.

(20) Emery, Ashley F., Dean R. Heerwagen, Brian R. Johnson, and Charles J. Kippenhan. "Conventional Versus Earth-Sheltered Housing: A Comparative Study of Construction and Operation Costs For Three Cities." Earth Shelter Performance and Evaluation Proceedings. L. L. Boyer (ed.), Stillwater, Oklahoma: Oklahoma State University (1981), pp. 165-174.

(21) Isakson, Hans R. "Institutional Constraints On The Marketing And Financing Of Earth Covered Settlements." Alternatives in Habitat: The Use of Earth Covered Settlements Proceedings. F. L. Moreland (ed.), Fort Worth, Texas: University of Texas at Arlington (1978), Report for Department of Energy, pp. 7-11.

(22) Smith, Shelby. "Comments On The Finance Of Earth Covered Dwellings." Alternatives in Habitat: The Use of Earth Covered Settlements Proceedings. F. L. Moreland (ed.), Fort Worth, Texas: University of Texas at Arlington (1978), Report for Department of Energy, pp. 54-70.

(23) Haviland, David S. Life Cycle Cost Analysis 2: Using it in Practice. Washington, D. C.: American Institute of Architects (1978).

(24) Life Cycle Cost Analysis: A Guide for Architects. Washington, D. C.: American Institute of Architects (1977).

(25) Oswald, Richard. "Tight House Can Seal in Pollution." Earth Shelter Living. No. 27 (May/June), (1983), pp. 36-37.

(26) Smolen, Marguerite. "Radon Remedies." Rodale's New Shelter. Vol. 5, No. 5, (May/June), (1984), pp. 28-32.

(27) Earth Sheltered Structures Fact Sheet 08: Indoor Air Quality. Washington, D.C.: by Center For Natural Energy Design, Oklahoma State University, for U.S. Department of Energy, (1981).

(28) Lowing, Arnold N. "Earthquakes." Earth Shelter Living. Three Parts: No. 23, (September/October), (1982), pp. 13-14; No. 24, (November/December), (1982), pp. 23-24; No. 25, (January/February), (1983), pp. 34-35.

(29) Boyer, Lester L. "Daylighting Designs Presented." Earth Shelter Digest & Energy Report. No. 18, (November/December), (1981), pp. 13-15.

(30) White, John A., Marvin H. Agee, and Kenneth E. Case. Principles of Engineering Economic Analysis. New York: John Wiley and Sons (1977).

(31) Skyrzycki, Cindy. "If You're Looking for a House You Can Afford." U.S. News & World Report. Vol. 95, No.23, (December 5), (1983), pp. 67-68.

(32) Edmunds, John. Personal Interview. Broken Arrow, Oklahoma, April 22, 1984.

(33) "Earth Shelters for Low-, Mid-Incomes." Earth Shelter Living. No. 30 (November-December), (1983), pp. 18-19.

(34) Vadnais, Kathleen. "Subdivision Owners Require Earth Sheltering." Earth Shelter Living. No. 26 (March-April), (1983), pp. 18-20.

(35) "FNMA Buying, Says Official." Earth Shelter Living. No. 30 (November-December), (1983), pp. 43.

(36) Elias, Jeff. Residential Financial Guidebook. Garland, Texas: Realty Financial Services, Inc. (1982).

(37) Edmunds, Mary. Personal Interview. Broken Arrow, Oklahoma, April 21, 1984.

(38) Vadnais, Kathleen. "Insurance Study Favors Earth Sheltering." Earth Shelter Living. No. 26 (March-April), (1983), pp. 26-28.

(39) "Where Inflation Has Taken Us." U.S. News & World Report. Vol. 95, No. 15 (October 10), (1983), pp. 80.

(40) Seals, Lanny M. "Building Design and Energy Consumption of a Selected Group of Earth Sheltered Houses in an Eight State Area." (Master's Thesis in Architectural Engineering, Oklahoma State University, 1983).

(41) Zanker, Alfred. "The World's Inflation: Ebbing at Last?". U.S. News & World Report. Vol. 95, No. 12 (October 24), (1983), pp. 23.

(42) Means Historical Cost Indexes 1983. Kingston, Massachusetts: Construction Consultants & Publishers, (1983).

APPENDICES

APPENDIX DIRECTORY

APPENDIX A

LISTING OF COMPUTER PROGRAM "LCCA"

```
1   REM  "LCCA": Life Cycle Cost Analysis Program
10 ! RE-STORE "LCCA:H8"
20   MASS STORAGE IS ":H8"
30   PRINTER IS 16
40   OPTION BASE 1
50 ! **  VARIABLE DEFINITIONS **
60 ! Ag/Es yzc  - year zero cost (I) (I=below)
70 !             - I=1 downpayment                I=4 prepaid insuran
       ce
80 !             - I=2 loan origination fee       I=5 mortgage points
90 !             - I=3 private mortgage ins>      I=6 general closing
        costs
100 ! Ag/Es iac  - incremental annual costs (I,J) (I=year, J=below
       )
110 !            - J=1 mortgage cost              J=2 insurance cost
120 !            - J=3 energy cost                J=4 painting cost
130 !            - J=5 HVAC replacement cost      J=6 roofing mainten
       ance cost
140 !            - J=7 opportunity cost           J=8 annual PMI cost
150 ! Fc ag/es   - purchase cost of home
160 ! Finr ag/es - financing rate of mortgage (input as integer)
170 ! I ag/es    - mortgage interest rate
180 ! Points ag/es - mortgage interest "points"
190 ! Ec ag/es  - annual energy costs
200 ! Realapp   - real estate appreciation
210 ! Inflation - inflation rate
220 ! Energyesc - energy escalaton rate
230 ! Insmate   - matrix for normalized insurance costs J=1 is hom
       e value
240 !                                                 J=2 is ins
       urance cost
250 ! Closing   - basic closing costs
260 ! Payback(30,2) - 30 = year    2 - 1=a/g, 2=e/s
270 ! Ag/Es costsum - annual incremental cost summation
280 ! Pyear     - breakeven year
290 ! Insesred  - percent of insurance reduction
300 ! Insred    - percent reduction of insurance for new homes
310 Returnpoint:! ** return to this line for another case **
320   DIM Agiac(30,8),Esiac(30,8),Agyzc(6),Esyzc(6),Insmate(131,2)
330   DIM Agcostsum(30),Escostsum(30),Payback(30,2),Insred(10),Cas
       eno$[2]
340   DIM Ahtbreak$[2]
350   MAT Insmate=ZER
360   MAT Agiac=ZER
370   MAT Agyzc=ZER
380   MAT Esiac=ZER
390   MAT Esyzc=ZER
400   MAT Agcostsum=ZER
410   MAT Escostsum=ZER
420   MAT Payback=ZER
430   INPUT "PRINT OUT OLD CASE (ans=1) OR INPUT NEW CASE (ans=2)"
       ,Ans
440   IF Ans=2 THEN Input
450   INPUT "CASE FILE NUMBER",Caseno$
460     ! ** NOTE - for sensitivity analysis, File$="CASE" as
470     !            opposed to "CAS-".
480   File$="CAS-"&Caseno$
```

```
490   ASSIGN #1 TO File$
500     ! ** NOTE - for sensitivity analysis, remove the variable
        Ahtbreak$
510     !           both here and in the print # statements. ***
520    READ #1;Caseno$,Fcag,Fces,Ecag,Eces,Finrag,Finres,Iag,Ies,P
        ointsag
530    READ #1;Pointses,Insagred,Insesred,Upfrontag,Upfrontes,Pyea
        r,Ahtbreak$
540    READ #1;Inflation,Energyesc,Realapp
550    READ #1;Agyzc(*),Esyzc(*),Agiac(*),Esiac(*),Payback(*)
560   GOTO Printout
570 Input:! **  INPUT NEW CASE  **
580   DISP "INPUT CASE FILE NUMBER   (previous file number was: ";
        Caseno$;")";
590   INPUT Caseno$
600   File$="CAS-"&Caseno$
610   CREATE File$,23,256
620   ASSIGN #1 TO File$
630 ! **  BEGIN COST DATA INPUT  -- SECTION --  **
640 ! **  BEGIN --AG-- INPUT  -- SUBSECTION --  **
650   PRINTER IS 16
660    PRINT CHR$(12);LIN(10);"CONVENTIONAL HOME --AG--"
670    Fcag=73040
680   INPUT "PURCHASE COST OF CONVENTIONAL HOME --AG--(default=730
        40)",Fcag
690   Finrag=90
700   INPUT "FINANCING RATE FOR --AG-- (default = 90 %)(INTEGER)",
        Finrag
710   Iag=13.5
720   INPUT "MORTGAGE INTEREST RATE OF --AG--(default=13.5) (INTEG
        ER)",Iag
730   Pointsag=1.5
740   INPUT "MORTGAGE 'POINTS' FOR --AG-- (default=1.5)(INTEGER)",
        Pointsag
750    PRINT LIN(2);"FOR ALL RECURRING COSTS, INPUT FIRST COST AND
         IT WILL"
760    PRINT "AUTOMATICALLY BE ESCALATED"
770    Ecag=1225
780   INPUT "ANNUAL ENERGY COST FOR --AG--(default=1225)",Ecag
790   No=6
800   INPUT "NUMBER OF PAINTINGS FOR --AG--(default=6)",No
810   Cost=265
820   INPUT "COST FOR INITIAL PAINTING (default=265)",Cost
830     FOR I=1 TO No
840     Year=30/No*I
850     Agiac(Year,4)=Cost
860     NEXT I
870   No=3
880   INPUT "NUMBER OF HVAC REPLACEMENTS FOR --AG--(default=3)",No
890   Cost=1120
900   INPUT "CURRENT COST OF REPLACEMENT (default=1120)",Cost
910     FOR I=1 TO No
920     Year=30/No*I
930     Agiac(Year,5)=Cost
940     NEXT I
950   No=2
```

```
960    INPUT "NUMBER OF ROOFING REPLACEMENTS FOR --AG-- (default=2)
         ",No
970    Cost=3575
980    INPUT "COST FOR INITIAL ROOFING REPLACEMENT (default=3575)",
         Cost
990      FOR I=1 TO No
1000     Year=30/No*I
1010     Agiac(Year,6)=Cost
1020     NEXT I
1030 ! **  START OF -- ES -- INPUT SUBSECTION  **
1040    PRINT CHR$(12);LIN(10);"EARTH SHELTER HOME --ES--"
1050   Fces=81200
1060   INPUT "PURCHASE COST OF HOME --ES--(default=81200)",Fces
1070   Finres=80
1080   INPUT "FINANCING RATE FOR --ES-- (default= 80 %)(INTEGER)",F
         inres
1090   Ies=13.5
1100   INPUT "MORTGAGE INTEREST RATE OF --ES-- (default=13.5) (INTE
         GER)",Ies
1110   Pointses=2
1120   INPUT "MORTGAGE 'POINTS' FOR --ES--(default=2) (INTEGER)",Po
         intses
1130   Insesred=0
1140   INPUT "PERCENT REDUCTION FOR INSURANCE COST FOR --ES--(def=0
         )(POSITIVE INTEGER)",Insesred
1150    PRINT LIN(2);"FOR ALL RECURRING COSTS, INPUT FIRST COST AND
          IT WILL"
1160    PRINT "AUTOMATICALLY BE ESCALATED"
1170    Eces=950
1180   INPUT "ANNUAL ENERGY COST FOR --ES--(default=950)",Eces
1190   No=6
1200   INPUT "NUMBER OF PAINTINGS FOR --ES--(default=6)",No
1210   Cost=47
1220   INPUT "COST FOR INITIAL PAINTING (default=47)",Cost
1230     FOR I=1 TO No
1240     Year=30/No*I
1250     Esiac(Year,4)=Cost
1260     NEXT I
1270   No=3
1280   INPUT "NUMBER OF HVAC REPLACEMENTS FOR --ES--(default=3)",No
1290   Cost=450
1300   INPUT "CURRENT COST OF REPLACEMENT (default=450)",Cost
1310     FOR I=1 TO No
1320     Year=30/No*I
1330     Esiac(Year,5)=Cost
1340     NEXT I
1350   No=2
1360   INPUT "NUMBER OF ROOFING REPAIRS FOR --ES--(default=2)",No
1370   Cost=720
1380   INPUT "COST FOR INITIAL ROOFING REPAIR (default=720)",Cost
1390     FOR I=1 TO No
1400     Year=30/No*I
1410     Esiac(Year,6)=Cost
1420     NEXT I
1430 ! **  BEGIN -----  SECTION FOR INPUT OF COMMON COST DATA  **
1440   PRINT CHR$(12);LIN(10);"INPUT COMMON DATA"
1450   Realapp=6
```

```
1460  INPUT "REAL ESTATE APPRECIATION RATE (INTEGER)(default = 6%)
        ",Realapp
1470  Realapp=Realapp/100
1480  Inflation=5.7
1490  INPUT "GENERAL INFLATION RATE (INTEGER)(default = 5.7%)",Inf
        lation
1500  Inflation=Inflation/100
1510  Energyesc=5.7
1520  INPUT "ENERGY ESCALATION RATE (INTEGER)(default = 5.7%)",Ene
        rgyesc
1530  Energyesc=Energyesc/100
1540  Closing=361
1550  INPUT "INPUT TOTAL BASIC COMMON CLOSING COST (default=361)",
        Closing
1560  Agyzc(6)=Esyzc(6)=Closing
1570  PRINT CHR$(12);LIN(10);"PROGRAM IS IN OPERATION, ALLOW A FEW
         MOMENTS FOR PRINTOUT"
1580 ! **  CALCULATION OF ANNUAL MORTGAGE COST -- SECTION  **
1590 ! **  MORTGAGE COST    -- AG -- SUBSECTION  **
1600  Int=Iag/12/100
1610  Factor=DROUND(Int*(1+Int)^360/((1+Int)^360-1),4)
1620  Mcag=PROUND(Fcag*Finrag/100*Factor*12,0)
1630    FOR I=1 TO 30
1640    Agiac(I,1)=Mcag
1650    NEXT I
1660 ! **  MORTGAGE COST  -- ES -- SUBSECTION  **
1670  Int=Ies/12/100
1680  Factor=DROUND(Int*(1+Int)^360/((1+Int)^360-1),4)
1690  Mces=PROUND(Fces*Finres/100*Factor*12,0)
1700    FOR I=1 TO 30
1710    Esiac(I,1)=Mces
1720    NEXT I
1730 ! **  BEGINNING OF INSURANCE SECTION  **
1740  RESTORE 1750
1750  DATA 70,378,71,380,72,385,73,390,74,396,75,401,76,404,77,408
        ,78,411
1760  DATA 79,413,80,417,81,425,82,432,83,440,84,448,85,455,86,456
        ,87,456
1770  DATA 88,457,89,457,90,458,91,462,92,466,93,470,94,474,95,478
        ,96,482
1780  DATA 97,486,98,490,99,494
1790  DATA 100,498,101,502,102,506,103,510,104,514,105,518,106,522
        ,107,526
1800  DATA 108,530,109,534,110,538,111,542,112,546,113,550,114,554
        ,115,558
1810  DATA 116,562,117,566,118,570,119,574,120,578,121,582,122,586
        ,123,590
1820  DATA 124,594,125,598,126,602,127,606,128,610,129,614,130,618
        ,131,622
1830  DATA 132,626,133,630,134,634,135,638,136,642,137,646,138,650
        ,139,654
1840  DATA 140,658,141,663,142,668,143,672,144,677,145,682,146,687
        ,147,691
1850  DATA 148,696,149,700,150,705,151,710,152,715,153,719,154,724
        ,155,729
1860  DATA 156,734,157,738,158,743
1870  DATA 159,747,160,752,161,757,162,762,163,766,164,771
```

```
1880  DATA 165,776,166,781,167,785,168,790,169,794,170,799,171,804
        ,172,809
1890  DATA 173,813,174,818,175,823,176,828,177,832,178,837,179,841
        ,180,846
1900  DATA 181,851,182,856,183,860,184,865,185,870,186,875,187,879
        ,188,884
1910  DATA 189,888,190,893,191,898,192,902,193,907,194,912,195,917
        ,196,921
1920  DATA 197,926,198,931,199,935,200,940
1930  MAT READ Insmate
1940  DATA .9,.9,.9,.92,.94,.96,.98,1,1,1
1950  MAT READ Insred
1960 ! **  BEGINNING OF --AG--INSURANCE SUBSECTION  **
1970    FOR I=1 TO 10
1980    Value=Fcag*(1+Realapp)^(I-1)
1990    X=INT(Value/1000)
2000      FOR J=1 TO 131
2010      IF J<131 THEN 2060
2020      IF X>Insmate(J,1) THEN 2040
2030      GOTO 2060
2040      Agiac(I,2)=((X-200)*5+940)*Insred(I)
2050      GOTO 2090
2060      IF X>Insmate(J,1) THEN 2090
2070      Agiac(I,2)=Insmate(J,2)*Insred(I)
2080      J=131
2090      NEXT J
2100    NEXT I
2110    Z=Agiac(10,2)
2120      FOR I=11 TO 30
2130      Agiac(I,2)=Z
2140      NEXT I
2150 ! **  BEGINNING OF --ES--INSURANCE SUBSECTION  **
2160    FOR I=1 TO 10
2170    Value=Fces*(1+Realapp)^(I-1)
2180    X=INT(Value/1000)
2190      FOR J=1 TO 131
2200      IF J<131 THEN 2250
2210      IF X>Insmate(J,1) THEN 2230
2220      GOTO 2250
2230      Esiac(I,2)=((X-200)*5+940)*(1-Insesred/100)*Insred(I)
2240      GOTO 2280
2250      IF X>Insmate(J,1) THEN 2280
2260      Esiac(I,2)=Insmate(J,2)*(1-Insesred/100)*Insred(I)
2270      J=131
2280      NEXT J
2290    NEXT I
2300    Z=Esiac(10,2)
2310      FOR I=11 TO 30
2320      Esiac(I,2)=Z
2330      NEXT I
2340 ! **  START OF ENERGY SECTION  **
2350 ! **  BEGINNING OF --AG-- ENERGY SUBSECTION  **
2360    FOR I=1 TO 30
2370    Agiac(I,3)=PROUND(Ecag*(1+Energyesc)^(I-1),0)
2380    NEXT I
2390 ! **  BEGINNING OF --ES-- ENERGY SUBSECTION  **
2400    FOR I=1 TO 30
```

```
2410    Esiac(I,3)=PROUND(Eces*(1+Energyesc)^(I-1),0)
2420    NEXT I
2430 ! **  START PAINTING SECTION  **
2440 ! **  BEGINNING OF --AG-- PAINTING SUBSECTION  **
2450    FOR I=1 TO 30
2460    IF Agiac(I,4)=0 THEN 2480
2470    Agiac(I,4)=PROUND(Agiac(I,4)*(1+Inflation)^(I-1),0)
2480    NEXT I
2490 ! **  BEGINNING OF --ES-- PAINTING SUBSECTION  **
2500    FOR I=1 TO 30
2510    IF Esiac(I,4)=0 THEN 2530
2520    Esiac(I,4)=PROUND(Esiac(I,4)*(1+Inflation)^(I-1),0)
2530    NEXT I
2540 ! **  START HVAC REPLACEMENT SECTION  **
2550 ! **  BEGINNING OF --AG-- HVAC SUBSECTION  **
2560    FOR I=1 TO 30
2570    IF Agiac(I,5)=0 THEN 2590
2580    Agiac(I,5)=PROUND(Agiac(I,5)*(1+Inflation)^(I-1),0)
2590    NEXT I
2600 ! **  BEGINNING OF --ES-- HVAC SUBSECTION  **
2610    FOR I=1 TO 30
2620    IF Esiac(I,5)=0 THEN 2640
2630    Esiac(I,5)=PROUND(Esiac(I,5)*(1+Inflation)^(I-1),0)
2640    NEXT I
2650 ! **  START ROOFING SECTION  **
2660 ! **  BEGINNING OF --AG-- ROOFING  SUBSECTION  **
2670    FOR I=1 TO 30
2680    IF Agiac(I,6)=0 THEN 2700
2690    Agiac(I,6)=PROUND(Agiac(I,6)*(1+Inflation)^(I-1),0)
2700    NEXT I
2710 ! **  BEGINNING OF --ES-- ROOFING  SUBSECTION  **
2720    FOR I=1 TO 30
2730    IF Esiac(I,6)=0 THEN 2750
2740    Esiac(I,6)=PROUND(Esiac(I,6)*(1+Inflation)^(I-1),0)
2750    NEXT I
2760 ! **  BEGIN FIRST COST SECTION  **
2770 ! **  BEGIN  --AG-- FIRST COST SUBSECTION  **
2780  Agyzc(1)=PROUND(Fcag*(1-Finrag/100),0)
2790  Agyzc(2)=PROUND(Fcag*Finrag/100*.01,0)
2800  Agyzc(3)=PROUND(Fcag*Finrag/100*.005,0)
2810  Agyzc(4)=PROUND(.85*Agiac(1,2)*14/12,0)
2820  Agyzc(5)=PROUND(Pointsag/100*Fcag*Finrag/100,0)
2830  Upfrontag=SUM(Agyzc)
2840 ! **  BEGIN  --ES-- FIRST COST SUBSECTION  **
2850  Esyzc(1)=PROUND(Fces*(1-Finres/100),0)
2860  Esyzc(2)=PROUND(Fces*Finres/100*.01,0)
2870  IF Finres<90 THEN 2900
2880  Esyzc(3)=PROUND(Fces*Finres/100*.005,0)
2890  GOTO 2910
2900  Esyzc(3)=0
2910  Esyzc(4)=PROUND(.85*Esiac(1,2)*14/12,0)
2920  Esyzc(5)=PROUND(Pointses/100*Fces*Finres/100,0)
2930  Upfrontes=SUM(Esyzc)
2940 ! **  OPPOUTUNITY COST  **
2950  IF Upfrontag>Upfrontes THEN 3000
2960    FOR I=1 TO 5
2970    Agiac(I,7)=PROUND((Upfrontag-Upfrontes)*.06,0)
```

```
2980     NEXT I
2990   GOTO 3030
3000     FOR I=1 TO 5
3010     Esiac(I,7)=PROUND((Upfrontes-Upfrontag)*.06,0)
3020     NEXT I
3030 ! **  PRIVATE MORTGAGE INSURANCE **
3040 ! **  A/G PMI SUBSECTION  **
3050   Int=Iag/12/100
3060   Factor=DROUND(Int*(1+Int)^360/((1+Int)^360-1),4)
3070   Pymt=PROUND(Fcag*Finrag/100*Factor,E-2)
3080   Princ=PROUND(Fcag*Finrag/100,E-2)
3090   Q=Fcag*.8
3100     FOR I=1 TO 360
3110     Princ=PROUND(Princ-(Pymt-Princ*Int),E-2)
3120     IF Princ>Q THEN 3150
3130     Y=PROUND(I/12,0)
3140     I=360
3150     NEXT I
3160   B=PROUND(Fcag*Finrag/100*.0025,0)
3170     FOR I=1 TO Y
3180     Agiac(I,8)=B
3190     NEXT I
3200 ! **  E/S PMI SUBSECTION  **
3210    IF Finres<90 THEN 3370
3220   Int=Iag/12/100
3230   Factor=DROUND(Int*(1+Int)^360/((1+Int)^360-1),4)
3240   Pymt=PROUND(Fces*Finres/100*Factor,E-2)
3250   Princ=PROUND(Fces*Finres/100,E-2)
3260   Q=Fcag*.8
3270     FOR I=1 TO 360
3280     Princ=PROUND(Princ-(Pymt-Princ*Int),E-2)
3290     IF Princ>Q THEN 3320
3300     Y=PROUND(I/12,0)
3310     I=360
3320     NEXT I
3330   B=PROUND(Fces*Finres/100*.0025,0)
3340     FOR I=1 TO Y
3350     Esiac(I,8)=B
3360     NEXT I
3370 ! **  START ANNUAL SUMMATION SECTION  **
3380   MAT Agcostsum=RSUM(Agiac)
3390   MAT Escostsum=RSUM(Esiac)
3400 ! **  START BREAKEVEN SECTION  **
3410 ! **  START --AG-- BREAKEVEN SUBSECTION  **
3420   X=Upfrontag
3430     FOR I=1 TO 30
3440     X=Payback(1,1)=X+Agcostsum(I)
3450     NEXT I
3460 ! **  START --ES-- BREAKEVEN SUBSECTION  **
3470   X=Upfrontes
3480     FOR I=1 TO 30
3490     X=Payback(1,2)=X+Escostsum(I)
3500     NEXT I
3510 ! **  START BREAKEVEN ANALYSIS SUBSECTION  **
3520   Pyear=0
3530     FOR I=1 TO 30
3540     IF Payback(I,1)<Payback(I,2) THEN 3570
```

```
3550     Pyear=I
3560     I=30
3570     NEXT I
3580     IF Pyear<>0 THEN 3650
3590     Valueag=Fcag*(1+Realapp)^10
3600     Valuees=Fces*(1+Realapp)^10
3610     IF Payback(30,2)-Valuees<Payback(30,1)-Valueag THEN 3640
3620     Pyear=99
3630     GOTO 3650
3640     Pyear=30
3650 ! **  START AHT BREAK-EVEN ANALYSIS  **
3660  Agsbk=Essbk=0
3670  Agsbk=Payback(8,1)-Fcag*(1+Realapp)^I
3680  Essbk=Payback(8,2)-Fces*(1+Realapp)^I
3690  IF Agsbk<Essbk THEN 3720
3700  Ahtbreak$="Y"
3710  GOTO 3730
3720  Ahtbreak$="N"
3730 ! **  START STORE DATA SECTION  **
3740   PRINT #1;Caseno$,Fcag,Fces,Ecag,Eces,Finrag,Finres,Iag,Ies,
       Pointsag
3750   PRINT #1;Pointses,Insagred,Insesred,Upfrontag,Upfrontes,Pye
       ar,Ahtbreak$
3760   PRINT #1;Inflation,Energyesc,Realapp
3770   PRINT #1;Agyzc(*),Esyzc(*),Agiac(*),Esiac(*),Payback(*)
3780 Printout:! **  START PRINT OUT  SECTION  **
3790  PRINT CHR$(12)
3800   PRINTER IS 0
3810 Image1:IMAGE 9X,18A,10X,3D.2D,"%",12X,3D.2D,"%"
3820 Image2:IMAGE 9X,18A, 9X,"$",6D,12X,"$",6D
3830 Image3:IMAGE X,2D,3X,"$",X,6D,3X,"$",  4D,4X,"$",5D,2X,"$",X,
       4D,3X,"$",  5D,2X,"$",5D,2X,"$",S 4D,  X,"$",X,3D,X,"$",X,
       6D
3840 Image4:IMAGE XX,"0",69X,"$",X,6D
3850 Image5:IMAGE '****",2X,"$",X,6D,3X,"$",  4D,4X,"$",5D,2X,"$",
       X,4D,3X,"$',  5D,2X,"$",5D,2X,"$",S 4D,  X,"$",X,3D,X,"$",
       X,6D
3860 Image6:IMAGE 11X,"0",7X,"$",6D,4X,"$",6D
3870 Image7:IMAGE 2(10X,DD,7X,"$",6D,4X,"$",6D)
3880  PRINT TAB(10);"CASE NUMBER: ";Caseno$;SPA(10);"PARAMETERS AR
       E AS FOLLOWS:";LIN(1)
3890  PRINT TAB(10);CHR$(132);"COST FACTOR";TAB(37);"ABOVE GROUND"
       ;TAB(55);"EARTH SHELTER";CHR$(128);LIN(1)
3900  PRINT USING Image2;"FIRST COST",Fcag,Fces
3910  PRINT USING Image2;"ANNUAL ENERGY COST",Ecag,Eces
3920  PRINT USING Image1;"FINANCING RATE",Finrag,Finres
3930  PRINT USING Image1;"MORTGAGE RATE",Iag,Ies
3940  PRINT USING Image1;"MORTGAGE POINTS",Pointsag,Pointses
3950  PRINT USING Image1;"INS. REDUCTION",Insagred,Insesred
3960     PRINT TAB(10);CHR$(132);RPT$(" ",57);CHR$(128);LIN(1)
3970  PRINT LIN(1);TAB(10);CHR$(132);"COMMON PARAMETERS:";SPA(39);
       CHR$(128);LIN(1)
3980  PRINT USING '9X,K,14X,DD.DD,K";"INFLATION RATE:";Inflation*1
       00;"%"
3990  PRINT USING '9X,K, 6X,DD.DD,K";"ENERGY ESCALATION RATE:";Ene
       rgyesc*100;"%"
```

```
4000  PRINT USING '9X,K, 6X,DD.DD,K";"REAL ESTATE APP. RATE: ";Rea
        lapp*100;"%"
4010     PRINT TAB(10);CHR$(132);RPT$(" ",57);CHR$(128);LIN(1)
4020  PRINT LIN(1);TAB(10);CHR$(132);"BREAKDOWN OF FIRST COSTS:";S
        PA(32);CHR$(128);LIN(1)
4030  PRINT USING Image2;"DOWNPAYMENT",Agyzc(1),Esyzc(1)
4040  PRINT USING Image2;"LOAN ORIG. FEE.",Agyzc(2),Esyzc(2)
4050  PRINT USING Image2;"PRIVATE MORT. INS.",Agyzc(3),Esyzc(3)
4060  PRINT USING Image2;"PREPAID INS.",Agyzc(4),Esyzc(4)
4070  PRINT USING Image2;"MORTGAGE POINTS",Agyzc(5),Esyzc(5)
4080  PRINT USING Image2;"GEN.CLOSING COSTS",Agyzc(6),Esyzc(6)
4090  PRINT TAB(10);CHR$(132);RPT$(" ",57);CHR$(128)
4100  PRINT USING Image2;"TOTAL UPFRONT COSTS",Upfrontag,Upfrontes
4110     PRINT TAB(10);CHR$(132);RPT$(" ",57);CHR$(128);LIN(3)
4120  PRINT TAB(10);CHR$(132);"COMPARATIVE SUMMARY OF RUNNING TOTA
        LS";SPA(8);"AHT YEAR = 8";CHR$(128);LIN(1)
4130  PRINT TAB(10);CHR$(132);"YEAR";SPA(8);"A/G";SPA(8);"E/S";SPA
        (11);"YEAR';SPA(8);"A/G";SPA(8);"E/S  ";CHR$(128);LIN(1)
4140  PRINT USING Image6;Upfrontag,Upfrontes
4150    FOR I=1 TO 15
4160    PRINT USING Image7;I,Payback(I,1),Payback(I,2),I+15,Paybac
        k(I+15,1),Payback(I+15,2)
4170    NEXT I
4180       PRINT TAB(10);CHR$(132);RPT$(" ",65);CHR$(128)
4190       PRINT TAB(10);"BREAKEVEN YEAR = ";Pyear;SPA(17);"BREAK-
        EVEN AT AHT: ";Ahtbreak$;LIN(3)
4200  PRINT LIN(1);CHR$(132);"SUMMARY OF ALL ANNUAL COSTS: CONVEN
        TIONAL HOME:  CASE NUMBER: ";Caseno$;SPA(17);CHR$(128)
4210  PRINT TAB(5);" |MORTGAGE|HOMEOWNERS|ANNUAL|EXTERIOR| HVAC
        |ROOF    | OPP. | AN. |RUNNING"
4220  PRINT CHR$(132);"YEAR |  COST  | INSURANCE|ENERGY|PAINTING|R
        EPLACE.|MAINT. | COST | PMI |  TOTAL";CHR$(128)
4230  PRINT USING Image4;Upfrontag
4240    FOR I=1 TO 30
4250    IF I<>Pyear THEN 4280
4260    PRINT USING Image5;Agiac(I,1),Agiac(I,2),Agiac(I,3),Agiac(
        I,4),Agiac(I,5),Agiac(I,6),Agiac(I,7),Agiac(I,8),Payback(I
        ,1)
4270    GOTO 4290
4280    PRINT USING Image3;I,Agiac(I,1),Agiac(I,2),Agiac(I,3),Agia
        c(I,4),Agiac(I,5),Agiac(I,6),Agiac(I,7),Agiac(I,8),Payback
        (I,1)
4290    NEXT I
4300       PRINT CHR$(132);RPT$(" ",79);CHR$(128)
4310       PRINT "**** = BREAKEVEN YEAR";LIN(3)
4320  PRINT LIN(1);CHR$(132);"SUMMARY OF ALL ANNUAL COSTS:  EARTH
        SHELTER:  CASE NUMBER: ";Caseno$;SPA(21);CHR$(128)
4330  PRINT TAB(5);" |MORTGAGE|HOMEOWNERS|ANNUAL|EXTERIOR| HVAC
        |ROOF    | OPP. | AN. |RUNNING"
4340  PRINT CHR$(132);"YEAR |  COST  | INSURANCE|ENERGY|PAINTING|R
        EPLACE.|MAINT. | COST | PMI |  TOTAL";CHR$(128)
4350  PRINT USING Image4;Upfrontes
4360    FOR I=1 TO 30
4370    IF I<>Pyear THEN 4400
4380    PRINT USING Image5;Esiac(I,1),Esiac(I,2),Esiac(I,3),Esiac(
        I,4),Esiac(I,5),Esiac(I,6),Esiac(I,7),Esiac(I,8),Payback(I
        ,2)
```

```
4390     GOTO 4410
4400     PRINT USING Image3;I,Esiac(I,1),Esiac(I,2),Esiac(I,3),Esia
         c(I,4),Esiac(I,5),Esiac(I,6),Esiac(I,7),Esiac(I,8),Payback
         (I,2)
4410     NEXT I
4420   PRINT CHR$(132);RPT$(" ",79);CHR$(128)
4430        PRINT "*=== = BREAKEVEN YEAR";LIN(3)
4440   PRINTER IS 16
4450   INPUT "DO ANOTHER CASE",A$
4460   IF POS(A$,"Y') THEN Returnpoint
4470   PRINT CHR$(12);LIN(10);TAB(8);"THANK YOU FOR USING ANOTHER
         AJ enterprises COMPUTER PROGRAM !"
4480   STOP
4490   END
5000 !
5010 !
5020 ! ************************************************************
5030 ! *  LCCA: LIFE CYCLE COST ANALYSIS PROGRAM                  *
5040 ! *  PROGRAM DEVELOPED BY ALLEN JONES, SPRING 1984           *
5050 ! *  PROGRAM IS PURELY FUNCTIONAL (NOT USER FRIENDLY)        *
5060 ! *  PROGRAM WAS DEVELOPED TO ASSIST IN THESIS WORK          *
5070 ! *  PROGRAM IS WRITTEN IN HEWLETT-PACKARD "ENHANCED"        *
5080 ! *    BASIC LANGUAGE, AND WAS DESIGNED FOR USE ON THE       *
5090 ! *    H-P 9845B.                                            *
5100 ! ************************************************************
```

APPENDIX B

BUILDING COST QUESTIONNAIRE AND RESULTS

There is very little published information about the building costs of homes, especially for the cost of the home without the land. For this reason something more than a literature search was needed to compile these building costs. The context information for the parameters on which to base costs was much too detailed to easily discuss via a telephone interview, therefore a mailed questionnaire format was chosen. The questionnaire package contained a cover letter explaining the questionnaire and the information which was needed, next was a list of parameters to base the costs on and finally a simple questionnaire to fill in the needed information. Since all of the information requested was listed in the cover letter, the questionnaire form was simply a tool to help the respondent compile his response in an orderly fashion. The building parameters used were derived from the survey of earth sheltered home owners and builders, conducted by the Center for Natural Energy Design at Oklahoma State University. The following figures show the cover letter, the building parameters, and the questionnaire form.

OKLAHOMA STATE UNIVERSITY
SCHOOL OF ARCHITECTURE

Allen Jones
101 Architecture Building
Oklahoma State University
Stillwater, Oklahoma 74078

Dear Mr.

I am a graduate student in Architectural Engineering, Environmental Control, at Oklahoma State University and am developing a Master's Thesis which deals with a life cycle cost comparison between conventional and earth sheltered (earth covered) housing. I hope you can provide some information needed for this project. The enclosed survey should only take a few moments of your time.

I am trying to obtain information on the building purchase costs of both conventional and earth sheltered housing. Data to base the costs on is included on following pages. If possible, please include the purchase costs of both a "custom built" home and a home built as a part of a housing development, which usually has lower costs due to the economics of building several similar repetitive homes. Also, if you currently use or know of an alternative building system that you feel gives a lower cost, please include the system and the cost reduction. You may report all cost information either as a cost per square foot or as a total building cost of an approximately 1600 sq ft house.

I realize that each home is different and costs will vary, however all I need are "ballpark" estimates of these costs. If it will simplify matters, you may give the costs in a range from minimum to maximum expected cost, rather than a single average cost.

If at all possible could you also include a list of names and addresses of contractors that you either have worked with or know of that have experience in building earth shelters.

Any cost information that you furnish will be combined with that from other architects and builders and there will be no relation of any specific costs to you or your firm presented in the thesis.

Thank you very much for your time. Please use the enclosed envelope to mail the questionnaire back. If you have any questions or need further information, feel free to call me at the OSU School of Architecture during days (405) 624-6043 or at home in evenings (405) 743-1845.

Sincerely,

Allen D. Jones
Graduate Student
Architectural Engineering

STILLWATER, OKLAHOMA 74074 [illegible]

Figure 12. Building Cost Questionnaire Cover Letter

EARTH SHELTERED BUILDING PARAMETERS

WALL SYSTEM - Poured in place concrete.

ROOF SYSTEM - Poured in place structural slab - or - metal joists and deck system with concrete slab.

FLOOR SYSTEM - Slab on grade.

CONCRETE - All concrete to be 3500 to 4000 psi.

SOIL AND SITE CONDITIONS - No problems with water table. Soil has adequate compressive strength and only a small content of high expansion clays. Excavation equal to about 1/2 of the volume of the house. Cut and fill equal - little or no earth to be transported to or from the site. Site to be basically flat or gently sloped. Underground drainage of gravel bed and french drain around base of all earth contact walls.

MECHANICAL SYSTEM - Conventional furnace and air conditioning or heat pump system.

WATERPROOFING - Bentionite clay sheets for walls and either bentonite sheets or neoprene membrane for roof. Wall waterproofing materials to be protected with suitable protection board.

EXTERIOR INSULATION - 2 inch Styrofoam boards on roof and 1/2 of the way down the walls.

INTERIOR WALLS - Gypsum board on stud walls (metal or wood studs).

INTERIOR FINISHES - Moderately finished. Typical finishes found in moderately priced homes for middle income families.

TYPICAL BUILDING SIZE - 1600 square feet.

BUILDING SHAPE - Rectangular - length 2-1/2 to 3 times the width.

GARAGE - also earth covered and attached to house.
2 car - 500 sq. ft.
3 car - 750 sq. ft.

Figure 13. Earth Shelter Building Parameters for Cost Questionnaire

CONVENTIONAL HOUSE BUILDING PARAMETERS

WALL SYSTEM AND STRUCTURE - 2 by 4 wood frame with brick veneer.

ROOF SYSTEM - Asphalt shingles on tar/felt paper on plywood decking.

FLOOR SYSTEM - Slab on grade.

CONCRETE - All concrete to be 3000 to 3500 psi.

SOIL AND SITE CONDITIONS - No problems with water table. Soil has adequate compressive strength and only a small content of high expansion clays. No major excavation required. Little or no earth to be transported to or from the site. Site to be basically flat or gently sloped.

MECHANICAL SYSTEM - Conventional furnace and air conditioning or heat pump system.

INSULATION - Fiberglass or comparable insulation material in both wall cavities and between ceiling joists. "R" values to be at least 15 for walls and 26 for ceiling.

INTERIOR WALLS - Gypsum board on wood stud walls.

INTERIOR FINISHES - Moderately finished. Typical finishes found in moderately priced homes for middle income families.

TYPICAL BUILDING SIZE - 1600 square feet.

BUILDING SHAPE - Rectangular - length 2-1/2 to 3 times the width.

GARAGE - 2 car - 500 sq. ft., attached to house.

Figure 14. Conventional Building Parameters for Cost Questionnaire

BUILDING COST QUESTIONNAIRE

1). How would you rank your experience with building earth-sheltered homes ?

a). none b). little 1-2 homes
c). moderate 3-5 homes d). good 6 or more homes

EARTH-SHELTERED SECTION

2). Using the data for the earth-sheltered home, what would you estimate the cost to be ?

List costs either as an average cost or minimum to maximum range.

2 car garage

Custom home _____ Tract home _____ /sq ft or total

3 car garage cost increase _____.

3). If you know of or presently use any alternate building systems that you feel would reduce the cost of the earth-shelter, please list the system(s) and the resultant cost reduction.

SYSTEMS: (you may continue on back if necessary)

_____

_____.

Cost Reduction _____.

CONVENTIONAL BUILDING SECTION

4). Using the data for the conventional home what would you estimate the cost to be ?

Custom home _____ Tract home _____/sq ft or total

5). If you know of or presently use any alternate building systems that you feel would reduce the cost of the conventional home, please list the system(s) and the resultant cost reduction.

SYSTEMS: (you may continue on back if necessary)

_____

_____.

Cost Reduction _____.

Thank you very much for your time.

Figure 15. Building Cost Questionnaire Form

The questionnaire began with the experience the respondent had with building earth shelters. The results generally followed the trend that respondents who had no experience with earth shelters did not give any cost values for the earth shelters. The respondents who had little experience (only one or two houses) gave costs that were very similar to those given by respondents with more experience. There were 10 valid responses to the earth shelter section, some responses had to be deleted because the costs submitted were for homes that differed greatly from the given parameters. Twelve valid responses were received in the conventional section. Included in both the earth shelter and conventional section were spaces to include any parameter changes which the respondent used that reduced the overall cost of the building, however, this section was not completed by any respondent. Table XI below gives the resultant costs from the questionnaire in cost per square foot. The average costs are taken from the average of the responses to the questionnaire. The minimum and maximum values are one standard deviation away from the average. Therefore the range of prices shown includes almost 70 percent of the responses and the average response in each category.

TABLE XIX

BUILDING COSTS FROM QUESTIONNAIRE

Housing Type	Minimum Cost	Average Cost	Maximum Cost
Earth shelter:			
Custom	$50.75	$56.85	$62.95
Tract	$46.50	$50.50	$54.50
Conventional:			
Custom	$45.65	$52.50	$59.35
Tract	$37.00	$44.75	$52.50

Costs for average building size of 1600 sq ft.

APPENDIX C

MISCELLANEOUS TABLES

This appendix contains miscellaneous tables which are either too long or too detailed to include in the text of the chapters.

TABLE XX

NORMALIZED HOMEOWNERS INSURANCE COSTS

Home Value	Annual Cost	Home Value	Annual Cost	Home Value	Annual Cost
$40,000	230	$60,000	$340	$100,000	$498
41,000	236	61,000	345	105,000	518
42,000	242	62,000	349	110,000	538
43,000	248	63,000	350	115,000	558
44,000	253	64,000	352	120,000	578
45,000	259	65,000	357	125,000	598
46,000	265	66,000	363	130,000	618
47,000	270	67,000	368	135,000	638
48,000	276	68,000	374	140,000	658
49,000	282	69,000	375	145,000	682
50,000	288	70,000	378	150,000	705
51,000	294	71,000	380	155,000	729
52,000	299	72,000	385	160,000	752
53,000	305	73,000	390	165,000	776
54,000	311	74,000	396	170,000	799
55,000	317	75,000	401	175,000	823
56,000	322	80,000	417	180,000	846
57,000	328	85,000	455	185,000	870
58,000	334	90,000	458	190,000	893
59,000	339	95,000	478	200,000	940

Source: Reference (36).

TABLE XXI

PRINCIPAL AND INTEREST FACTORS PER $1000 OF LOAN

Interest Rate	Period 30 Year	Period 15 Year	Interest Rate	Period 30 Year	Period 15 Year
10.00	8.78	10.75	15.00	12.65	14.00
10.125	8.87	10.82	15.125	12.75	14.09
10.25	8.97	10.90	15.25	12.85	14.17
10.375	9.05	10.98	15.375	12.95	14.26
10.50	9.15	11.06	15.50	13.05	14.34
10.625	9.24	11.13	15.625	13.15	14.43
10.75	9.34	11.21	15.75	13.25	14.52
10.875	9.43	11.29	15.875	13.35	14.60
11.00	9.53	11.37	16.00	13.45	14.69
11.125	9.62	11.44	16.125	13.55	14.78
11.25	9.72	11.53	16.25	13.65	14.87
11.375	9.81	11.60	16.375	13.76	14.95
11.50	9.91	11.69	16.50	13.86	15.04
11.625	10.00	11.76	16.625	13.96	15.13
11.75	10.10	11.85	16.75	14.06	15.22
11.875	10.19	11.92	16.875	14.16	15.30
12.00	10.29	12.00	17.00	14.26	15.40
12.125	10.38	12.08	17.125	14.36	15.48
12.25	10.48	12.16	17.25	14.46	15.57
12.375	10.58	12.24	17.375	14.56	15.66
12.50	10.67	12.33	17.50	14.67	15.75
12.625	10.77	12.41	17.625	14.77	15.84
12.75	10.87	12.49	17.75	14.87	15.93
12.875	10.96	12.57	17.875	14.97	16.02
13.00	11.06	12.65	18.00	15.08	16.11
13.125	11.16	12.73	18.125	15.17	16.19
13.25	11.26	12.82	18.25	15.28	16.28
13.375	11.36	12.90	18.375	15.38	16.37
13.50	11.45	12.98	18.50	15.48	16.47
13.625	11.55	13.07	18.625	15.58	16.56
13.75	11.65	13.15	18.75	15.68	16.65
13.875	11.75	13.23	18.875	15.79	16.74
14.00	11.85	13.32	19.00	15.89	16.83
14.125	11.95	13.40	19.125	15.99	16.92
14.25	12.05	13.49	19.25	16.09	17.01
14.375	12.15	13.57	19.375	16.20	17.10
14.50	12.25	13.66	19.50	16.30	17.19
14.625	12.35	13.74	19.625	16.40	17.29
14.75	12.44	13.83	19.75	16.50	17.38
14.875	12.54	13.91	19.875	16.61	17.47
			20.00	16.71	17.56

To calculate monthly principal and interest (P+I) payment: Multiply factor from above times the loan amount in thousands, for example, to find monthly P+I payment for a 30 year mortgage at 11% with a $50,000 financed amount, take 50 X 9.53 = $476.50. Source: Reference (36).

APPENDIX D

DETAILED SUMMARIES FROM SENSITIVITY ANALYSIS

CASE NUMBER: 1 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 85000	$ 93500
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8500	$ 18700
LOAN ORIG. FEE.	$ 765	$ 748
PRIVATE MORT. INS.	$ 383	$ 0
PREPAID INS.	$ 406	$ 419
MORTGAGE POINTS	$ 1148	$ 1496
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11563	$ 21724

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11563	$ 21724			
1	$ 23290	$ 33375	16	$230445	$222591
2	$ 35089	$ 45102	17	$244602	$235913
3	$ 46980	$ 56907	18	$258928	$249367
4	$ 58981	$ 68805	19	$273434	$262960
5	$ 71427	$ 80864	20	$292100	$278125
6	$ 84273	$ 92969	21	$306995	$292020
7	$ 97250	$105186	22	$322102	$306079
8	$110364	$117522	23	$337432	$320311
9	$123613	$129980	24	$352999	$334727
10	$139285	$143379	25	$369818	$349515
11	$152791	$156049	26	$385899	$364329
12	$166419	$168813	27	$402259	$379360
13	$180176	$181677	28	$418914	$394620
14	$194068	$194646	29	$435881	$410122
15	$216448	$209393	30	$477933	$431953

BREAKEVEN YEAR = 15 BREAK-EVEN AT AHT:

SUMMARY OF ALL ANNUAL COSTS: CONVENTIONAL HOME: CASE NUMBER: 1

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 11563
1	$ 10511	$ 410	$ 1225	$ 0	$ 0	$ 0	$ -610	$ 191	$ 23290
2	$ 10511	$ 412	$ 1295	$ 0	$ 0	$ 0	$ -610	$ 191	$ 35089
3	$ 10511	$ 430	$ 1369	$ 0	$ 0	$ 0	$ -610	$ 191	$ 46980
4	$ 10511	$ 462	$ 1447	$ 0	$ 0	$ 0	$ -610	$ 191	$ 58981
5	$ 10511	$ 494	$ 1529	$ 331	$ 0	$ 0	$ -610	$ 191	$ 71427
6	$ 10511	$ 528	$ 1616	$ 0	$ 0	$ 0	$ +0	$ 191	$ 84273
7	$ 10511	$ 566	$ 1708	$ 0	$ 0	$ 0	$ +0	$ 191	$ 97250
8	$ 10511	$ 606	$ 1806	$ 0	$ 0	$ 0	$ +0	$ 191	$ 110364
9	$ 10511	$ 638	$ 1909	$ 0	$ 0	$ 0	$ +0	$ 191	$ 123613
10	$ 10511	$ 672	$ 2017	$ 436	$ 1845	$ 0	$ +0	$ 191	$ 139285
11	$ 10511	$ 672	$ 2132	$ 0	$ 0	$ 0	$ +0	$ 191	$ 152791
12	$ 10511	$ 672	$ 2254	$ 0	$ 0	$ 0	$ +0	$ 191	$ 166419
13	$ 10511	$ 672	$ 2383	$ 0	$ 0	$ 0	$ +0	$ 191	$ 180176
14	$ 10511	$ 672	$ 2518	$ 0	$ 0	$ 0	$ +0	$ 191	$ 194068
****	$ 10511	$ 672	$ 2662	$ 576	$ 0	$ 7768	$ +0	$ 191	$ 216448
16	$ 10511	$ 672	$ 2814	$ 0	$ 0	$ 0	$ +0	$ 0	$ 230445
17	$ 10511	$ 672	$ 2974	$ 0	$ 0	$ 0	$ +0	$ 0	$ 244602
18	$ 10511	$ 672	$ 3143	$ 0	$ 0	$ 0	$ +0	$ 0	$ 258928
19	$ 10511	$ 672	$ 3323	$ 0	$ 0	$ 0	$ +0	$ 0	$ 273434
20	$ 10511	$ 672	$ 3512	$ 760	$ 3211	$ 0	$ +0	$ 0	$ 292100
21	$ 10511	$ 672	$ 3712	$ 0	$ 0	$ 0	$ +0	$ 0	$ 306995
22	$ 10511	$ 672	$ 3924	$ 0	$ 0	$ 0	$ +0	$ 0	$ 322102
23	$ 10511	$ 672	$ 4147	$ 0	$ 0	$ 0	$ +0	$ 0	$ 337432
24	$ 10511	$ 672	$ 4384	$ 0	$ 0	$ 0	$ +0	$ 0	$ 352999
25	$ 10511	$ 672	$ 4634	$ 1002	$ 0	$ 0	$ +0	$ 0	$ 369818
26	$ 10511	$ 672	$ 4898	$ 0	$ 0	$ 0	$ +0	$ 0	$ 385899
27	$ 10511	$ 672	$ 5177	$ 0	$ 0	$ 0	$ +0	$ 0	$ 402259
28	$ 10511	$ 672	$ 5472	$ 0	$ 0	$ 0	$ +0	$ 0	$ 418914
29	$ 10511	$ 672	$ 5784	$ 0	$ 0	$ 0	$ +0	$ 0	$ 435881
30	$ 10511	$ 672	$ 6114	$ 1323	$ 5590	$17842	$ +0	$ 0	$ 477933

**** = BREAKEVEN YEAR

SUMMARY OF ALL ANNUAL COSTS: EARTH SHELTER: CASE NUMBER: 1

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 21724
1	$ 10278	$ 423	$ 950	$ 0	$ 0	$ 0	$ +0	$ 0	$ 33375
2	$ 10278	$ 445	$ 1004	$ 0	$ 0	$ 0	$ +0	$ 0	$ 45102
3	$ 10278	$ 466	$ 1061	$ 0	$ 0	$ 0	$ +0	$ 0	$ 56907
4	$ 10278	$ 499	$ 1122	$ 0	$ 0	$ 0	$ +0	$ 0	$ 68805
5	$ 10278	$ 536	$ 1186	$ 59	$ 0	$ 0	$ +0	$ 0	$ 80864
6	$ 10278	$ 574	$ 1253	$ 0	$ 0	$ 0	$ +0	$ 0	$ 92969
7	$ 10278	$ 613	$ 1325	$ 0	$ 0	$ 0	$ +0	$ 0	$ 105186
8	$ 10278	$ 658	$ 1400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 117522
9	$ 10278	$ 700	$ 1480	$ 0	$ 0	$ 0	$ +0	$ 0	$ 129980
10	$ 10278	$ 738	$ 1565	$ 77	$ 741	$ 0	$ +0	$ 0	$ 143379
11	$ 10278	$ 738	$ 1654	$ 0	$ 0	$ 0	$ +0	$ 0	$ 156049
12	$ 10278	$ 738	$ 1748	$ 0	$ 0	$ 0	$ +0	$ 0	$ 168813
13	$ 10278	$ 738	$ 1848	$ 0	$ 0	$ 0	$ +0	$ 0	$ 181677
14	$ 10278	$ 738	$ 1953	$ 0	$ 0	$ 0	$ +0	$ 0	$ 194646
****	$ 10278	$ 738	$ 2064	$ 102	$ 0	$ 1565	$ +0	$ 0	$ 209393
16	$ 10278	$ 738	$ 2182	$ 0	$ 0	$ 0	$ +0	$ 0	$ 222591
17	$ 10278	$ 738	$ 2306	$ 0	$ 0	$ 0	$ +0	$ 0	$ 235913
18	$ 10278	$ 738	$ 2438	$ 0	$ 0	$ 0	$ +0	$ 0	$ 249367
19	$ 10278	$ 738	$ 2577	$ 0	$ 0	$ 0	$ +0	$ 0	$ 262960
20	$ 10278	$ 738	$ 2724	$ 135	$ 1290	$ 0	$ +0	$ 0	$ 278125
21	$ 10278	$ 738	$ 2879	$ 0	$ 0	$ 0	$ +0	$ 0	$ 292020
22	$ 10278	$ 738	$ 3043	$ 0	$ 0	$ 0	$ +0	$ 0	$ 306079
23	$ 10278	$ 738	$ 3216	$ 0	$ 0	$ 0	$ +0	$ 0	$ 320311
24	$ 10278	$ 738	$ 3400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 334727
25	$ 10278	$ 738	$ 3594	$ 178	$ 0	$ 0	$ +0	$ 0	$ 349515
26	$ 10278	$ 738	$ 3798	$ 0	$ 0	$ 0	$ +0	$ 0	$ 364329
27	$ 10278	$ 738	$ 4015	$ 0	$ 0	$ 0	$ +0	$ 0	$ 379360
28	$ 10278	$ 738	$ 4244	$ 0	$ 0	$ 0	$ +0	$ 0	$ 394620
29	$ 10278	$ 738	$ 4486	$ 0	$ 0	$ 0	$ +0	$ 0	$ 4101.22
30	$ 10278	$ 738	$ 4741	$ 235	$ 2246	$ 3593	$ +0	$ 0	$ 431953

**** = BREAKEVEN YEAR

CASE NUMBER: 2 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 85000	$ 85000
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8500	$ 17000
LOAN ORIG. FEE.	$ 765	$ 680
PRIVATE MORT. INS.	$ 383	$ 0
PREPAID INS.	$ 406	$ 406
MORTGAGE POINTS	$ 1148	$ 1360
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11563	$ 19807

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11563	$ 19807			
1	$ 23405	$ 30510	16	$231020	$204885
2	$ 35319	$ 41269	17	$245177	$217206
3	$ 47325	$ 52103	18	$259503	$229659
4	$ 59441	$ 63030	19	$274009	$242251
5	$ 72002	$ 74112	20	$292675	$256415
6	$ 84848	$ 85236	21	$307570	$269309
7	$ 97825	$ 96471	22	$322677	$282367
8	$110939	$107820	23	$338007	$295598
9	$124188	$119281	24	$353574	$309013
10	$139860	$131679	25	$370393	$322800
11	$153366	$143348	26	$386474	$336613
12	$166994	$155111	27	$402834	$350643
13	$180751	$166974	28	$419489	$364902
14	$194643	$178942	29	$436456	$379403
15	$217023	$192688	30	$478508	$400233

BREAKEVEN YEAR = 7 BREAK-EVEN AT AHT:

SUMMARY OF ALL ANNUAL COSTS: CONVENTIONAL HOME: CASE NUMBER: 2

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 11563
1	$ 10511	$ 410	$ 1225	$ 0	$ 0	$ 0	$ -495	$ 191	$ 23405
2	$ 10511	$ 412	$ 1295	$ 0	$ 0	$ 0	$ -495	$ 191	$ 35319
3	$ 10511	$ 430	$ 1369	$ 0	$ 0	$ 0	$ -495	$ 191	$ 47325
4	$ 10511	$ 462	$ 1447	$ 0	$ 0	$ 0	$ -495	$ 191	$ 59441
5	$ 10511	$ 494	$ 1529	$ 331	$ 0	$ 0	$ -495	$ 191	$ 72002
6	$ 10511	$ 528	$ 1616	$ 0	$ 0	$ 0	$ +0	$ 191	$ 84848
****	$ 10511	$ 566	$ 1708	$ 0	$ 0	$ 0	$ +0	$ 191	$ 97825
8	$ 10511	$ 606	$ 1806	$ 0	$ 0	$ 0	$ +0	$ 191	$ 110939
9	$ 10511	$ 638	$ 1909	$ 0	$ 0	$ 0	$ +0	$ 191	$ 124188
10	$ 10511	$ 672	$ 2017	$ 436	$ 1845	$ 0	$ +0	$ 191	$ 139860
11	$ 10511	$ 672	$ 2132	$ 0	$ 0	$ 0	$ +0	$ 191	$ 153366
12	$ 10511	$ 672	$ 2254	$ 0	$ 0	$ 0	$ +0	$ 191	$ 166994
13	$ 10511	$ 672	$ 2383	$ 0	$ 0	$ 0	$ +0	$ 191	$ 180751
14	$ 10511	$ 672	$ 2518	$ 0	$ 0	$ 0	$ +0	$ 191	$ 194643
15	$ 10511	$ 672	$ 2662	$ 576	$ 0	$ 7768	$ +0	$ 191	$ 217023
16	$ 10511	$ 672	$ 2814	$ 0	$ 0	$ 0	$ +0	$ 0	$ 231020
17	$ 10511	$ 672	$ 2974	$ 0	$ 0	$ 0	$ +0	$ 0	$ 245177
18	$ 10511	$ 672	$ 3143	$ 0	$ 0	$ 0	$ +0	$ 0	$ 259503
19	$ 10511	$ 672	$ 3323	$ 0	$ 0	$ 0	$ +0	$ 0	$ 274009
20	$ 10511	$ 672	$ 3512	$ 760	$ 3211	$ 0	$ +0	$ 0	$ 292675
21	$ 10511	$ 672	$ 3712	$ 0	$ 0	$ 0	$ +0	$ 0	$ 307570
22	$ 10511	$ 672	$ 3924	$ 0	$ 0	$ 0	$ +0	$ 0	$ 322677
23	$ 10511	$ 672	$ 4147	$ 0	$ 0	$ 0	$ +0	$ 0	$ 338007
24	$ 10511	$ 672	$ 4384	$ 0	$ 0	$ 0	$ +0	$ 0	$ 353574
25	$ 10511	$ 672	$ 4634	$ 1002	$ 0	$ 0	$ +0	$ 0	$ 370393
26	$ 10511	$ 672	$ 4898	$ 0	$ 0	$ 0	$ +0	$ 0	$ 386474
27	$ 10511	$ 672	$ 5177	$ 0	$ 0	$ 0	$ +0	$ 0	$ 402834
28	$ 10511	$ 672	$ 5472	$ 0	$ 0	$ 0	$ +0	$ 0	$ 419489
29	$ 10511	$ 672	$ 5784	$ 0	$ 0	$ 0	$ +0	$ 0	$ 436456
30	$ 10511	$ 672	$ 6114	$ 1323	$ 5590	$17842	$ +0	$ 0	$ 478508

**** = BREAKEVEN YEAR

SUMMARY OF ALL ANNUAL COSTS: EARTH SHELTER: CASE NUMBER: 2

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 19807
1	$ 9343	$ 410	$ 950	$ 0	$ 0	$ 0	+0	$ 0	$ 30510
2	$ 9343	$ 412	$ 1004	$ 0	$ 0	$ 0	+0	$ 0	$ 41269
3	$ 9343	$ 430	$ 1061	$ 0	$ 0	$ 0	+0	$ 0	$ 52103
4	$ 9343	$ 462	$ 1122	$ 0	$ 0	$ 0	+0	$ 0	$ 63030
5	$ 9343	$ 494	$ 1186	$ 59	$ 0	$ 0	+0	$ 0	$ 74112
6	$ 9343	$ 528	$ 1253	$ 0	$ 0	$ 0	+0	$ 0	$ 85236
****	$ 9343	$ 566	$ 1325	$ 0	$ 0	$ 0	+0	$ 0	$ 96471
8	$ 9343	$ 606	$ 1400	$ 0	$ 0	$ 0	+0	$ 0	$ 107820
9	$ 9343	$ 638	$ 1480	$ 0	$ 0	$ 0	+0	$ 0	$ 119281
10	$ 9343	$ 672	$ 1565	$ 77	$ 741	$ 0	+0	$ 0	$ 131679
11	$ 9343	$ 672	$ 1654	$ 0	$ 0	$ 0	+0	$ 0	$ 143348
12	$ 9343	$ 672	$ 1748	$ 0	$ 0	$ 0	+0	$ 0	$ 155111
13	$ 9343	$ 672	$ 1848	$ 0	$ 0	$ 0	+0	$ 0	$ 166974
14	$ 9343	$ 672	$ 1953	$ 0	$ 0	$ 0	+0	$ 0	$ 178942
15	$ 9343	$ 672	$ 2064	$ 102	$ 0	$ 1565	+0	$ 0	$ 192688
16	$ 9343	$ 672	$ 2182	$ 0	$ 0	$ 0	+0	$ 0	$ 204885
17	$ 9343	$ 672	$ 2306	$ 0	$ 0	$ 0	+0	$ 0	$ 217206
18	$ 9343	$ 672	$ 2438	$ 0	$ 0	$ 0	+0	$ 0	$ 229659
19	$ 9343	$ 672	$ 2577	$ 0	$ 0	$ 0	+0	$ 0	$ 242251
20	$ 9343	$ 672	$ 2724	$ 135	$ 1290	$ 0	+0	$ 0	$ 256415
21	$ 9343	$ 672	$ 2879	$ 0	$ 0	$ 0	+0	$ 0	$ 269309
22	$ 9343	$ 672	$ 3043	$ 0	$ 0	$ 0	+0	$ 0	$ 282367
23	$ 9343	$ 672	$ 3216	$ 0	$ 0	$ 0	+0	$ 0	$ 295598
24	$ 9343	$ 672	$ 3400	$ 0	$ 0	$ 0	+0	$ 0	$ 309013
25	$ 9343	$ 672	$ 3594	$ 178	$ 0	$ 0	+0	$ 0	$ 322800
26	$ 9343	$ 672	$ 3798	$ 0	$ 0	$ 0	+0	$ 0	$ 336613
27	$ 9343	$ 672	$ 4015	$ 0	$ 0	$ 0	+0	$ 0	$ 350643
28	$ 9343	$ 672	$ 4244	$ 0	$ 0	$ 0	+0	$ 0	$ 364902
29	$ 9343	$ 672	$ 4486	$ 0	$ 0	$ 0	+0	$ 0	$ 379403
30	$ 9343	$ 672	$ 4741	$ 235	$ 2246	$ 3593	+0	$ 0	$ 400233

**** = BREAKEVEN YEAR

CASE NUMBER: 3 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 85000	$102000
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8500	$ 20400
LOAN ORIG. FEE.	$ 765	$ 816
PRIVATE MORT. INS.	$ 383	$ 0
PREPAID INS.	$ 406	$ 452
MORTGAGE POINTS	$ 1148	$ 1632
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11563	$ 23661

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11563	$ 23661			
1	$ 23174	$ 36278	16	$229865	$240356
2	$ 34857	$ 48971	17	$244022	$254683
3	$ 46632	$ 61743	18	$258348	$269142
4	$ 58517	$ 74612	19	$272854	$283740
5	$ 70847	$ 87643	20	$291520	$299910
6	$ 83693	$100724	21	$306415	$314810
7	$ 96670	$113925	22	$321522	$329874
8	$109784	$127256	23	$336852	$345111
9	$123033	$140710	24	$352419	$360532
10	$138705	$155114	25	$369238	$376325
11	$152211	$168789	26	$385319	$392144
12	$165839	$182558	27	$401679	$408180
13	$179596	$196427	28	$418334	$424445
14	$193488	$210401	29	$435301	$440952
15	$215868	$226153	30	$477353	$463788

BREAKEVEN YEAR = 30 BREAK-EVEN AT AHT:

SUMMARY OF ALL ANNUAL COSTS: CONVENTIONAL HOME: CASE NUMBER: 3

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 11563
1	$ 10511	$ 410	$ 1225	$ 0	$ 0	$ 0	$ -726	$ 191	$ 23174
2	$ 10511	$ 412	$ 1295	$ 0	$ 0	$ 0	$ -726	$ 191	$ 34857
3	$ 10511	$ 430	$ 1369	$ 0	$ 0	$ 0	$ -726	$ 191	$ 46632
4	$ 10511	$ 462	$ 1447	$ 0	$ 0	$ 0	$ -726	$ 191	$ 58517
5	$ 10511	$ 494	$ 1529	$ 331	$ 0	$ 0	$ -726	$ 191	$ 70847
6	$ 10511	$ 528	$ 1616	$ 0	$ 0	$ 0	$ +0	$ 191	$ 83693
7	$ 10511	$ 566	$ 1708	$ 0	$ 0	$ 0	$ +0	$ 191	$ 96670
8	$ 10511	$ 606	$ 1806	$ 0	$ 0	$ 0	$ +0	$ 191	$ 109784
9	$ 10511	$ 638	$ 1909	$ 0	$ 0	$ 0	$ +0	$ 191	$ 123033
10	$ 10511	$ 672	$ 2017	$ 436	$ 1845	$ 0	$ +0	$ 191	$ 138705
11	$ 10511	$ 672	$ 2132	$ 0	$ 0	$ 0	$ +0	$ 191	$ 152211
12	$ 10511	$ 672	$ 2254	$ 0	$ 0	$ 0	$ +0	$ 191	$ 165839
13	$ 10511	$ 672	$ 2383	$ 0	$ 0	$ 0	$ +0	$ 191	$ 179596
14	$ 10511	$ 672	$ 2518	$ 0	$ 0	$ 0	$ +0	$ 191	$ 193488
15	$ 10511	$ 672	$ 2662	$ 576	$ 0	$ 7768	$ +0	$ 191	$ 215868
16	$ 10511	$ 672	$ 2814	$ 0	$ 0	$ 0	$ +0	$ 0	$ 229865
17	$ 10511	$ 672	$ 2974	$ 0	$ 0	$ 0	$ +0	$ 0	$ 244022
18	$ 10511	$ 672	$ 3143	$ 0	$ 0	$ 0	$ +0	$ 0	$ 258348
19	$ 10511	$ 672	$ 3323	$ 0	$ 0	$ 0	$ +0	$ 0	$ 272854
20	$ 10511	$ 672	$ 3512	$ 760	$ 3211	$ 0	$ +0	$ 0	$ 291520
21	$ 10511	$ 672	$ 3712	$ 0	$ 0	$ 0	$ +0	$ 0	$ 306415
22	$ 10511	$ 672	$ 3924	$ 0	$ 0	$ 0	$ +0	$ 0	$ 321522
23	$ 10511	$ 672	$ 4147	$ 0	$ 0	$ 0	$ +0	$ 0	$ 336852
24	$ 10511	$ 672	$ 4384	$ 0	$ 0	$ 0	$ +0	$ 0	$ 352419
25	$ 10511	$ 672	$ 4634	$ 1002	$ 0	$ 0	$ +0	$ 0	$ 369238
26	$ 10511	$ 672	$ 4898	$ 0	$ 0	$ 0	$ +0	$ 0	$ 385319
27	$ 10511	$ 672	$ 5177	$ 0	$ 0	$ 0	$ +0	$ 0	$ 401679
28	$ 10511	$ 672	$ 5472	$ 0	$ 0	$ 0	$ +0	$ 0	$ 418334
29	$ 10511	$ 672	$ 5784	$ 0	$ 0	$ 0	$ +0	$ 0	$ 435301
****	$ 10511	$ 672	$ 6114	$ 1323	$ 5590	$17842	$ +0	$ 0	$ 477353

**** = BREAKEVEN YEAR

SUMMARY OF ALL ANNUAL COSTS: EARTH SHELTER: CASE NUMBER: 3

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 23661
1	$ 11212	$ 455	$ 950	$ 0	$ 0	$ 0	$ +0	$ 0	$ 36278
2	$ 11212	$ 477	$ 1004	$ 0	$ 0	$ 0	$ +0	$ 0	$ 48971
3	$ 11212	$ 499	$ 1061	$ 0	$ 0	$ 0	$ +0	$ 0	$ 61743
4	$ 11212	$ 535	$ 1122	$ 0	$ 0	$ 0	$ +0	$ 0	$ 74612
5	$ 11212	$ 573	$ 1186	$ 59	$ 0	$ 0	$ +0	$ 0	$ 87643
6	$ 11212	$ 616	$ 1253	$ 0	$ 0	$ 0	$ +0	$ 0	$ 100724
7	$ 11212	$ 663	$ 1325	$ 0	$ 0	$ 0	$ +0	$ 0	$ 113925
8	$ 11212	$ 719	$ 1400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 127256
9	$ 11212	$ 762	$ 1480	$ 0	$ 0	$ 0	$ +0	$ 0	$ 140710
10	$ 11212	$ 809	$ 1565	$ 77	$ 741	$ 0	$ +0	$ 0	$ 155114
11	$ 11212	$ 809	$ 1654	$ 0	$ 0	$ 0	$ +0	$ 0	$ 168789
12	$ 11212	$ 809	$ 1748	$ 0	$ 0	$ 0	$ +0	$ 0	$ 182558
13	$ 11212	$ 809	$ 1848	$ 0	$ 0	$ 0	$ +0	$ 0	$ 196427
14	$ 11212	$ 809	$ 1953	$ 0	$ 0	$ 0	$ +0	$ 0	$ 210401
15	$ 11212	$ 809	$ 2064	$ 102	$ 0	$ 1565	$ +0	$ 0	$ 226153
16	$ 11212	$ 809	$ 2182	$ 0	$ 0	$ 0	$ +0	$ 0	$ 240356
17	$ 11212	$ 809	$ 2306	$ 0	$ 0	$ 0	$ +0	$ 0	$ 254683
18	$ 11212	$ 809	$ 2438	$ 0	$ 0	$ 0	$ +0	$ 0	$ 269142
19	$ 11212	$ 809	$ 2577	$ 0	$ 0	$ 0	$ +0	$ 0	$ 283740
20	$ 11212	$ 809	$ 2724	$ 135	$ 1290	$ 0	$ +0	$ 0	$ 299910
21	$ 11212	$ 809	$ 2879	$ 0	$ 0	$ 0	$ +0	$ 0	$ 314810
22	$ 11212	$ 809	$ 3043	$ 0	$ 0	$ 0	$ +0	$ 0	$ 329874
23	$ 11212	$ 809	$ 3216	$ 0	$ 0	$ 0	$ +0	$ 0	$ 345111
24	$ 11212	$ 809	$ 3400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 360532
25	$ 11212	$ 809	$ 3594	$ 178	$ 0	$ 0	$ +0	$ 0	$ 376325
26	$ 11212	$ 809	$ 3798	$ 0	$ 0	$ 0	$ +0	$ 0	$ 392144
27	$ 11212	$ 809	$ 4015	$ 0	$ 0	$ 0	$ +0	$ 0	$ 408180
28	$ 11212	$ 809	$ 4244	$ 0	$ 0	$ 0	$ +0	$ 0	$ 424445
29	$ 11212	$ 809	$ 4486	$ 0	$ 0	$ 0	$ +0	$ 0	$ 440952
****	$ 11212	$ 809	$ 4741	$ 235	$ 2246	$ 3593	$ +0	$ 0	$ 463788

**** = BREAKEVEN YEAR

CASE NUMBER: 4 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 85000	$ 93500
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	70.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8500	$ 28050
LOAN ORIG. FEE.	$ 765	$ 655
PRIVATE MORT. INS.	$ 383	$ 0
PREPAID INS.	$ 406	$ 419
MORTGAGE POINTS	$ 1148	$ 1309
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11563	$ 30794

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11563	$ 30794			
1	$ 22746	$ 41160	16	$227725	$211101
2	$ 34001	$ 51602	17	$241882	$223138
3	$ 45348	$ 62122	18	$256208	$235307
4	$ 56805	$ 72735	19	$270714	$247615
5	$ 68707	$ 83509	20	$289380	$261495
6	$ 81553	$ 94329	21	$304275	$274105
7	$ 94530	$105261	22	$319382	$286879
8	$107644	$116312	23	$334712	$299826
9	$120893	$127485	24	$350279	$312957
10	$136565	$139599	25	$367098	$326460
11	$150071	$150984	26	$383179	$339989
12	$163699	$162463	27	$399539	$353735
13	$177456	$174042	28	$416194	$367710
14	$191348	$185726	29	$433161	$381927
15	$213728	$199188	30	$475213	$402473

BREAKEVEN YEAR = .12 BREAK-EVEN AT AHT:

SUMMARY OF ALL ANNUAL COSTS: CONVENTIONAL HOME: CASE NUMBER: 4

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 11563
1	$ 10511	$ 410	$ 1225	$ 0	$ 0	$ 0	$-1154	$ 191	$ 22746
2	$ 10511	$ 412	$ 1295	$ 0	$ 0	$ 0	$-1154	$ 191	$ 34001
3	$ 10511	$ 430	$ 1369	$ 0	$ 0	$ 0	$-1154	$ 191	$ 45348
4	$ 10511	$ 462	$ 1447	$ 0	$ 0	$ 0	$-1154	$ 191	$ 56805
5	$ 10511	$ 494	$ 1529	$ 331	$ 0	$ 0	$-1154	$ 191	$ 68707
6	$ 10511	$ 528	$ 1616	$ 0	$ 0	$ 0	$ +0	$ 191	$ 81553
7	$ 10511	$ 566	$ 1708	$ 0	$ 0	$ 0	$ +0	$ 191	$ 94530
8	$ 10511	$ 606	$ 1806	$ 0	$ 0	$ 0	$ +0	$ 191	$ 107644
9	$ 10511	$ 638	$ 1909	$ 0	$ 0	$ 0	$ +0	$ 191	$ 120893
10	$ 10511	$ 672	$ 2017	$ 436	$ 1845	$ 0	$ +0	$ 191	$ 136565
11	$ 10511	$ 672	$ 2132	$ 0	$ 0	$ 0	$ +0	$ 191	$ 150071
****	$ 10511	$ 672	$ 2254	$ 0	$ 0	$ 0	$ +0	$ 191	$ 163699
13	$ 10511	$ 672	$ 2383	$ 0	$ 0	$ 0	$ +0	$ 191	$ 177456
14	$ 10511	$ 672	$ 2518	$ 0	$ 0	$ 0	$ +0	$ 191	$ 191348
15	$ 10511	$ 672	$ 2662	$ 576	$ 0	$ 7768	$ +0	$ 191	$ 213728
16	$ 10511	$ 672	$ 2814	$ 0	$ 0	$ 0	$ +0	$ 0	$ 227725
17	$ 10511	$ 672	$ 2974	$ 0	$ 0	$ 0	$ +0	$ 0	$ 241882
18	$ 10511	$ 672	$ 3143	$ 0	$ 0	$ 0	$ +0	$ 0	$ 256208
19	$ 10511	$ 672	$ 3323	$ 0	$ 0	$ 0	$ +0	$ 0	$ 270714
20	$ 10511	$ 672	$ 3512	$ 760	$ 3211	$ 0	$ +0	$ 0	$ 289380
21	$ 10511	$ 672	$ 3712	$ 0	$ 0	$ 0	$ +0	$ 0	$ 304275
22	$ 10511	$ 672	$ 3924	$ 0	$ 0	$ 0	$ +0	$ 0	$ 319382
23	$ 10511	$ 672	$ 4147	$ 0	$ 0	$ 0	$ +0	$ 0	$ 334712
24	$ 10511	$ 672	$ 4384	$ 0	$ 0	$ 0	$ +0	$ 0	$ 350279
25	$ 10511	$ 672	$ 4634	$ 1002	$ 0	$ 0	$ +0	$ 0	$ 367098
26	$ 10511	$ 672	$ 4898	$ 0	$ 0	$ 0	$ +0	$ 0	$ 383179
27	$ 10511	$ 672	$ 5177	$ 0	$ 0	$ 0	$ +0	$ 0	$ 399539
28	$ 10511	$ 672	$ 5472	$ 0	$ 0	$ 0	$ +0	$ 0	$ 416194
29	$ 10511	$ 672	$ 5784	$ 0	$ 0	$ 0	$ +0	$ 0	$ 433161
30	$ 10511	$ 672	$ 6114	$ 1323	$ 5590	$17842	$ +0	$ 0	$ 475213

**** = BREAKEVEN YEAR

SUMMARY OF ALL ANNUAL COSTS: EARTH SHELTER: CASE NUMBER: 4

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 30794
1	$ 8993	$ 423	$ 950	$ 0	$ 0	$ 0	$ +0	$ 0	$ 41160
2	$ 8993	$ 445	$ 1004	$ 0	$ 0	$ 0	$ +0	$ 0	$ 51602
3	$ 8993	$ 466	$ 1061	$ 0	$ 0	$ 0	$ +0	$ 0	$ 62122
4	$ 8993	$ 499	$ 1122	$ 0	$ 0	$ 0	$ +0	$ 0	$ 72735
5	$ 8993	$ 536	$ 1186	$ 59	$ 0	$ 0	$ +0	$ 0	$ 83509
6	$ 8993	$ 574	$ 1253	$ 0	$ 0	$ 0	$ +0	$ 0	$ 94329
7	$ 8993	$ 613	$ 1325	$ 0	$ 0	$ 0	$ +0	$ 0	$ 105261
8	$ 8993	$ 658	$ 1400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 116312
9	$ 8993	$ 700	$ 1480	$ 0	$ 0	$ 0	$ +0	$ 0	$ 127485
10	$ 8993	$ 738	$ 1565	$ 77	$ 741	$ 0	$ +0	$ 0	$ 139599
11	$ 8993	$ 738	$ 1654	$ 0	$ 0	$ 0	$ +0	$ 0	$ 150984
****	$ 8993	$ 738	$ 1748	$ 0	$ 0	$ 0	$ +0	$ 0	$ 162463
13	$ 8993	$ 738	$ 1848	$ 0	$ 0	$ 0	$ +0	$ 0	$ 174042
14	$ 8993	$ 738	$ 1953	$ 0	$ 0	$ 0	$ +0	$ 0	$ 185726
15	$ 8993	$ 738	$ 2064	$ 102	$ 0	$ 1565	$ +0	$ 0	$ 199188
16	$ 8993	$ 738	$ 2182	$ 0	$ 0	$ 0	$ +0	$ 0	$ 211101
17	$ 8993	$ 738	$ 2306	$ 0	$ 0	$ 0	$ +0	$ 0	$ 223138
18	$ 8993	$ 738	$ 2438	$ 0	$ 0	$ 0	$ +0	$ 0	$ 235307
19	$ 8993	$ 738	$ 2577	$ 0	$ 0	$ 0	$ +0	$ 0	$ 247615
20	$ 8993	$ 738	$ 2724	$ 135	$ 1290	$ 0	$ +0	$ 0	$ 261495
21	$ 8993	$ 738	$ 2879	$ 0	$ 0	$ 0	$ +0	$ 0	$ 274105
22	$ 8993	$ 738	$ 3043	$ 0	$ 0	$ 0	$ +0	$ 0	$ 286879
23	$ 8993	$ 738	$ 3216	$ 0	$ 0	$ 0	$ +0	$ 0	$ 299826
24	$ 8993	$ 738	$ 3400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 312957
25	$ 8993	$ 738	$ 3594	$ 178	$ 0	$ 0	$ +0	$ 0	$ 326460
26	$ 8993	$ 738	$ 3798	$ 0	$ 0	$ 0	$ +0	$ 0	$ 339989
27	$ 8993	$ 738	$ 4015	$ 0	$ 0	$ 0	$ +0	$ 0	$ 353735
28	$ 8993	$ 738	$ 4244	$ 0	$ 0	$ 0	$ +0	$ 0	$ 367710
29	$ 8993	$ 738	$ 4486	$ 0	$ 0	$ 0	$ +0	$ 0	$ 381927
30	$ 8993	$ 738	$ 4741	$ 235	$ 2246	$ 3593	$ +0	$ 0	$ 402473

**** = BREAKEVEN YEAR

CASE NUMBER: 5 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 85000	$ 93500
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	90.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8500	$ 9350
LOAN ORIG. FEE.	$ 765	$ 842
PRIVATE MORT. INS.	$ 383	$ 421
PREPAID INS.	$ 406	$ 419
MORTGAGE POINTS	$ 1148	$ 1683
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11563	$ 13076

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11563	$ 13076			
1	$ 23809	$ 26221	16	$233040	$237847
2	$ 36127	$ 39442	17	$247197	$252663
3	$ 48537	$ 52741	18	$261523	$267611
4	$ 61057	$ 66133	19	$276029	$282488
5	$ 74022	$ 79686	20	$294695	$298937
6	$ 86868	$ 93285	21	$309590	$314116
7	$ 99845	$106996	22	$324697	$329459
8	$112959	$120826	23	$340027	$344975
9	$126208	$134778	24	$355594	$360675
10	$141880	$149671	25	$372413	$376747
11	$155386	$163835	26	$388494	$392845
12	$169014	$178093	27	$404854	$409160
13	$182771	$192451	28	$421509	$425704
14	$196663	$206914	29	$438476	$442490
15	$219043	$223155	30	$480528	$465605

BREAKEVEN YEAR = 30 BREAK-EVEN AT AHT:

SUMMARY OF ALL ANNUAL COSTS: CONVENTIONAL HOME: CASE NUMBER: 5

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 11563
1	$ 10511	$ 410	$ 1225	$ 0	$ 0	$ 0	$ -91	$ 191	$ 23809
2	$ 10511	$ 412	$ 1295	$ 0	$ 0	$ 0	$ -91	$ 191	$ 36127
3	$ 10511	$ 430	$ 1369	$ 0	$ 0	$ 0	$ -91	$ 191	$ 48537
4	$ 10511	$ 462	$ 1447	$ 0	$ 0	$ 0	$ -91	$ 191	$ 61057
5	$ 10511	$ 494	$ 1529	$ 331	$ 0	$ 0	$ -91	$ 191	$ 74022
6	$ 10511	$ 528	$ 1616	$ 0	$ 0	$ 0	$ +0	$ 191	$ 86868
7	$ 10511	$ 566	$ 1708	$ 0	$ 0	$ 0	$ +0	$ 191	$ 99845
8	$ 10511	$ 606	$ 1806	$ 0	$ 0	$ 0	$ +0	$ 191	$ 112959
9	$ 10511	$ 638	$ 1909	$ 0	$ 0	$ 0	$ +0	$ 191	$ 126208
10	$ 10511	$ 672	$ 2017	$ 436	$ 1845	$ 0	$ +0	$ 191	$ 141880
11	$ 10511	$ 672	$ 2132	$ 0	$ 0	$ 0	$ +0	$ 191	$ 155386
12	$ 10511	$ 672	$ 2254	$ 0	$ 0	$ 0	$ +0	$ 191	$ 169014
13	$ 10511	$ 672	$ 2383	$ 0	$ 0	$ 0	$ +0	$ 191	$ 182771
14	$ 10511	$ 672	$ 2518	$ 0	$ 0	$ 0	$ +0	$ 191	$ 196663
15	$ 10511	$ 672	$ 2662	$ 576	$ 0	$ 7768	$ +0	$ 191	$ 219043
16	$ 10511	$ 672	$ 2814	$ 0	$ 0	$ 0	$ +0	$ 0	$ 233040
17	$ 10511	$ 672	$ 2974	$ 0	$ 0	$ 0	$ +0	$ 0	$ 247197
18	$ 10511	$ 672	$ 3143	$ 0	$ 0	$ 0	$ +0	$ 0	$ 261523
19	$ 10511	$ 672	$ 3323	$ 0	$ 0	$ 0	$ +0	$ 0	$ 276029
20	$ 10511	$ 672	$ 3512	$ 760	$ 3211	$ 0	$ +0	$ 0	$ 294695
21	$ 10511	$ 672	$ 3712	$ 0	$ 0	$ 0	$ +0	$ 0	$ 309590
22	$ 10511	$ 672	$ 3924	$ 0	$ 0	$ 0	$ +0	$ 0	$ 324697
23	$ 10511	$ 672	$ 4147	$ 0	$ 0	$ 0	$ +0	$ 0	$ 340027
24	$ 10511	$ 672	$ 4384	$ 0	$ 0	$ 0	$ +0	$ 0	$ 355594
25	$ 10511	$ 672	$ 4634	$ 1002	$ 0	$ 0	$ +0	$ 0	$ 372413
26	$ 10511	$ 672	$ 4898	$ 0	$ 0	$ 0	$ +0	$ 0	$ 388494
27	$ 10511	$ 672	$ 5177	$ 0	$ 0	$ 0	$ +0	$ 0	$ 404854
28	$ 10511	$ 672	$ 5472	$ 0	$ 0	$ 0	$ +0	$ 0	$ 421509
29	$ 10511	$ 672	$ 5784	$ 0	$ 0	$ 0	$ +0	$ 0	$ 438476
****	$ 10511	$ 672	$ 6114	$ 1323	$ 5590	$17842	$ +0	$ 0	$ 480528

**** = BREAKEVEN YEAR

SUMMARY OF ALL ANNUAL COSTS: EARTH SHELTER: CASE NUMBER: 5

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 13076
1	$ 11562	$ 423	$ 950	$ 0	$ 0	$ 0	$ +0	$ 210	$ 26221
2	$ 11562	$ 445	$ 1004	$ 0	$ 0	$ 0	$ +0	$ 210	$ 39442
3	$ 11562	$ 466	$ 1061	$ 0	$ 0	$ 0	$ +0	$ 210	$ 52741
4	$ 11562	$ 499	$ 1122	$ 0	$ 0	$ 0	$ +0	$ 210	$ 66133
5	$ 11562	$ 536	$ 1186	$ 59	$ 0	$ 0	$ +0	$ 210	$ 79686
6	$ 11562	$ 574	$ 1253	$ 0	$ 0	$ 0	$ +0	$ 210	$ 93285
7	$ 11562	$ 613	$ 1325	$ 0	$ 0	$ 0	$ +0	$ 210	$ 106996
8	$ 11562	$ 658	$ 1400	$ 0	$ 0	$ 0	$ +0	$ 210	$ 120826
9	$ 11562	$ 700	$ 1480	$ 0	$ 0	$ 0	$ +0	$ 210	$ 134778
10	$ 11562	$ 738	$ 1565	$ 77	$ 741	$ 0	$ +0	$ 210	$ 149671
11	$ 11562	$ 738	$ 1654	$ 0	$ 0	$ 0	$ +0	$ 210	$ 163835
12	$ 11562	$ 738	$ 1748	$ 0	$ 0	$ 0	$ +0	$ 210	$ 178093
13	$ 11562	$ 738	$ 1848	$ 0	$ 0	$ 0	$ +0	$ 210	$ 192451
14	$ 11562	$ 738	$ 1953	$ 0	$ 0	$ 0	$ +0	$ 210	$ 206914
15	$ 11562	$ 738	$ 2064	$ 102	$ 0	$ 1565	$ +0	$ 210	$ 223155
16	$ 11562	$ 738	$ 2182	$ 0	$ 0	$ 0	$ +0	$ 210	$ 237847
17	$ 11562	$ 738	$ 2306	$ 0	$ 0	$ 0	$ +0	$ 210	$ 252663
18	$ 11562	$ 738	$ 2438	$ 0	$ 0	$ 0	$ +0	$ 210	$ 267611
19	$ 11562	$ 738	$ 2577	$ 0	$ 0	$ 0	$ +0	$ 0	$ 282488
20	$ 11562	$ 738	$ 2724	$ 135	$ 1290	$ 0	$ +0	$ 0	$ 298937
21	$ 11562	$ 738	$ 2879	$ 0	$ 0	$ 0	$ +0	$ 0	$ 314116
22	$ 11562	$ 738	$ 3043	$ 0	$ 0	$ 0	$ +0	$ 0	$ 329459
23	$ 11562	$ 738	$ 3216	$ 0	$ 0	$ 0	$ +0	$ 0	$ 344975
24	$ 11562	$ 738	$ 3400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 360675
25	$ 11562	$ 738	$ 3594	$ 178	$ 0	$ 0	$ +0	$ 0	$ 376747
26	$ 11562	$ 738	$ 3798	$ 0	$ 0	$ 0	$ +0	$ 0	$ 392845
27	$ 11562	$ 738	$ 4015	$ 0	$ 0	$ 0	$ +0	$ 0	$ 409160
28	$ 11562	$ 738	$ 4244	$ 0	$ 0	$ 0	$ +0	$ 0	$ 425704
29	$ 11562	$ 738	$ 4486	$ 0	$ 0	$ 0	$ +0	$ 0	$ 442490
****	$ 11562	$ 738	$ 4741	$ 235	$ 2246	$ 3593	$ +0	$ 0	$ 465605

**** = BREAKEVEN YEAR

CASE NUMBER: 6 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 85000	$ 93500
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	12.00%	12.00%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8500	$ 18700
LOAN ORIG. FEE.	$ 765	$ 748
PRIVATE MORT. INS.	$ 383	$ 0
PREPAID INS.	$ 406	$ 419
MORTGAGE POINTS	$ 1148	$ 1496
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11563	$ 21724

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11563	$ 21724			
1	$ 22225	$ 32333	16	$213023	$205919
2	$ 32959	$ 43018	17	$226115	$218199
3	$ 43785	$ 53781	18	$239376	$230611
4	$ 54721	$ 64637	19	$252817	$243162
5	$ 66102	$ 75654	20	$270418	$257285
6	$ 77883	$ 86717	21	$284248	$270138
7	$ 89795	$ 97892	22	$298290	$283155
8	$101844	$109186	23	$312555	$296345
9	$114028	$120602	24	$327057	$309719
10	$128635	$132959	25	$342811	$323465
11	$141076	$144587	26	$357827	$337237
12	$153639	$156309	27	$373122	$351226
13	$166331	$168131	28	$388712	$365444
14	$178967	$180058	29	$404614	$379904
15	$200091	$193763	30	$445601	$400693

BREAKEVEN YEAR = 15 BREAK-EVEN AT AHT:

SUMMARY OF ALL ANNUAL COSTS: CONVENTIONAL HOME: CASE NUMBER: 6

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 11563
1	$ 9446	$ 410	$ 1225	$ 0	$ 0	$ 0	$ -610	$ 191	$ 22225
2	$ 9446	$ 412	$ 1295	$ 0	$ 0	$ 0	$ -610	$ 191	$ 32959
3	$ 9446	$ 430	$ 1369	$ 0	$ 0	$ 0	$ -610	$ 191	$ 43785
4	$ 9446	$ 462	$ 1447	$ 0	$ 0	$ 0	$ -610	$ 191	$ 54721
5	$ 9446	$ 494	$ 1529	$ 331	$ 0	$ 0	$ -610	$ 191	$ 66102
6	$ 9446	$ 528	$ 1616	$ 0	$ 0	$ 0	$ +0	$ 191	$ 77883
7	$ 9446	$ 566	$ 1708	$ 0	$ 0	$ 0	$ +0	$ 191	$ 89795
8	$ 9446	$ 606	$ 1806	$ 0	$ 0	$ 0	$ +0	$ 191	$ 101844
9	$ 9446	$ 638	$ 1909	$ 0	$ 0	$ 0	$ +0	$ 191	$ 114028
10	$ 9446	$ 672	$ 2017	$ 436	$ 1845	$ 0	$ +0	$ 191	$ 128635
11	$ 9446	$ 672	$ 2132	$ 0	$ 0	$ 0	$ +0	$ 191	$ 141076
12	$ 9446	$ 672	$ 2254	$ 0	$ 0	$ 0	$ +0	$ 191	$ 153639
13	$ 9446	$ 672	$ 2383	$ 0	$ 0	$ 0	$ +0	$ 191	$ 166331
14	$ 9446	$ 672	$ 2518	$ 0	$ 0	$ 0	$ +0	$ 0	$ 178967
****	$ 9446	$ 672	$ 2662	$ 576	$ 0	$ 7768	$ +0	$ 0	$ 200091
16	$ 9446	$ 672	$ 2814	$ 0	$ 0	$ 0	$ +0	$ 0	$ 213023
17	$ 9446	$ 672	$ 2974	$ 0	$ 0	$ 0	$ +0	$ 0	$ 226115
18	$ 9446	$ 672	$ 3143	$ 0	$ 0	$ 0	$ +0	$ 0	$ 239376
19	$ 9446	$ 672	$ 3323	$ 0	$ 0	$ 0	$ +0	$ 0	$ 252817
20	$ 9446	$ 672	$ 3512	$ 760	$ 3211	$ 0	$ +0	$ 0	$ 270418
21	$ 9446	$ 672	$ 3712	$ 0	$ 0	$ 0	$ +0	$ 0	$ 284248
22	$ 9446	$ 672	$ 3924	$ 0	$ 0	$ 0	$ +0	$ 0	$ 298290
23	$ 9446	$ 672	$ 4147	$ 0	$ 0	$ 0	$ +0	$ 0	$ 312555
24	$ 9446	$ 672	$ 4384	$ 0	$ 0	$ 0	$ +0	$ 0	$ 327057
25	$ 9446	$ 672	$ 4634	$ 1002	$ 0	$ 0	$ +0	$ 0	$ 342811
26	$ 9446	$ 672	$ 4898	$ 0	$ 0	$ 0	$ +0	$ 0	$ 357827
27	$ 9446	$ 672	$ 5177	$ 0	$ 0	$ 0	$ +0	$ 0	$ 373122
28	$ 9446	$ 672	$ 5472	$ 0	$ 0	$ 0	$ +0	$ 0	$ 388712
29	$ 9446	$ 672	$ 5784	$ 0	$ 0	$ 0	$ +0	$ 0	$ 404614
30	$ 9446	$ 672	$ 6114	$ 1323	$ 5590	$17842	$ +0	$ 0	$ 445601

**** = BREAKEVEN YEAR

SUMMARY OF ALL ANNUAL COSTS: EARTH SHELTER: CASE NUMBER: 6

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 21724
1	$ 9236	$ 423	$ 950	$ 0	$ 0	$ 0	$ +0	$ 0	$ 32333
2	$ 9236	$ 445	$ 1004	$ 0	$ 0	$ 0	$ +0	$ 0	$ 43018
3	$ 9236	$ 466	$ 1061	$ 0	$ 0	$ 0	$ +0	$ 0	$ 53781
4	$ 9236	$ 499	$ 1122	$ 0	$ 0	$ 0	$ +0	$ 0	$ 64637
5	$ 9236	$ 536	$ 1186	$ 59	$ 0	$ 0	$ +0	$ 0	$ 75654
6	$ 9236	$ 574	$ 1253	$ 0	$ 0	$ 0	$ +0	$ 0	$ 86717
7	$ 9236	$ 613	$ 1325	$ 0	$ 0	$ 0	$ +0	$ 0	$ 97892
8	$ 9236	$ 658	$ 1400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 109186
9	$ 9236	$ 700	$ 1480	$ 0	$ 0	$ 0	$ +0	$ 0	$ 120602
10	$ 9236	$ 738	$ 1565	$ 77	$ 741	$ 0	$ +0	$ 0	$ 132959
11	$ 9236	$ 738	$ 1654	$ 0	$ 0	$ 0	$ +0	$ 0	$ 144587
12	$ 9236	$ 738	$ 1748	$ 0	$ 0	$ 0	$ +0	$ 0	$ 156309
13	$ 9236	$ 738	$ 1848	$ 0	$ 0	$ 0	$ +0	$ 0	$ 168131
14	$ 9236	$ 738	$ 1953	$ 0	$ 0	$ 0	$ +0	$ 0	$ 180058
****	$ 9236	$ 738	$ 2064	$ 102	$ 0	$ 1565	$ +0	$ 0	$ 193763
16	$ 9236	$ 738	$ 2182	$ 0	$ 0	$ 0	$ +0	$ 0	$ 205919
17	$ 9236	$ 738	$ 2306	$ 0	$ 0	$ 0	$ +0	$ 0	$ 218199
18	$ 9236	$ 738	$ 2438	$ 0	$ 0	$ 0	$ +0	$ 0	$ 230611
19	$ 9236	$ 738	$ 2577	$ 0	$ 0	$ 0	$ +0	$ 0	$ 243162
20	$ 9236	$ 738	$ 2724	$ 135	$ 1290	$ 0	$ +0	$ 0	$ 257285
21	$ 9236	$ 738	$ 2879	$ 0	$ 0	$ 0	$ +0	$ 0	$ 270138
22	$ 9236	$ 738	$ 3043	$ 0	$ 0	$ 0	$ +0	$ 0	$ 283155
23	$ 9236	$ 738	$ 3216	$ 0	$ 0	$ 0	$ +0	$ 0	$ 296345
24	$ 9236	$ 738	$ 3400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 309719
25	$ 9236	$ 738	$ 3594	$ 178	$ 0	$ 0	$ +0	$ 0	$ 323465
26	$ 9236	$ 738	$ 3798	$ 0	$ 0	$ 0	$ +0	$ 0	$ 337237
27	$ 9236	$ 738	$ 4015	$ 0	$ 0	$ 0	$ +0	$ 0	$ 351226
28	$ 9236	$ 738	$ 4244	$ 0	$ 0	$ 0	$ +0	$ 0	$ 365444
29	$ 9236	$ 738	$ 4486	$ 0	$ 0	$ 0	$ +0	$ 0	$ 379904
30	$ 9236	$ 738	$ 4741	$ 235	$ 2246	$ 3593	$ +0	$ 0	$ 400693

**** = BREAKEVEN YEAR

CASE NUMBER: 7 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 85000	$ 93500
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	18.00%	18.00%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8500	$ 18700
LOAN ORIG. FEE.	$ 765	$ 748
PRIVATE MORT. INS.	$ 383	$ 0
PREPAID INS.	$ 406	$ 419
MORTGAGE POINTS	$ 1148	$ 1496
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11563	$ 21724

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11563	$ 21724			
1	$ 26613	$ 36624	16	$283804	$274575
2	$ 41735	$ 51600	17	$301475	$291146
3	$ 56949	$ 66654	18	$319315	$307849
4	$ 72273	$ 81801	19	$337144	$324691
5	$ 88042	$ 97109	20	$359133	$343105
6	$104211	$112463	21	$377351	$360249
7	$120511	$127929	22	$395781	$377557
8	$136948	$143514	23	$414434	$395038
9	$153520	$159221	24	$433324	$412703
10	$172515	$175869	25	$453466	$430740
11	$189344	$191788	26	$472870	$448803
12	$206295	$207801	27	$492553	$467083
13	$223375	$223914	28	$512531	$485592
14	$240590	$240132	29	$532821	$504343
15	$266293	$258128	30	$578196	$529423

BREAKEVEN YEAR = 14 BREAK-EVEN AT AHT:

SUMMARY OF ALL ANNUAL COSTS: CONVENTIONAL HOME: CASE NUMBER: 7

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 11563
1	$ 13834	$ 410	$ 1225	$ 0	$ 0	$ 0	$ -610	$ 191	$ 26613
2	$ 13834	$ 412	$ 1295	$ 0	$ 0	$ 0	$ -610	$ 191	$ 41735
3	$ 13834	$ 430	$ 1369	$ 0	$ 0	$ 0	$ -610	$ 191	$ 56949
4	$ 13834	$ 462	$ 1447	$ 0	$ 0	$ 0	$ -610	$ 191	$ 72273
5	$ 13834	$ 494	$ 1529	$ 331	$ 0	$ 0	$ -610	$ 191	$ 88042
6	$ 13834	$ 528	$ 1616	$ 0	$ 0	$ 0	$ +0	$ 191	$ 104211
7	$ 13834	$ 566	$ 1708	$ 0	$ 0	$ 0	$ +0	$ 191	$ 120511
8	$ 13834	$ 606	$ 1806	$ 0	$ 0	$ 0	$ +0	$ 191	$ 136948
9	$ 13834	$ 638	$ 1909	$ 0	$ 0	$ 0	$ +0	$ 191	$ 153520
10	$ 13834	$ 672	$ 2017	$ 436	$ 1845	$ 0	$ +0	$ 191	$ 172515
11	$ 13834	$ 672	$ 2132	$ 0	$ 0	$ 0	$ +0	$ 191	$ 189344
12	$ 13834	$ 672	$ 2254	$ 0	$ 0	$ 0	$ +0	$ 191	$ 206295
13	$ 13834	$ 672	$ 2383	$ 0	$ 0	$ 0	$ +0	$ 191	$ 223375
****	$ 13834	$ 672	$ 2518	$ 0	$ 0	$ 0	$ +0	$ 191	$ 240590
15	$ 13834	$ 672	$ 2662	$ 576	$ 0	$ 7768	$ +0	$ 191	$ 266293
16	$ 13834	$ 672	$ 2814	$ 0	$ 0	$ 0	$ +0	$ 191	$ 283804
17	$ 13834	$ 672	$ 2974	$ 0	$ 0	$ 0	$ +0	$ 191	$ 301475
18	$ 13834	$ 672	$ 3143	$ 0	$ 0	$ 0	$ +0	$ 191	$ 319315
19	$ 13834	$ 672	$ 3323	$ 0	$ 0	$ 0	$ +0	$ 0	$ 337144
20	$ 13834	$ 672	$ 3512	$ 760	$ 3211	$ 0	$ +0	$ 0	$ 359133
21	$ 13834	$ 672	$ 3712	$ 0	$ 0	$ 0	$ +0	$ 0	$ 377351
22	$ 13834	$ 672	$ 3924	$ 0	$ 0	$ 0	$ +0	$ 0	$ 395781
23	$ 13834	$ 672	$ 4147	$ 0	$ 0	$ 0	$ +0	$ 0	$ 414434
24	$ 13834	$ 672	$ 4384	$ 0	$ 0	$ 0	$ +0	$ 0	$ 433324
25	$ 13834	$ 672	$ 4634	$ 1002	$ 0	$ 0	$ +0	$ 0	$ 453466
26	$ 13834	$ 672	$ 4898	$ 0	$ 0	$ 0	$ +0	$ 0	$ 472870
27	$ 13834	$ 672	$ 5177	$ 0	$ 0	$ 0	$ +0	$ 0	$ 492553
28	$ 13834	$ 672	$ 5472	$ 0	$ 0	$ 0	$ +0	$ 0	$ 512531
29	$ 13834	$ 672	$ 5784	$ 0	$ 0	$ 0	$ +0	$ 0	$ 532821
30	$ 13834	$ 672	$ 6114	$ 1323	$ 5590	$17842	$ +0	$ 0	$ 578196

**** = BREAKEVEN YEAR

SUMMARY OF ALL ANNUAL COSTS: EARTH SHELTER: CASE NUMBER: 7

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 21724
1	$ 13527	$ 423	$ 950	$ 0	$ 0	$ 0	+0	$ 0	$ 36624
2	$ 13527	$ 445	$ 1004	$ 0	$ 0	$ 0	+0	$ 0	$ 51600
3	$ 13527	$ 466	$ 1061	$ 0	$ 0	$ 0	+0	$ 0	$ 66654
4	$ 13527	$ 499	$ 1122	$ 0	$ 0	$ 0	+0	$ 0	$ 81801
5	$ 13527	$ 536	$ 1186	$ 59	$ 0	$ 0	+0	$ 0	$ 97109
6	$ 13527	$ 574	$ 1253	$ 0	$ 0	$ 0	+0	$ 0	$ 112463
7	$ 13527	$ 613	$ 1325	$ 0	$ 0	$ 0	+0	$ 0	$ 127929
8	$ 13527	$ 658	$ 1400	$ 0	$ 0	$ 0	+0	$ 0	$ 143514
9	$ 13527	$ 700	$ 1480	$ 0	$ 0	$ 0	+0	$ 0	$ 159221
10	$ 13527	$ 738	$ 1565	$ 77	$ 741	$ 0	+0	$ 0	$ 175869
11	$ 13527	$ 738	$ 1654	$ 0	$ 0	$ 0	+0	$ 0	$ 191788
12	$ 13527	$ 738	$ 1748	$ 0	$ 0	$ 0	+0	$ 0	$ 207801
13	$ 13527	$ 738	$ 1848	$ 0	$ 0	$ 0	+0	$ 0	$ 223914
****	$ 13527	$ 738	$ 1953	$ 0	$ 0	$ 0	+0	$ 0	$ 240132
15	$ 13527	$ 738	$ 2064	$ 102	$ 0	$ 1565	+0	$ 0	$ 258128
16	$ 13527	$ 738	$ 2182	$ 0	$ 0	$ 0	+0	$ 0	$ 274575
17	$ 13527	$ 738	$ 2306	$ 0	$ 0	$ 0	+0	$ 0	$ 291146
18	$ 13527	$ 738	$ 2438	$ 0	$ 0	$ 0	+0	$ 0	$ 307849
19	$ 13527	$ 738	$ 2577	$ 0	$ 0	$ 0	+0	$ 0	$ 324691
20	$ 13527	$ 738	$ 2724	$ 135	$ 1290	$ 0	+0	$ 0	$ 343105
21	$ 13527	$ 738	$ 2879	$ 0	$ 0	$ 0	+0	$ 0	$ 360249
22	$ 13527	$ 738	$ 3043	$ 0	$ 0	$ 0	+0	$ 0	$ 377557
23	$ 13527	$ 738	$ 3216	$ 0	$ 0	$ 0	+0	$ 0	$ 395038
24	$ 13527	$ 738	$ 3400	$ 0	$ 0	$ 0	+0	$ 0	$ 412703
25	$ 13527	$ 738	$ 3594	$ 178	$ 0	$ 0	+0	$ 0	$ 430740
26	$ 13527	$ 738	$ 3798	$ 0	$ 0	$ 0	+0	$ 0	$ 448803
27	$ 13527	$ 738	$ 4015	$ 0	$ 0	$ 0	+0	$ 0	$ 467083
28	$ 13527	$ 738	$ 4244	$ 0	$ 0	$ 0	+0	$ 0	$ 485592
29	$ 13527	$ 738	$ 4486	$ 0	$ 0	$ 0	+0	$ 0	$ 504343
30	$ 13527	$ 738	$ 4741	$ 235	$ 2246	$ 3593	+0	$ 0	$ 529423

**** = BREAKEVEN YEAR

CASE NUMBER: 8 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 85000	$ 93500
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	12.00%	14.00%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8500	$ 18700
LOAN ORIG. FEE.	$ 765	$ 748
PRIVATE MORT. INS.	$ 383	$ 0
PREPAID INS.	$ 406	$ 419
MORTGAGE POINTS	$ 1148	$ 1496
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11563	$ 21724

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11563	$ 21724			
1	$ 22225	$ 33734	16	$213023	$228335
2	$ 32959	$ 45820	17	$226115	$242016
3	$ 43785	$ 57984	18	$239376	$255829
4	$ 54721	$ 70241	19	$252817	$269781
5	$ 66102	$ 82659	20	$270418	$285305
6	$ 77883	$ 95123	21	$284248	$299559
7	$ 89795	$107699	22	$298290	$313977
8	$101844	$120394	23	$312555	$328568
9	$114028	$133211	24	$327057	$343343
10	$128635	$146969	25	$342811	$358490
11	$141076	$159998	26	$357827	$373663
12	$153639	$173121	27	$373122	$389053
13	$166331	$186344	28	$388712	$404672
14	$178967	$199672	29	$404614	$420533
15	$200091	$214778	30	$445601	$442723

BREAKEVEN YEAR = 30 BREAK-EVEN AT AHT:

SUMMARY OF ALL ANNUAL COSTS: CONVENTIONAL HOME: CASE NUMBER: 8

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 11563
1	$ 9446	$ 410	$ 1225	$ 0	$ 0	$ 0	$ -610	$ 191	$ 22225
2	$ 9446	$ 412	$ 1295	$ 0	$ 0	$ 0	$ -610	$ 191	$ 32959
3	$ 9446	$ 430	$ 1369	$ 0	$ 0	$ 0	$ -610	$ 191	$ 43785
4	$ 9446	$ 462	$ 1447	$ 0	$ 0	$ 0	$ -610	$ 191	$ 54721
5	$ 9446	$ 494	$ 1529	$ 331	$ 0	$ 0	$ -610	$ 191	$ 66102
6	$ 9446	$ 528	$ 1616	$ 0	$ 0	$ 0	$ +0	$ 191	$ 77883
7	$ 9446	$ 566	$ 1708	$ 0	$ 0	$ 0	$ +0	$ 191	$ 89795
8	$ 9446	$ 606	$ 1806	$ 0	$ 0	$ 0	$ +0	$ 191	$ 101844
9	$ 9446	$ 638	$ 1909	$ 0	$ 0	$ 0	$ +0	$ 191	$ 114028
10	$ 9446	$ 672	$ 2017	$ 436	$ 1845	$ 0	$ +0	$ 191	$ 128635
11	$ 9446	$ 672	$ 2132	$ 0	$ 0	$ 0	$ +0	$ 191	$ 141076
12	$ 9446	$ 672	$ 2254	$ 0	$ 0	$ 0	$ +0	$ 191	$ 153639
13	$ 9446	$ 672	$ 2383	$ 0	$ 0	$ 0	$ +0	$ 191	$ 166331
14	$ 9446	$ 672	$ 2518	$ 0	$ 0	$ 0	$ +0	$ 0	$ 178967
15	$ 9446	$ 672	$ 2662	$ 576	$ 0	$ 7768	$ +0	$ 0	$ 200091
16	$ 9446	$ 672	$ 2814	$ 0	$ 0	$ 0	$ +0	$ 0	$ 213023
17	$ 9446	$ 672	$ 2974	$ 0	$ 0	$ 0	$ +0	$ 0	$ 226115
18	$ 9446	$ 672	$ 3143	$ 0	$ 0	$ 0	$ +0	$ 0	$ 239376
19	$ 9446	$ 672	$ 3323	$ 0	$ 0	$ 0	$ +0	$ 0	$ 252817
20	$ 9446	$ 672	$ 3512	$ 760	$ 3211	$ 0	$ +0	$ 0	$ 270418
21	$ 9446	$ 672	$ 3712	$ 0	$ 0	$ 0	$ +0	$ 0	$ 284248
22	$ 9446	$ 672	$ 3924	$ 0	$ 0	$ 0	$ +0	$ 0	$ 298290
23	$ 9446	$ 672	$ 4147	$ 0	$ 0	$ 0	$ +0	$ 0	$ 312555
24	$ 9446	$ 672	$ 4384	$ 0	$ 0	$ 0	$ +0	$ 0	$ 327057
25	$ 9446	$ 672	$ 4634	$ 1002	$ 0	$ 0	$ +0	$ 0	$ 342811
26	$ 9446	$ 672	$ 4898	$ 0	$ 0	$ 0	$ +0	$ 0	$ 357827
27	$ 9446	$ 672	$ 5177	$ 0	$ 0	$ 0	$ +0	$ 0	$ 373122
28	$ 9446	$ 672	$ 5472	$ 0	$ 0	$ 0	$ +0	$ 0	$ 388712
29	$ 9446	$ 672	$ 5784	$ 0	$ 0	$ 0	$ +0	$ 0	$ 404614
****	$ 9446	$ 672	$ 6114	$ 1323	$ 5590	$17842	$ +0	$ 0	$ 445601

**** = BREAKEVEN YEAR

SUMMARY OF ALL ANNUAL COSTS: EARTH SHELTER: CASE NUMBER: 8

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 21724
1	$ 10637	$ 423	$ 950	$ 0	$ 0	$ 0	$ +0	$ 0	$ 33734
2	$ 10637	$ 445	$ 1004	$ 0	$ 0	$ 0	$ +0	$ 0	$ 45820
3	$ 10637	$ 466	$ 1061	$ 0	$ 0	$ 0	$ +0	$ 0	$ 57984
4	$ 10637	$ 499	$ 1122	$ 0	$ 0	$ 0	$ +0	$ 0	$ 70241
5	$ 10637	$ 536	$ 1186	$ 59	$ 0	$ 0	$ +0	$ 0	$ 82659
6	$ 10637	$ 574	$ 1253	$ 0	$ 0	$ 0	$ +0	$ 0	$ 95123
7	$ 10637	$ 613	$ 1325	$ 0	$ 0	$ 0	$ +0	$ 0	$ 107699
8	$ 10637	$ 658	$ 1400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 120394
9	$ 10637	$ 700	$ 1480	$ 0	$ 0	$ 0	$ +0	$ 0	$ 133211
10	$ 10637	$ 738	$ 1565	$ 77	$ 741	$ 0	$ +0	$ 0	$ 146969
11	$ 10637	$ 738	$ 1654	$ 0	$ 0	$ 0	$ +0	$ 0	$ 159998
12	$ 10637	$ 738	$ 1748	$ 0	$ 0	$ 0	$ +0	$ 0	$ 173121
13	$ 10637	$ 738	$ 1848	$ 0	$ 0	$ 0	$ +0	$ 0	$ 186344
14	$ 10637	$ 738	$ 1953	$ 0	$ 0	$ 0	$ +0	$ 0	$ 199672
15	$ 10637	$ 738	$ 2064	$ 102	$ 0	$ 1565	$ +0	$ 0	$ 214778
16	$ 10637	$ 738	$ 2182	$ 0	$ 0	$ 0	$ +0	$ 0	$ 228335
17	$ 10637	$ 738	$ 2306	$ 0	$ 0	$ 0	$ +0	$ 0	$ 242016
18	$ 10637	$ 738	$ 2438	$ 0	$ 0	$ 0	$ +0	$ 0	$ 255829
19	$ 10637	$ 738	$ 2577	$ 0	$ 0	$ 0	$ +0	$ 0	$ 269781
20	$ 10637	$ 738	$ 2724	$ 135	$ 1290	$ 0	$ +0	$ 0	$ 285305
21	$ 10637	$ 738	$ 2879	$ 0	$ 0	$ 0	$ +0	$ 0	$ 299559
22	$ 10637	$ 738	$ 3043	$ 0	$ 0	$ 0	$ +0	$ 0	$ 313977
23	$ 10637	$ 738	$ 3216	$ 0	$ 0	$ 0	$ +0	$ 0	$ 328568
24	$ 10637	$ 738	$ 3400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 343343
25	$ 10637	$ 738	$ 3594	$ 178	$ 0	$ 0	$ +0	$ 0	$ 358490
26	$ 10637	$ 738	$ 3798	$ 0	$ 0	$ 0	$ +0	$ 0	$ 373663
27	$ 10637	$ 738	$ 4015	$ 0	$ 0	$ 0	$ +0	$ 0	$ 389053
28	$ 10637	$ 738	$ 4244	$ 0	$ 0	$ 0	$ +0	$ 0	$ 404672
29	$ 10637	$ 738	$ 4486	$ 0	$ 0	$ 0	$ +0	$ 0	$ 420533
****	$ 10637	$ 738	$ 4741	$ 235	$ 2246	$ 3593	$ +0	$ 0	$ 442723

**** = BREAKEVEN YEAR

CASE NUMBER: 9 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 85000	$ 93500
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	18.00%	20.00%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8500	$ 18700
LOAN ORIG. FEE.	$ 765	$ 748
PRIVATE MORT. INS.	$ 383	$ 0
PREPAID INS.	$ 406	$ 419
MORTGAGE POINTS	$ 1148	$ 1496
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11563	$ 21724

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11563	$ 21724			
1	$ 26613	$ 38096	16	$283804	$298127
2	$ 41735	$ 54544	17	$301475	$316170
3	$ 56949	$ 71070	18	$319315	$334345
4	$ 72273	$ 87689	19	$337144	$352659
5	$ 88042	$104469	20	$359133	$372545
6	$104211	$121295	21	$377351	$391161
7	$120511	$138233	22	$395781	$409941
8	$136948	$155290	23	$414434	$428894
9	$153520	$172469	24	$433324	$448031
10	$172515	$190589	25	$453466	$467540
11	$189344	$207980	26	$472870	$487075
12	$206295	$225465	27	$492553	$506827
13	$223375	$243050	28	$512531	$526808
14	$240590	$260740	29	$532821	$547031
15	$266293	$280208	30	$578196	$573583

BREAKEVEN YEAR = 30 BREAK-EVEN AT AHT:

SUMMARY OF ALL ANNUAL COSTS: CONVENTIONAL HOME: CASE NUMBER: 9

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 11563
1	$ 13834	$ 410	$ 1225	$ 0	$ 0	$ 0	$ -610	$ 191	$ 26613
2	$ 13834	$ 412	$ 1295	$ 0	$ 0	$ 0	$ -610	$ 191	$ 41735
3	$ 13834	$ 430	$ 1369	$ 0	$ 0	$ 0	$ -610	$ 191	$ 56949
4	$ 13834	$ 462	$ 1447	$ 0	$ 0	$ 0	$ -610	$ 191	$ 72273
5	$ 13834	$ 494	$ 1529	$ 331	$ 0	$ 0	$ -610	$ 191	$ 88042
6	$ 13834	$ 528	$ 1616	$ 0	$ 0	$ 0	$ +0	$ 191	$ 104211
7	$ 13834	$ 566	$ 1708	$ 0	$ 0	$ 0	$ +0	$ 191	$ 120511
8	$ 13834	$ 606	$ 1806	$ 0	$ 0	$ 0	$ +0	$ 191	$ 136948
9	$ 13834	$ 638	$ 1909	$ 0	$ 0	$ 0	$ +0	$ 191	$ 153520
10	$ 13834	$ 672	$ 2017	$ 436	$ 1845	$ 0	$ +0	$ 191	$ 172515
11	$ 13834	$ 672	$ 2132	$ 0	$ 0	$ 0	$ +0	$ 191	$ 189344
12	$ 13834	$ 672	$ 2254	$ 0	$ 0	$ 0	$ +0	$ 191	$ 206295
13	$ 13834	$ 672	$ 2383	$ 0	$ 0	$ 0	$ +0	$ 191	$ 223375
14	$ 13834	$ 672	$ 2518	$ 0	$ 0	$ 0	$ +0	$ 191	$ 240590
15	$ 13834	$ 672	$ 2662	$ 576	$ 0	$ 7768	$ +0	$ 191	$ 266293
16	$ 13834	$ 672	$ 2814	$ 0	$ 0	$ 0	$ +0	$ 191	$ 283804
17	$ 13834	$ 672	$ 2974	$ 0	$ 0	$ 0	$ +0	$ 191	$ 301475
18	$ 13834	$ 672	$ 3143	$ 0	$ 0	$ 0	$ +0	$ 191	$ 319315
19	$ 13834	$ 672	$ 3323	$ 0	$ 0	$ 0	$ +0	$ 0	$ 337144
20	$ 13834	$ 672	$ 3512	$ 760	$ 3211	$ 0	$ +0	$ 0	$ 359133
21	$ 13834	$ 672	$ 3712	$ 0	$ 0	$ 0	$ +0	$ 0	$ 377351
22	$ 13834	$ 672	$ 3924	$ 0	$ 0	$ 0	$ +0	$ 0	$ 395781
23	$ 13834	$ 672	$ 4147	$ 0	$ 0	$ 0	$ +0	$ 0	$ 414434
24	$ 13834	$ 672	$ 4384	$ 0	$ 0	$ 0	$ +0	$ 0	$ 433324
25	$ 13834	$ 672	$ 4634	$ 1002	$ 0	$ 0	$ +0	$ 0	$ 453466
26	$ 13834	$ 672	$ 4898	$ 0	$ 0	$ 0	$ +0	$ 0	$ 472870
27	$ 13834	$ 672	$ 5177	$ 0	$ 0	$ 0	$ +0	$ 0	$ 492553
28	$ 13834	$ 672	$ 5472	$ 0	$ 0	$ 0	$ +0	$ 0	$ 512531
29	$ 13834	$ 672	$ 5784	$ 0	$ 0	$ 0	$ +0	$ 0	$ 532821
****	$ 13834	$ 672	$ 6114	$ 1323	$ 5590	$17842	$ +0	$ 0	$ 578196

**** = BREAKEVEN YEAR

SUMMARY OF ALL ANNUAL COSTS: EARTH SHELTER: CASE NUMBER: 9

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 21724
1	$ 14999	$ 423	$ 950	$ 0	$ 0	$ 0	$ +0	$ 0	$ 38096
2	$ 14999	$ 445	$ 1004	$ 0	$ 0	$ 0	$ +0	$ 0	$ 54544
3	$ 14999	$ 466	$ 1061	$ 0	$ 0	$ 0	$ +0	$ 0	$ 71070
4	$ 14999	$ 499	$ 1122	$ 0	$ 0	$ 0	$ +0	$ 0	$ 87689
5	$ 14999	$ 536	$ 1186	$ 59	$ 0	$ 0	$ +0	$ 0	$ 104469
6	$ 14999	$ 574	$ 1253	$ 0	$ 0	$ 0	$ +0	$ 0	$ 121295
7	$ 14999	$ 613	$ 1325	$ 0	$ 0	$ 0	$ +0	$ 0	$ 138233
8	$ 14999	$ 658	$ 1400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 155290
9	$ 14999	$ 700	$ 1480	$ 0	$ 0	$ 0	$ +0	$ 0	$ 172469
10	$ 14999	$ 738	$ 1565	$ 77	$ 741	$ 0	$ +0	$ 0	$ 190589
11	$ 14999	$ 738	$ 1654	$ 0	$ 0	$ 0	$ +0	$ 0	$ 207980
12	$ 14999	$ 738	$ 1748	$ 0	$ 0	$ 0	$ +0	$ 0	$ 225465
13	$ 14999	$ 738	$ 1848	$ 0	$ 0	$ 0	$ +0	$ 0	$ 243050
14	$ 14999	$ 738	$ 1953	$ 0	$ 0	$ 0	$ +0	$ 0	$ 260740
15	$ 14999	$ 738	$ 2064	$ 102	$ 0	$ 1565	$ +0	$ 0	$ 280208
16	$ 14999	$ 738	$ 2182	$ 0	$ 0	$ 0	$ +0	$ 0	$ 298127
17	$ 14999	$ 738	$ 2306	$ 0	$ 0	$ 0	$ +0	$ 0	$ 316170
18	$ 14999	$ 738	$ 2438	$ 0	$ 0	$ 0	$ +0	$ 0	$ 334345
19	$ 14999	$ 738	$ 2577	$ 0	$ 0	$ 0	$ +0	$ 0	$ 352659
20	$ 14999	$ 738	$ 2724	$ 135	$ 1290	$ 0	$ +0	$ 0	$ 372545
21	$ 14999	$ 738	$ 2879	$ 0	$ 0	$ 0	$ +0	$ 0	$ 391161
22	$ 14999	$ 738	$ 3043	$ 0	$ 0	$ 0	$ +0	$ 0	$ 409941
23	$ 14999	$ 738	$ 3216	$ 0	$ 0	$ 0	$ +0	$ 0	$ 428894
24	$ 14999	$ 738	$ 3400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 448031
25	$ 14999	$ 738	$ 3594	$ 178	$ 0	$ 0	$ +0	$ 0	$ 467540
26	$ 14999	$ 738	$ 3798	$ 0	$ 0	$ 0	$ +0	$ 0	$ 487075
27	$ 14999	$ 738	$ 4015	$ 0	$ 0	$ 0	$ +0	$ 0	$ 506827
28	$ 14999	$ 738	$ 4244	$ 0	$ 0	$ 0	$ +0	$ 0	$ 526808
29	$ 14999	$ 738	$ 4486	$ 0	$ 0	$ 0	$ +0	$ 0	$ 547031
****	$ 14999	$ 738	$ 4741	$ 235	$ 2246	$ 3593	$ +0	$ 0	$ 573583

**** = BREAKEVEN YEAR

CASE NUMBER: 10 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 85000	$ 93500
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.00%	1.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8500	$ 18700
LOAN ORIG. FEE.	$ 765	$ 748
PRIVATE MORT. INS.	$ 383	$ 0
PREPAID INS.	$ 406	$ 419
MORTGAGE POINTS	$ 765	$ 748
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11180	$ 20976

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11180	$ 20976			
1	$ 22929	$ 32627	16	$230172	$221843
2	$ 34750	$ 44354	17	$244329	$235165
3	$ 46663	$ 56159	18	$258655	$248619
4	$ 58686	$ 68057	19	$273161	$262212
5	$ 71154	$ 80116	20	$291827	$277377
6	$ 84000	$ 92221	21	$306722	$291272
7	$ 96977	$104438	22	$321829	$305331
8	$110091	$116774	23	$337159	$319563
9	$123340	$129232	24	$352726	$333979
10	$139012	$142631	25	$369545	$348767
11	$152518	$155301	26	$385626	$363581
12	$166146	$168065	27	$401986	$378612
13	$179903	$180929	28	$418641	$393872
14	$193795	$193898	29	$435608	$409374
15	$216175	$208645	30	$477660	$431205

BREAKEVEN YEAR = 15 BREAK-EVEN AT AHT:

SUMMARY OF ALL ANNUAL COSTS: CONVENTIONAL HOME: CASE NUMBER: 10

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 11180
1	$ 10511	$ 410	$ 1225	$ 0	$ 0	$ 0	$ -588	$ 191	$ 22929
2	$ 10511	$ 412	$ 1295	$ 0	$ 0	$ 0	$ -588	$ 191	$ 34750
3	$ 10511	$ 430	$ 1369	$ 0	$ 0	$ 0	$ -588	$ 191	$ 46663
4	$ 10511	$ 462	$ 1447	$ 0	$ 0	$ 0	$ -588	$ 191	$ 58686
5	$ 10511	$ 494	$ 1529	$ 331	$ 0	$ 0	$ -588	$ 191	$ 71154
6	$ 10511	$ 528	$ 1616	$ 0	$ 0	$ 0	$ +0	$ 191	$ 84000
7	$ 10511	$ 566	$ 1708	$ 0	$ 0	$ 0	$ +0	$ 191	$ 96977
8	$ 10511	$ 606	$ 1806	$ 0	$ 0	$ 0	$ +0	$ 191	$ 110091
9	$ 10511	$ 638	$ 1909	$ 0	$ 0	$ 0	$ +0	$ 191	$ 123340
10	$ 10511	$ 672	$ 2017	$ 436	$ 1845	$ 0	$ +0	$ 191	$ 139012
11	$ 10511	$ 672	$ 2132	$ 0	$ 0	$ 0	$ +0	$ 191	$ 152518
12	$ 10511	$ 672	$ 2254	$ 0	$ 0	$ 0	$ +0	$ 191	$ 166146
13	$ 10511	$ 672	$ 2383	$ 0	$ 0	$ 0	$ +0	$ 191	$ 179903
14	$ 10511	$ 672	$ 2518	$ 0	$ 0	$ 0	$ +0	$ 191	$ 193795
****	$ 10511	$ 672	$ 2662	$ 576	$ 0	$ 7768	$ +0	$ 191	$ 216175
16	$ 10511	$ 672	$ 2814	$ 0	$ 0	$ 0	$ +0	$ 0	$ 230172
17	$ 10511	$ 672	$ 2974	$ 0	$ 0	$ 0	$ +0	$ 0	$ 244329
18	$ 10511	$ 672	$ 3143	$ 0	$ 0	$ 0	$ +0	$ 0	$ 258655
19	$ 10511	$ 672	$ 3323	$ 0	$ 0	$ 0	$ +0	$ 0	$ 273161
20	$ 10511	$ 672	$ 3512	$ 760	$ 3211	$ 0	$ +0	$ 0	$ 291827
21	$ 10511	$ 672	$ 3712	$ 0	$ 0	$ 0	$ +0	$ 0	$ 306722
22	$ 10511	$ 672	$ 3924	$ 0	$ 0	$ 0	$ +0	$ 0	$ 321829
23	$ 10511	$ 672	$ 4147	$ 0	$ 0	$ 0	$ +0	$ 0	$ 337159
24	$ 10511	$ 672	$ 4384	$ 0	$ 0	$ 0	$ +0	$ 0	$ 352726
25	$ 10511	$ 672	$ 4634	$ 1002	$ 0	$ 0	$ +0	$ 0	$ 369545
26	$ 10511	$ 672	$ 4898	$ 0	$ 0	$ 0	$ +0	$ 0	$ 385626
27	$ 10511	$ 672	$ 5177	$ 0	$ 0	$ 0	$ +0	$ 0	$ 401986
28	$ 10511	$ 672	$ 5472	$ 0	$ 0	$ 0	$ +0	$ 0	$ 418641
29	$ 10511	$ 672	$ 5784	$ 0	$ 0	$ 0	$ +0	$ 0	$ 435608
30	$ 10511	$ 672	$ 6114	$ 1323	$ 5590	$17842	$ +0	$ 0	$ 477660

**** = BREAKEVEN YEAR

SUMMARY OF ALL ANNUAL COSTS: EARTH SHELTER: CASE NUMBER: 10

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 20976
1	$ 10278	$ 423	$ 950	$ 0	$ 0	$ 0	$ +0	$ 0	$ 32627
2	$ 10278	$ 445	$ 1004	$ 0	$ 0	$ 0	$ +0	$ 0	$ 44354
3	$ 10278	$ 466	$ 1061	$ 0	$ 0	$ 0	$ +0	$ 0	$ 56159
4	$ 10278	$ 499	$ 1122	$ 0	$ 0	$ 0	$ +0	$ 0	$ 68057
5	$ 10278	$ 536	$ 1186	$ 59	$ 0	$ 0	$ +0	$ 0	$ 80116
6	$ 10278	$ 574	$ 1253	$ 0	$ 0	$ 0	$ +0	$ 0	$ 92221
7	$ 10278	$ 613	$ 1325	$ 0	$ 0	$ 0	$ +0	$ 0	$ 104438
8	$ 10278	$ 658	$ 1400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 116774
9	$ 10278	$ 700	$ 1480	$ 0	$ 0	$ 0	$ +0	$ 0	$ 129232
10	$ 10278	$ 738	$ 1565	$ 77	$ 741	$ 0	$ +0	$ 0	$ 142631
11	$ 10278	$ 738	$ 1654	$ 0	$ 0	$ 0	$ +0	$ 0	$ 155301
12	$ 10278	$ 738	$ 1748	$ 0	$ 0	$ 0	$ +0	$ 0	$ 168065
13	$ 10278	$ 738	$ 1848	$ 0	$ 0	$ 0	$ +0	$ 0	$ 180929
14	$ 10278	$ 738	$ 1953	$ 0	$ 0	$ 0	$ +0	$ 0	$ 193898
****	$ 10278	$ 738	$ 2064	$ 102	$ 0	$ 1565	$ +0	$ 0	$ 208645
16	$ 10278	$ 738	$ 2182	$ 0	$ 0	$ 0	$ +0	$ 0	$ 221843
17	$ 10278	$ 738	$ 2306	$ 0	$ 0	$ 0	$ +0	$ 0	$ 235165
18	$ 10278	$ 738	$ 2438	$ 0	$ 0	$ 0	$ +0	$ 0	$ 248619
19	$ 10278	$ 738	$ 2577	$ 0	$ 0	$ 0	$ +0	$ 0	$ 262212
20	$ 10278	$ 738	$ 2724	$ 135	$ 1290	$ 0	$ +0	$ 0	$ 277377
21	$ 10278	$ 738	$ 2879	$ 0	$ 0	$ 0	$ +0	$ 0	$ 291272
22	$ 10278	$ 738	$ 3043	$ 0	$ 0	$ 0	$ +0	$ 0	$ 305331
23	$ 10278	$ 738	$ 3216	$ 0	$ 0	$ 0	$ +0	$ 0	$ 319563
24	$ 10278	$ 738	$ 3400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 333979
25	$ 10278	$ 738	$ 3594	$ 178	$ 0	$ 0	$ +0	$ 0	$ 348767
26	$ 10278	$ 738	$ 3798	$ 0	$ 0	$ 0	$ +0	$ 0	$ 363581
27	$ 10278	$ 738	$ 4015	$ 0	$ 0	$ 0	$ +0	$ 0	$ 378612
28	$ 10278	$ 738	$ 4244	$ 0	$ 0	$ 0	$ +0	$ 0	$ 393872
29	$ 10278	$ 738	$ 4486	$ 0	$ 0	$ 0	$ +0	$ 0	$ 409374
30	$ 10278	$ 738	$ 4741	$ 235	$ 2246	$ 3593	$ +0	$ 0	$ 431205

**** = BREAKEVEN YEAR

CASE NUMBER: 11 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 85000	$ 93500
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	4.00%	4.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8500	$ 18700
LOAN ORIG. FEE.	$ 765	$ 748
PRIVATE MORT. INS.	$ 383	$ 0
PREPAID INS.	$ 406	$ 419
MORTGAGE POINTS	$ 3060	$ 2992
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 13475	$ 23220

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 13475	$ 23220			
1	$ 25227	$ 34871	16	$232482	$224087
2	$ 37051	$ 46598	17	$246639	$237409
3	$ 48967	$ 58403	18	$260965	$250863
4	$ 60993	$ 70301	19	$275471	$264456
5	$ 73464	$ 82360	20	$294137	$279621
6	$ 86310	$ 94465	21	$309032	$293516
7	$ 99287	$106682	22	$324139	$307575
8	$112401	$119018	23	$339469	$321807
9	$125650	$131476	24	$355036	$336223
10	$141322	$144875	25	$371855	$351011
11	$154828	$157545	26	$387936	$365825
12	$168456	$170309	27	$404296	$380856
13	$182213	$183173	28	$420951	$396116
14	$196105	$196142	29	$437918	$411618
15	$218485	$210889	30	$479970	$433449

BREAKEVEN YEAR = 15 BREAK-EVEN AT AHT:

SUMMARY OF ALL ANNUAL COSTS: CONVENTIONAL HOME: CASE NUMBER: 11

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 13475
1	$ 10511	$ 410	$ 1225	$ 0	$ 0	$ 0	$ -585	$ 191	$ 25227
2	$ 10511	$ 412	$ 1295	$ 0	$ 0	$ 0	$ -585	$ 191	$ 37051
3	$ 10511	$ 430	$ 1369	$ 0	$ 0	$ 0	$ -585	$ 191	$ 48967
4	$ 10511	$ 462	$ 1447	$ 0	$ 0	$ 0	$ -585	$ 191	$ 60993
5	$ 10511	$ 494	$ 1529	$ 331	$ 0	$ 0	$ -585	$ 191	$ 73464
6	$ 10511	$ 528	$ 1616	$ 0	$ 0	$ 0	$ +0	$ 191	$ 86310
7	$ 10511	$ 566	$ 1708	$ 0	$ 0	$ 0	$ +0	$ 191	$ 99287
8	$ 10511	$ 606	$ 1806	$ 0	$ 0	$ 0	$ +0	$ 191	$ 112401
9	$ 10511	$ 638	$ 1909	$ 0	$ 0	$ 0	$ +0	$ 191	$ 125650
10	$ 10511	$ 672	$ 2017	$ 436	$ 1845	$ 0	$ +0	$ 191	$ 141322
11	$ 10511	$ 672	$ 2132	$ 0	$ 0	$ 0	$ +0	$ 191	$ 154828
12	$ 10511	$ 672	$ 2254	$ 0	$ 0	$ 0	$ +0	$ 191	$ 168456
13	$ 10511	$ 672	$ 2383	$ 0	$ 0	$ 0	$ +0	$ 191	$ 182213
14	$ 10511	$ 672	$ 2518	$ 0	$ 0	$ 0	$ +0	$ 191	$ 196105
****	$ 10511	$ 672	$ 2662	$ 576	$ 0	$ 7768	$ +0	$ 191	$ 218485
16	$ 10511	$ 672	$ 2814	$ 0	$ 0	$ 0	$ +0	$ 0	$ 232482
17	$ 10511	$ 672	$ 2974	$ 0	$ 0	$ 0	$ +0	$ 0	$ 246639
18	$ 10511	$ 672	$ 3143	$ 0	$ 0	$ 0	$ +0	$ 0	$ 260965
19	$ 10511	$ 672	$ 3323	$ 0	$ 0	$ 0	$ +0	$ 0	$ 275471
20	$ 10511	$ 672	$ 3512	$ 760	$ 3211	$ 0	$ +0	$ 0	$ 294137
21	$ 10511	$ 672	$ 3712	$ 0	$ 0	$ 0	$ +0	$ 0	$ 309032
22	$ 10511	$ 672	$ 3924	$ 0	$ 0	$ 0	$ +0	$ 0	$ 324139
23	$ 10511	$ 672	$ 4147	$ 0	$ 0	$ 0	$ +0	$ 0	$ 339469
24	$ 10511	$ 672	$ 4384	$ 0	$ 0	$ 0	$ +0	$ 0	$ 355036
25	$ 10511	$ 672	$ 4634	$ 1002	$ 0	$ 0	$ +0	$ 0	$ 371855
26	$ 10511	$ 672	$ 4898	$ 0	$ 0	$ 0	$ +0	$ 0	$ 387936
27	$ 10511	$ 672	$ 5177	$ 0	$ 0	$ 0	$ +0	$ 0	$ 404296
28	$ 10511	$ 672	$ 5472	$ 0	$ 0	$ 0	$ +0	$ 0	$ 420951
29	$ 10511	$ 672	$ 5784	$ 0	$ 0	$ 0	$ +0	$ 0	$ 437918
30	$ 10511	$ 672	$ 6114	$ 1323	$ 5590	$17842	$ +0	$ 0	$ 479970

**** = BREAKEVEN YEAR

SUMMARY OF ALL ANNUAL COSTS: EARTH SHELTER: CASE NUMBER: 11

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 23220
1	$ 10278	$ 423	$ 950	$ 0	$ 0	$ 0	$ +0	$ 0	$ 34871
2	$ 10278	$ 445	$ 1004	$ 0	$ 0	$ 0	$ +0	$ 0	$ 46598
3	$ 10278	$ 466	$ 1061	$ 0	$ 0	$ 0	$ +0	$ 0	$ 58403
4	$ 10278	$ 499	$ 1122	$ 0	$ 0	$ 0	$ +0	$ 0	$ 70301
5	$ 10278	$ 536	$ 1186	$ 59	$ 0	$ 0	$ +0	$ 0	$ 82360
6	$ 10278	$ 574	$ 1253	$ 0	$ 0	$ 0	$ +0	$ 0	$ 94465
7	$ 10278	$ 613	$ 1325	$ 0	$ 0	$ 0	$ +0	$ 0	$ 106682
8	$ 10278	$ 658	$ 1400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 119018
9	$ 10278	$ 700	$ 1480	$ 0	$ 0	$ 0	$ +0	$ 0	$ 131476
10	$ 10278	$ 738	$ 1565	$ 77	$ 741	$ 0	$ +0	$ 0	$ 144875
11	$ 10278	$ 738	$ 1654	$ 0	$ 0	$ 0	$ +0	$ 0	$ 157545
12	$ 10278	$ 738	$ 1748	$ 0	$ 0	$ 0	$ +0	$ 0	$ 170309
13	$ 10278	$ 738	$ 1848	$ 0	$ 0	$ 0	$ +0	$ 0	$ 183173
14	$ 10278	$ 738	$ 1953	$ 0	$ 0	$ 0	$ +0	$ 0	$ 196142
****	$ 10278	$ 738	$ 2064	$ 102	$ 0	$ 1565	$ +0	$ 0	$ 210889
16	$ 10278	$ 738	$ 2182	$ 0	$ 0	$ 0	$ +0	$ 0	$ 224087
17	$ 10278	$ 738	$ 2306	$ 0	$ 0	$ 0	$ +0	$ 0	$ 237409
18	$ 10278	$ 738	$ 2438	$ 0	$ 0	$ 0	$ +0	$ 0	$ 250863
19	$ 10278	$ 738	$ 2577	$ 0	$ 0	$ 0	$ +0	$ 0	$ 264456
20	$ 10278	$ 738	$ 2724	$ 135	$ 1290	$ 0	$ +0	$ 0	$ 279621
21	$ 10278	$ 738	$ 2879	$ 0	$ 0	$ 0	$ +0	$ 0	$ 293516
22	$ 10278	$ 738	$ 3043	$ 0	$ 0	$ 0	$ +0	$ 0	$ 307575
23	$ 10278	$ 738	$ 3216	$ 0	$ 0	$ 0	$ +0	$ 0	$ 321807
24	$ 10278	$ 738	$ 3400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 336223
25	$ 10278	$ 738	$ 3594	$ 178	$ 0	$ 0	$ +0	$ 0	$ 351011
26	$ 10278	$ 738	$ 3798	$ 0	$ 0	$ 0	$ +0	$ 0	$ 365825
27	$ 10278	$ 738	$ 4015	$ 0	$ 0	$ 0	$ +0	$ 0	$ 380856
28	$ 10278	$ 738	$ 4244	$ 0	$ 0	$ 0	$ +0	$ 0	$ 396116
29	$ 10278	$ 738	$ 4486	$ 0	$ 0	$ 0	$ +0	$ 0	$ 411618
30	$ 10278	$ 738	$ 4741	$ 235	$ 2246	$ 3593	$ +0	$ 0	$ 433449

**** = BREAKEVEN YEAR

CASE NUMBER: 12 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 85000	$ 93500
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	4.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8500	$ 18700
LOAN ORIG. FEE.	$ 765	$ 748
PRIVATE MORT. INS.	$ 383	$ 0
PREPAID INS.	$ 406	$ 419
MORTGAGE POINTS	$ 1148	$ 2992
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11563	$ 23220

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11563	$ 23220			
1	$ 23201	$ 34871	16	$230000	$224087
2	$ 34911	$ 46598	17	$244157	$237409
3	$ 46713	$ 58403	18	$258483	$250863
4	$ 58625	$ 70301	19	$272989	$264456
5	$ 70982	$ 82360	20	$291655	$279621
6	$ 83828	$ 94465	21	$306550	$293516
7	$ 96805	$106682	22	$321657	$307575
8	$109919	$119018	23	$336987	$321807
9	$123168	$131476	24	$352554	$336223
10	$138840	$144875	25	$369373	$351011
11	$152346	$157545	26	$385454	$365825
12	$165974	$170309	27	$401814	$380856
13	$179731	$183173	28	$418469	$396116
14	$193623	$196142	29	$435436	$411618
15	$216003	$210889	30	$477488	$433449

BREAKEVEN YEAR = 15 BREAK-EVEN AT AHT:

SUMMARY OF ALL ANNUAL COSTS: CONVENTIONAL HOME: CASE NUMBER: 12

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 11563
1	$ 10511	$ 410	$ 1225	$ 0	$ 0	$ 0	$ -699	$ 191	$ 23201
2	$ 10511	$ 412	$ 1295	$ 0	$ 0	$ 0	$ -699	$ 191	$ 34911
3	$ 10511	$ 430	$ 1369	$ 0	$ 0	$ 0	$ -699	$ 191	$ 46713
4	$ 10511	$ 462	$ 1447	$ 0	$ 0	$ 0	$ -699	$ 191	$ 58625
5	$ 10511	$ 494	$ 1529	$ 331	$ 0	$ 0	$ -699	$ 191	$ 70982
6	$ 10511	$ 528	$ 1616	$ 0	$ 0	$ 0	$ +0	$ 191	$ 83828
7	$ 10511	$ 566	$ 1708	$ 0	$ 0	$ 0	$ +0	$ 191	$ 96805
8	$ 10511	$ 606	$ 1806	$ 0	$ 0	$ 0	$ +0	$ 191	$ 109919
9	$ 10511	$ 638	$ 1909	$ 0	$ 0	$ 0	$ +0	$ 191	$ 123168
10	$ 10511	$ 672	$ 2017	$ 436	$ 1845	$ 0	$ +0	$ 191	$ 138840
11	$ 10511	$ 672	$ 2132	$ 0	$ 0	$ 0	$ +0	$ 191	$ 152346
12	$ 10511	$ 672	$ 2254	$ 0	$ 0	$ 0	$ +0	$ 191	$ 165974
13	$ 10511	$ 672	$ 2383	$ 0	$ 0	$ 0	$ +0	$ 191	$ 179731
14	$ 10511	$ 672	$ 2518	$ 0	$ 0	$ 0	$ +0	$ 191	$ 193623
****	$ 10511	$ 672	$ 2662	$ 576	$ 0	$ 7768	$ +0	$ 191	$ 216003
16	$ 10511	$ 672	$ 2814	$ 0	$ 0	$ 0	$ +0	$ 0	$ 230000
17	$ 10511	$ 672	$ 2974	$ 0	$ 0	$ 0	$ +0	$ 0	$ 244157
18	$ 10511	$ 672	$ 3143	$ 0	$ 0	$ 0	$ +0	$ 0	$ 258483
19	$ 10511	$ 672	$ 3323	$ 0	$ 0	$ 0	$ +0	$ 0	$ 272989
20	$ 10511	$ 672	$ 3512	$ 760	$ 3211	$ 0	$ +0	$ 0	$ 291655
21	$ 10511	$ 672	$ 3712	$ 0	$ 0	$ 0	$ +0	$ 0	$ 306550
22	$ 10511	$ 672	$ 3924	$ 0	$ 0	$ 0	$ +0	$ 0	$ 321657
23	$ 10511	$ 672	$ 4147	$ 0	$ 0	$ 0	$ +0	$ 0	$ 336987
24	$ 10511	$ 672	$ 4384	$ 0	$ 0	$ 0	$ +0	$ 0	$ 352554
25	$ 10511	$ 672	$ 4634	$ 1002	$ 0	$ 0	$ +0	$ 0	$ 369373
26	$ 10511	$ 672	$ 4898	$ 0	$ 0	$ 0	$ +0	$ 0	$ 385454
27	$ 10511	$ 672	$ 5177	$ 0	$ 0	$ 0	$ +0	$ 0	$ 401814
28	$ 10511	$ 672	$ 5472	$ 0	$ 0	$ 0	$ +0	$ 0	$ 418469
29	$ 10511	$ 672	$ 5784	$ 0	$ 0	$ 0	$ +0	$ 0	$ 435436
30	$ 10511	$ 672	$ 6114	$ 1323	$ 5590	$17842	$ +0	$ 0	$ 477488

**** = BREAKEVEN YEAR

SUMMARY OF ALL ANNUAL COSTS: EARTH SHELTER: CASE NUMBER: 12

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 23220
1	$ 10278	$ 423	$ 950	$ 0	$ 0	$ 0	$ +0	$ 0	$ 34871
2	$ 10278	$ 445	$ 1004	$ 0	$ 0	$ 0	$ +0	$ 0	$ 46598
3	$ 10278	$ 466	$ 1061	$ 0	$ 0	$ 0	$ +0	$ 0	$ 58403
4	$ 10278	$ 499	$ 1122	$ 0	$ 0	$ 0	$ +0	$ 0	$ 70301
5	$ 10278	$ 536	$ 1186	$ 59	$ 0	$ 0	$ +0	$ 0	$ 82360
6	$ 10278	$ 574	$ 1253	$ 0	$ 0	$ 0	$ +0	$ 0	$ 94465
7	$ 10278	$ 613	$ 1325	$ 0	$ 0	$ 0	$ +0	$ 0	$ 106682
8	$ 10278	$ 658	$ 1400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 119018
9	$ 10278	$ 700	$ 1480	$ 0	$ 0	$ 0	$ +0	$ 0	$ 131476
10	$ 10278	$ 738	$ 1565	$ 77	$ 741	$ 0	$ +0	$ 0	$ 144875
11	$ 10278	$ 738	$ 1654	$ 0	$ 0	$ 0	$ +0	$ 0	$ 157545
12	$ 10278	$ 738	$ 1748	$ 0	$ 0	$ 0	$ +0	$ 0	$ 170309
13	$ 10278	$ 738	$ 1848	$ 0	$ 0	$ 0	$ +0	$ 0	$ 183173
14	$ 10278	$ 738	$ 1953	$ 0	$ 0	$ 0	$ +0	$ 0	$ 196142
****	$ 10278	$ 738	$ 2064	$ 102	$ 0	$ 1565	$ +0	$ 0	$ 210889
16	$ 10278	$ 738	$ 2182	$ 0	$ 0	$ 0	$ +0	$ 0	$ 224087
17	$ 10278	$ 738	$ 2306	$ 0	$ 0	$ 0	$ +0	$ 0	$ 237409
18	$ 10278	$ 738	$ 2438	$ 0	$ 0	$ 0	$ +0	$ 0	$ 250863
19	$ 10278	$ 738	$ 2577	$ 0	$ 0	$ 0	$ +0	$ 0	$ 264456
20	$ 10278	$ 738	$ 2724	$ 135	$ 1290	$ 0	$ +0	$ 0	$ 279621
21	$ 10278	$ 738	$ 2879	$ 0	$ 0	$ 0	$ +0	$ 0	$ 293516
22	$ 10278	$ 738	$ 3043	$ 0	$ 0	$ 0	$ +0	$ 0	$ 307575
23	$ 10278	$ 738	$ 3216	$ 0	$ 0	$ 0	$ +0	$ 0	$ 321807
24	$ 10278	$ 738	$ 3400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 336223
25	$ 10278	$ 738	$ 3594	$ 178	$ 0	$ 0	$ +0	$ 0	$ 351011
26	$ 10278	$ 738	$ 3798	$ 0	$ 0	$ 0	$ +0	$ 0	$ 365825
27	$ 10278	$ 738	$ 4015	$ 0	$ 0	$ 0	$ +0	$ 0	$ 380856
28	$ 10278	$ 738	$ 4244	$ 0	$ 0	$ 0	$ +0	$ 0	$ 396116
29	$ 10278	$ 738	$ 4486	$ 0	$ 0	$ 0	$ +0	$ 0	$ 411618
30	$ 10278	$ 738	$ 4741	$ 235	$ 2246	$ 3593	$ +0	$ 0	$ 433449

**** = BREAKEVEN YEAR

CASE NUMBER: 13 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 85000	$ 93500
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	10.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8500	$ 18700
LOAN ORIG. FEE.	$ 765	$ 748
PRIVATE MORT. INS.	$ 383	$ 0
PREPAID INS.	$ 406	$ 378
MORTGAGE POINTS	$ 1148	$ 1496
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11563	$ 21683

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11563	$ 21683			
1	$ 23293	$ 33292	16	$230460	$221542
2	$ 35095	$ 44974	17	$244617	$234790
3	$ 46989	$ 56732	18	$258943	$248170
4	$ 58993	$ 68581	19	$273449	$261689
5	$ 71442	$ 80586	20	$292115	$276781
6	$ 84288	$ 92634	21	$307010	$290602
7	$ 97265	$104789	22	$322117	$304587
8	$110379	$117059	23	$337447	$318745
9	$123628	$129447	24	$353014	$333087
10	$139300	$142773	25	$369833	$347802
11	$152806	$155369	26	$385914	$362542
12	$166434	$168059	27	$402274	$377499
13	$180191	$180849	28	$418929	$392685
14	$194083	$193744	29	$435896	$408113
15	$216463	$208418	30	$477948	$429871

BREAKEVEN YEAR = 14 BREAK-EVEN AT AHT:

SUMMARY OF ALL ANNUAL COSTS: CONVENTIONAL HOME: CASE NUMBER: 13

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 11563
1	$ 10511	$ 410	$ 1225	$ 0	$ 0	$ 0	$ -607	$ 191	$ 23293
2	$ 10511	$ 412	$ 1295	$ 0	$ 0	$ 0	$ -607	$ 191	$ 35095
3	$ 10511	$ 430	$ 1369	$ 0	$ 0	$ 0	$ -607	$ 191	$ 46989
4	$ 10511	$ 462	$ 1447	$ 0	$ 0	$ 0	$ -607	$ 191	$ 58993
5	$ 10511	$ 494	$ 1529	$ 331	$ 0	$ 0	$ -607	$ 191	$ 71442
6	$ 10511	$ 528	$ 1616	$ 0	$ 0	$ 0	$ +0	$ 191	$ 84288
7	$ 10511	$ 566	$ 1708	$ 0	$ 0	$ 0	$ +0	$ 191	$ 97265
8	$ 10511	$ 606	$ 1806	$ 0	$ 0	$ 0	$ +0	$ 191	$ 110379
9	$ 10511	$ 638	$ 1909	$ 0	$ 0	$ 0	$ +0	$ 191	$ 123628
10	$ 10511	$ 672	$ 2017	$ 436	$ 1845	$ 0	$ +0	$ 191	$ 139300
11	$ 10511	$ 672	$ 2132	$ 0	$ 0	$ 0	$ +0	$ 191	$ 152806
12	$ 10511	$ 672	$ 2254	$ 0	$ 0	$ 0	$ +0	$ 191	$ 166434
13	$ 10511	$ 672	$ 2383	$ 0	$ 0	$ 0	$ +0	$ 191	$ 180191
****	$ 10511	$ 672	$ 2518	$ 0	$ 0	$ 0	$ +0	$ 191	$ 194083
15	$ 10511	$ 672	$ 2662	$ 576	$ 0	$ 7768	$ +0	$ 191	$ 216463
16	$ 10511	$ 672	$ 2814	$ 0	$ 0	$ 0	$ +0	$ 0	$ 230460
17	$ 10511	$ 672	$ 2974	$ 0	$ 0	$ 0	$ +0	$ 0	$ 244617
18	$ 10511	$ 672	$ 3143	$ 0	$ 0	$ 0	$ +0	$ 0	$ 258943
19	$ 10511	$ 672	$ 3323	$ 0	$ 0	$ 0	$ +0	$ 0	$ 273449
20	$ 10511	$ 672	$ 3512	$ 760	$ 3211	$ 0	$ +0	$ 0	$ 292115
21	$ 10511	$ 672	$ 3712	$ 0	$ 0	$ 0	$ +0	$ 0	$ 307010
22	$ 10511	$ 672	$ 3924	$ 0	$ 0	$ 0	$ +0	$ 0	$ 322117
23	$ 10511	$ 672	$ 4147	$ 0	$ 0	$ 0	$ +0	$ 0	$ 337447
24	$ 10511	$ 672	$ 4384	$ 0	$ 0	$ 0	$ +0	$ 0	$ 353014
25	$ 10511	$ 672	$ 4634	$ 1002	$ 0	$ 0	$ +0	$ 0	$ 369833
26	$ 10511	$ 672	$ 4898	$ 0	$ 0	$ 0	$ +0	$ 0	$ 385914
27	$ 10511	$ 672	$ 5177	$ 0	$ 0	$ 0	$ +0	$ 0	$ 402274
28	$ 10511	$ 672	$ 5472	$ 0	$ 0	$ 0	$ +0	$ 0	$ 418929
29	$ 10511	$ 672	$ 5784	$ 0	$ 0	$ 0	$ +0	$ 0	$ 435896
30	$ 10511	$ 672	$ 6114	$ 1323	$ 5590	$17842	$ +0	$ 0	$ 477948

**** = BREAKEVEN YEAR

SUMMARY OF ALL ANNUAL COSTS: EARTH SHELTER: CASE NUMBER: 13

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 21683
1	$ 10278	$ 381	$ 950	$ 0	$ 0	$ 0	$ +0	$ 0	$ 33292
2	$ 10278	$ 400	$ 1004	$ 0	$ 0	$ 0	$ +0	$ 0	$ 44974
3	$ 10278	$ 420	$ 1061	$ 0	$ 0	$ 0	$ +0	$ 0	$ 56732
4	$ 10278	$ 449	$ 1122	$ 0	$ 0	$ 0	$ +0	$ 0	$ 68581
5	$ 10278	$ 482	$ 1186	$ 59	$ 0	$ 0	$ +0	$ 0	$ 80586
6	$ 10278	$ 517	$ 1253	$ 0	$ 0	$ 0	$ +0	$ 0	$ 92634
7	$ 10278	$ 552	$ 1325	$ 0	$ 0	$ 0	$ +0	$ 0	$ 104789
8	$ 10278	$ 592	$ 1400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 117059
9	$ 10278	$ 630	$ 1480	$ 0	$ 0	$ 0	$ +0	$ 0	$ 129447
10	$ 10278	$ 664	$ 1565	$ 77	$ 741	$ 0	$ +0	$ 0	$ 142773
11	$ 10278	$ 664	$ 1654	$ 0	$ 0	$ 0	$ +0	$ 0	$ 155369
12	$ 10278	$ 664	$ 1748	$ 0	$ 0	$ 0	$ +0	$ 0	$ 168059
13	$ 10278	$ 664	$ 1848	$ 0	$ 0	$ 0	$ +0	$ 0	$ 180849
****	$ 10278	$ 664	$ 1953	$ 0	$ 0	$ 0	$ +0	$ 0	$ 193744
15	$ 10278	$ 664	$ 2064	$ 102	$ 0	$ 1565	$ +0	$ 0	$ 208418
16	$ 10278	$ 664	$ 2182	$ 0	$ 0	$ 0	$ +0	$ 0	$ 221542
17	$ 10278	$ 664	$ 2306	$ 0	$ 0	$ 0	$ +0	$ 0	$ 234790
18	$ 10278	$ 664	$ 2438	$ 0	$ 0	$ 0	$ +0	$ 0	$ 248170
19	$ 10278	$ 664	$ 2577	$ 0	$ 0	$ 0	$ +0	$ 0	$ 261689
20	$ 10278	$ 664	$ 2724	$ 135	$ 1290	$ 0	$ +0	$ 0	$ 276781
21	$ 10278	$ 664	$ 2879	$ 0	$ 0	$ 0	$ +0	$ 0	$ 290602
22	$ 10278	$ 664	$ 3043	$ 0	$ 0	$ 0	$ +0	$ 0	$ 304587
23	$ 10278	$ 664	$ 3216	$ 0	$ 0	$ 0	$ +0	$ 0	$ 318745
24	$ 10278	$ 664	$ 3400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 333087
25	$ 10278	$ 664	$ 3594	$ 178	$ 0	$ 0	$ +0	$ 0	$ 347802
26	$ 10278	$ 664	$ 3798	$ 0	$ 0	$ 0	$ +0	$ 0	$ 362542
27	$ 10278	$ 664	$ 4015	$ 0	$ 0	$ 0	$ +0	$ 0	$ 377499
28	$ 10278	$ 664	$ 4244	$ 0	$ 0	$ 0	$ +0	$ 0	$ 392685
29	$ 10278	$ 664	$ 4486	$ 0	$ 0	$ 0	$ +0	$ 0	$ 408113
30	$ 10278	$ 664	$ 4741	$ 235	$ 2246	$ 3593	$ +0	$ 0	$ 429871

**** = BREAKEVEN YEAR

CASE NUMBER: 14 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 85000	$ 93500
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	25.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8500	$ 18700
LOAN ORIG. FEE.	$ 765	$ 748
PRIVATE MORT. INS.	$ 383	$ 0
PREPAID INS.	$ 406	$ 315
MORTGAGE POINTS	$ 1148	$ 1496
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11563	$ 21620

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11563	$ 21620			
1	$ 23297	$ 33165	16	$230480	$219967
2	$ 35103	$ 44781	17	$244637	$233104
3	$ 47001	$ 56469	18	$258963	$246374
4	$ 59009	$ 68243	19	$273469	$259782
5	$ 71462	$ 80168	20	$292135	$274763
6	$ 84308	$ 92130	21	$307030	$288473
7	$ 97285	$104193	22	$322137	$302348
8	$110399	$116364	23	$337467	$316395
9	$123648	$128647	24	$353034	$330627
10	$139320	$141862	25	$369853	$345230
11	$152826	$154347	26	$385934	$359860
12	$166454	$166927	27	$402294	$374706
13	$180211	$179606	28	$418949	$389782
14	$194103	$192391	29	$435916	$405099
15	$216483	$206953	30	$477968	$426746

BREAKEVEN YEAR = 13 BREAK-EVEN AT AHT:

SUMMARY OF ALL ANNUAL COSTS: CONVENTIONAL HOME: CASE NUMBER: 14

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 11563
1	$ 10511	$ 410	$ 1225	$ 0	$ 0	$ 0	$ -603	$ 191	$ 23297
2	$ 10511	$ 412	$ 1295	$ 0	$ 0	$ 0	$ -603	$ 191	$ 35103
3	$ 10511	$ 430	$ 1369	$ 0	$ 0	$ 0	$ -603	$ 191	$ 47001
4	$ 10511	$ 462	$ 1447	$ 0	$ 0	$ 0	$ -603	$ 191	$ 59009
5	$ 10511	$ 494	$ 1529	$ 331	$ 0	$ 0	$ -603	$ 191	$ 71462
6	$ 10511	$ 528	$ 1616	$ 0	$ 0	$ 0	$ +0	$ 191	$ 84308
7	$ 10511	$ 566	$ 1708	$ 0	$ 0	$ 0	$ +0	$ 191	$ 97285
8	$ 10511	$ 606	$ 1806	$ 0	$ 0	$ 0	$ +0	$ 191	$ 110399
9	$ 10511	$ 638	$ 1909	$ 0	$ 0	$ 0	$ +0	$ 191	$ 123648
10	$ 10511	$ 672	$ 2017	$ 436	$ 1845	$ 0	$ +0	$ 191	$ 139320
11	$ 10511	$ 672	$ 2132	$ 0	$ 0	$ 0	$ +0	$ 191	$ 152826
12	$ 10511	$ 672	$ 2254	$ 0	$ 0	$ 0	$ +0	$ 191	$ 166454
****	$ 10511	$ 672	$ 2383	$ 0	$ 0	$ 0	$ +0	$ 191	$ 180211
14	$ 10511	$ 672	$ 2518	$ 0	$ 0	$ 0	$ +0	$ 191	$ 194103
15	$ 10511	$ 672	$ 2662	$ 576	$ 0	$ 7768	$ +0	$ 191	$ 216483
16	$ 10511	$ 672	$ 2814	$ 0	$ 0	$ 0	$ +0	$ 0	$ 230480
17	$ 10511	$ 672	$ 2974	$ 0	$ 0	$ 0	$ +0	$ 0	$ 244637
18	$ 10511	$ 672	$ 3143	$ 0	$ 0	$ 0	$ +0	$ 0	$ 258963
19	$ 10511	$ 672	$ 3323	$ 0	$ 0	$ 0	$ +0	$ 0	$ 273469
20	$ 10511	$ 672	$ 3512	$ 760	$ 3211	$ 0	$ +0	$ 0	$ 292135
21	$ 10511	$ 672	$ 3712	$ 0	$ 0	$ 0	$ +0	$ 0	$ 307030
22	$ 10511	$ 672	$ 3924	$ 0	$ 0	$ 0	$ +0	$ 0	$ 322137
23	$ 10511	$ 672	$ 4147	$ 0	$ 0	$ 0	$ +0	$ 0	$ 337467
24	$ 10511	$ 672	$ 4384	$ 0	$ 0	$ 0	$ +0	$ 0	$ 353034
25	$ 10511	$ 672	$ 4634	$ 1002	$ 0	$ 0	$ +0	$ 0	$ 369853
26	$ 10511	$ 672	$ 4898	$ 0	$ 0	$ 0	$ +0	$ 0	$ 385934
27	$ 10511	$ 672	$ 5177	$ 0	$ 0	$ 0	$ +0	$ 0	$ 402294
28	$ 10511	$ 672	$ 5472	$ 0	$ 0	$ 0	$ +0	$ 0	$ 418919
29	$ 10511	$ 672	$ 5784	$ 0	$ 0	$ 0	$ +0	$ 0	$ 435916
30	$ 10511	$ 672	$ 6114	$ 1323	$ 5590	$17842	$ +0	$ 0	$ 477968

**** = BREAKEVEN YEAR

SUMMARY OF ALL ANNUAL COSTS: EARTH SHELTER: CASE NUMBER: 14

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 21620
1	$ 10278	$ 317	$ 950	$ 0	$ 0	$ 0	$ +0	$ 0	$ 33165
2	$ 10278	$ 333	$ 1004	$ 0	$ 0	$ 0	$ +0	$ 0	$ 44781
3	$ 10278	$ 350	$ 1061	$ 0	$ 0	$ 0	$ +0	$ 0	$ 56469
4	$ 10278	$ 374	$ 1122	$ 0	$ 0	$ 0	$ +0	$ 0	$ 68243
5	$ 10278	$ 402	$ 1186	$ 59	$ 0	$ 0	$ +0	$ 0	$ 80168
6	$ 10278	$ 431	$ 1253	$ 0	$ 0	$ 0	$ +0	$ 0	$ 92130
7	$ 10278	$ 460	$ 1325	$ 0	$ 0	$ 0	$ +0	$ 0	$ 104193
8	$ 10278	$ 494	$ 1400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 116364
9	$ 10278	$ 525	$ 1480	$ 0	$ 0	$ 0	$ +0	$ 0	$ 128647
10	$ 10278	$ 554	$ 1565	$ 77	$ 741	$ 0	$ +0	$ 0	$ 141862
11	$ 10278	$ 554	$ 1654	$ 0	$ 0	$ 0	$ +0	$ 0	$ 154347
12	$ 10278	$ 554	$ 1748	$ 0	$ 0	$ 0	$ +0	$ 0	$ 166927
****	$ 10278	$ 554	$ 1848	$ 0	$ 0	$ 0	$ +0	$ 0	$ 179606
14	$ 10278	$ 554	$ 1953	$ 0	$ 0	$ 0	$ +0	$ 0	$ 192391
15	$ 10278	$ 554	$ 2064	$ 102	$ 0	$ 1565	$ +0	$ 0	$ 206953
16	$ 10278	$ 554	$ 2182	$ 0	$ 0	$ 0	$ +0	$ 0	$ 219967
17	$ 10278	$ 554	$ 2306	$ 0	$ 0	$ 0	$ +0	$ 0	$ 233104
18	$ 10278	$ 554	$ 2438	$ 0	$ 0	$ 0	$ +0	$ 0	$ 246374
19	$ 10278	$ 554	$ 2577	$ 0	$ 0	$ 0	$ +0	$ 0	$ 259782
20	$ 10278	$ 554	$ 2724	$ 135	$ 1290	$ 0	$ +0	$ 0	$ 274763
21	$ 10278	$ 554	$ 2879	$ 0	$ 0	$ 0	$ +0	$ 0	$ 288473
22	$ 10278	$ 554	$ 3043	$ 0	$ 0	$ 0	$ +0	$ 0	$ 302348
23	$ 10278	$ 554	$ 3216	$ 0	$ 0	$ 0	$ +0	$ 0	$ 316395
24	$ 10278	$ 554	$ 3400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 330627
25	$ 10278	$ 554	$ 3594	$ 178	$ 0	$ 0	$ +0	$ 0	$ 345230
26	$ 10278	$ 554	$ 3798	$ 0	$ 0	$ 0	$ +0	$ 0	$ 359860
27	$ 10278	$ 554	$ 4015	$ 0	$ 0	$ 0	$ +0	$ 0	$ 374706
28	$ 10278	$ 554	$ 4244	$ 0	$ 0	$ 0	$ +0	$ 0	$ 389782
29	$ 10278	$ 554	$ 4486	$ 0	$ 0	$ 0	$ +0	$ 0	$ 405099
30	$ 10278	$ 554	$ 4741	$ 235	$ 2246	$ 3593	$ +0	$ 0	$ 426746

**** = BREAKEVEN YEAR

CASE NUMBER: 15 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 85000	$ 93500
ANNUAL ENERGY COST	$ 1225	$ 605
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8500	$ 18700
LOAN ORIG. FEE.	$ 765	$ 748
PRIVATE MORT. INS.	$ 383	$ 0
PREPAID INS.	$ 406	$ 419
MORTGAGE POINTS	$ 1148	$ 1496
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11563	$ 21724

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11563	$ 21724			
1	$ 23290	$ 33030	16	$230445	$213950
2	$ 35089	$ 44392	17	$244602	$226435
3	$ 46980	$ 55812	18	$258928	$239003
4	$ 58981	$ 67302	19	$273434	$251660
5	$ 71427	$ 78930	20	$292100	$265836
6	$ 84273	$ 90580	21	$306995	$278685
7	$ 97250	$102316	22	$322102	$291639
8	$110364	$114144	23	$337432	$304703
9	$123613	$126065	24	$352999	$317884
10	$139285	$138895	25	$369818	$331367
11	$152791	$150964	26	$385899	$344802
12	$166419	$163093	27	$402259	$358375
13	$180176	$175286	28	$418914	$372094
14	$194068	$187546	29	$435881	$385967
15	$216448	$201544	30	$477933	$406076

BREAKEVEN YEAR = 10 BREAK-EVEN AT AHT:

SUMMARY OF ALL ANNUAL COSTS: CONVENTIONAL HOME: CASE NUMBER: 15

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 11563
1	$ 10511	$ 410	$ 1225	$ 0	$ 0	$ 0	$ -610	$ 191	$ 23290
2	$ 10511	$ 412	$ 1295	$ 0	$ 0	$ 0	$ -610	$ 191	$ 35089
3	$ 10511	$ 430	$ 1369	$ 0	$ 0	$ 0	$ -610	$ 191	$ 46980
4	$ 10511	$ 462	$ 1447	$ 0	$ 0	$ 0	$ -610	$ 191	$ 58981
5	$ 10511	$ 494	$ 1529	$ 331	$ 0	$ 0	$ -610	$ 191	$ 71427
6	$ 10511	$ 528	$ 1616	$ 0	$ 0	$ 0	$ +0	$ 191	$ 84273
7	$ 10511	$ 566	$ 1708	$ 0	$ 0	$ 0	$ +0	$ 191	$ 97250
8	$ 10511	$ 606	$ 1806	$ 0	$ 0	$ 0	$ +0	$ 191	$ 110364
9	$ 10511	$ 638	$ 1909	$ 0	$ 0	$ 0	$ +0	$ 191	$ 123613
****	$ 10511	$ 672	$ 2017	$ 436	$ 1845	$ 0	$ +0	$ 191	$ 139285
11	$ 10511	$ 672	$ 2132	$ 0	$ 0	$ 0	$ +0	$ 191	$ 152791
12	$ 10511	$ 672	$ 2254	$ 0	$ 0	$ 0	$ +0	$ 191	$ 166419
13	$ 10511	$ 672	$ 2383	$ 0	$ 0	$ 0	$ +0	$ 191	$ 180176
14	$ 10511	$ 672	$ 2518	$ 0	$ 0	$ 0	$ +0	$ 191	$ 194068
15	$ 10511	$ 672	$ 2662	$ 576	$ 0	$ 7768	$ +0	$ 191	$ 216448
16	$ 10511	$ 672	$ 2814	$ 0	$ 0	$ 0	$ +0	$ 0	$ 230445
17	$ 10511	$ 672	$ 2974	$ 0	$ 0	$ 0	$ +0	$ 0	$ 244602
18	$ 10511	$ 672	$ 3143	$ 0	$ 0	$ 0	$ +0	$ 0	$ 258928
19	$ 10511	$ 672	$ 3323	$ 0	$ 0	$ 0	$ +0	$ 0	$ 273434
20	$ 10511	$ 672	$ 3512	$ 760	$ 3211	$ 0	$ +0	$ 0	$ 292100
21	$ 10511	$ 672	$ 3712	$ 0	$ 0	$ 0	$ +0	$ 0	$ 306995
22	$ 10511	$ 672	$ 3924	$ 0	$ 0	$ 0	$ +0	$ 0	$ 322102
23	$ 10511	$ 672	$ 4147	$ 0	$ 0	$ 0	$ +0	$ 0	$ 337432
24	$ 10511	$ 672	$ 4384	$ 0	$ 0	$ 0	$ +0	$ 0	$ 352999
25	$ 10511	$ 672	$ 4634	$ 1002	$ 0	$ 0	$ +0	$ 0	$ 369818
26	$ 10511	$ 672	$ 4898	$ 0	$ 0	$ 0	$ +0	$ 0	$ 385899
27	$ 10511	$ 672	$ 5177	$ 0	$ 0	$ 0	$ +0	$ 0	$ 402259
28	$ 10511	$ 672	$ 5472	$ 0	$ 0	$ 0	$ +0	$ 0	$ 418914
29	$ 10511	$ 672	$ 5784	$ 0	$ 0	$ 0	$ +0	$ 0	$ 435881
30	$ 10511	$ 672	$ 6114	$ 1323	$ 5590	$17842	$ +0	$ 0	$ 477933

**** = BREAKEVEN YEAR

SUMMARY OF ALL ANNUAL COSTS: EARTH SHELTER: CASE NUMBER: 15

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 21724
1	$ 10278	$ 423	$ 605	$ 0	$ 0	$ 0	$ +0	$ 0	$ 33030
2	$ 10278	$ 445	$ 639	$ 0	$ 0	$ 0	$ +0	$ 0	$ 44392
3	$ 10278	$ 466	$ 676	$ 0	$ 0	$ 0	$ +0	$ 0	$ 55812
4	$ 10278	$ 499	$ 714	$ 0	$ 0	$ 0	$ +0	$ 0	$ 67302
5	$ 10278	$ 536	$ 755	$ 59	$ 0	$ 0	$ +0	$ 0	$ 78930
6	$ 10278	$ 574	$ 798	$ 0	$ 0	$ 0	$ +0	$ 0	$ 90580
7	$ 10278	$ 613	$ 844	$ 0	$ 0	$ 0	$ +0	$ 0	$ 102316
8	$ 10278	$ 658	$ 892	$ 0	$ 0	$ 0	$ +0	$ 0	$ 114144
9	$ 10278	$ 700	$ 943	$ 0	$ 0	$ 0	$ +0	$ 0	$ 126065
****	$ 10278	$ 738	$ 996	$ 77	$ 741	$ 0	$ +0	$ 0	$ 138895
11	$ 10278	$ 738	$ 1053	$ 0	$ 0	$ 0	$ +0	$ 0	$ 150964
12	$ 10278	$ 738	$ 1113	$ 0	$ 0	$ 0	$ +0	$ 0	$ 163093
13	$ 10278	$ 738	$ 1177	$ 0	$ 0	$ 0	$ +0	$ 0	$ 175286
14	$ 10278	$ 738	$ 1244	$ 0	$ 0	$ 0	$ +0	$ 0	$ 187546
15	$ 10278	$ 738	$ 1315	$ 102	$ 0	$ 1565	$ +0	$ 0	$ 201544
16	$ 10278	$ 738	$ 1390	$ 0	$ 0	$ 0	$ +0	$ 0	$ 213950
17	$ 10278	$ 738	$ 1469	$ 0	$ 0	$ 0	$ +0	$ 0	$ 226435
18	$ 10278	$ 738	$ 1552	$ 0	$ 0	$ 0	$ +0	$ 0	$ 239003
19	$ 10278	$ 738	$ 1641	$ 0	$ 0	$ 0	$ +0	$ 0	$ 251660
20	$ 10278	$ 738	$ 1735	$ 135	$ 1290	$ 0	$ +0	$ 0	$ 265836
21	$ 10278	$ 738	$ 1833	$ 0	$ 0	$ 0	$ +0	$ 0	$ 278685
22	$ 10278	$ 738	$ 1938	$ 0	$ 0	$ 0	$ +0	$ 0	$ 291639
23	$ 10278	$ 738	$ 2048	$ 0	$ 0	$ 0	$ +0	$ 0	$ 304703
24	$ 10278	$ 738	$ 2165	$ 0	$ 0	$ 0	$ +0	$ 0	$ 317884
25	$ 10278	$ 738	$ 2289	$ 178	$ 0	$ 0	$ +0	$ 0	$ 331367
26	$ 10278	$ 738	$ 2419	$ 0	$ 0	$ 0	$ +0	$ 0	$ 344802
27	$ 10278	$ 738	$ 2557	$ 0	$ 0	$ 0	$ +0	$ 9	$ 358375
28	$ 10278	$ 738	$ 2703	$ 0	$ 0	$ 0	$ +0	$ 0	$ 372094
29	$ 10278	$ 738	$ 2857	$ 0	$ 0	$ 0	$ +0	$ 0	$ 385967
30	$ 10278	$ 738	$ 3019	$ 235	$ 2246	$ 3593	$ +0	$ 0	$ 406076

**** = BREAKEVEN YEAR

SUMMARY OF ALL ANNUAL COSTS: CONVENTIONAL HOME: CASE NUMBER: 16

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 11563
1	$ 10511	$ 410	$ 1225	$ 0	$ 0	$ 0	$ -610	$ 191	$ 23290
2	$ 10511	$ 412	$ 1295	$ 0	$ 0	$ 0	$ -610	$ 191	$ 35089
3	$ 10511	$ 430	$ 1369	$ 0	$ 0	$ 0	$ -610	$ 191	$ 46980
4	$ 10511	$ 462	$ 1447	$ 0	$ 0	$ 0	$ -610	$ 191	$ 58981
5	$ 10511	$ 494	$ 1529	$ 331	$ 0	$ 0	$ -610	$ 191	$ 71427
6	$ 10511	$ 528	$ 1616	$ 0	$ 0	$ 0	$ +0	$ 191	$ 84273
7	$ 10511	$ 566	$ 1708	$ 0	$ 0	$ 0	$ +0	$ 191	$ 97250
8	$ 10511	$ 606	$ 1806	$ 0	$ 0	$ 0	$ +0	$ 191	$ 110364
9	$ 10511	$ 638	$ 1909	$ 0	$ 0	$ 0	$ +0	$ 191	$ 123613
10	$ 10511	$ 672	$ 2017	$ 436	$ 1845	$ 0	$ +0	$ 191	$ 139285
11	$ 10511	$ 672	$ 2132	$ 0	$ 0	$ 0	$ +0	$ 191	$ 152791
12	$ 10511	$ 672	$ 2254	$ 0	$ 0	$ 0	$ +0	$ 191	$ 166419
13	$ 10511	$ 672	$ 2383	$ 0	$ 0	$ 0	$ +0	$ 191	$ 180176
14	$ 10511	$ 672	$ 2518	$ 0	$ 0	$ 0	$ +0	$ 191	$ 194068
****	$ 10511	$ 672	$ 2662	$ 576	$ 0	$ 7768	$ +0	$ 191	$ 216448
16	$ 10511	$ 672	$ 2814	$ 0	$ 0	$ 0	$ +0	$ 0	$ 230445
17	$ 10511	$ 672	$ 2974	$ 0	$ 0	$ 0	$ +0	$ 0	$ 244602
18	$ 10511	$ 672	$ 3143	$ 0	$ 0	$ 0	$ +0	$ 0	$ 258928
19	$ 10511	$ 672	$ 3323	$ 0	$ 0	$ 0	$ +0	$ 0	$ 273434
20	$ 10511	$ 672	$ 3512	$ 760	$ 3211	$ 0	$ +0	$ 0	$ 292100
21	$ 10511	$ 672	$ 3712	$ 0	$ 0	$ 0	$ +0	$ 0	$ 306995
22	$ 10511	$ 672	$ 3924	$ 0	$ 0	$ 0	$ +0	$ 0	$ 322102
23	$ 10511	$ 672	$ 4147	$ 0	$ 0	$ 0	$ +0	$ 0	$ 337432
24	$ 10511	$ 672	$ 4384	$ 0	$ 0	$ 0	$ +0	$ 0	$ 352999
25	$ 10511	$ 672	$ 4634	$ 1002	$ 0	$ 0	$ +0	$ 0	$ 369818
26	$ 10511	$ 672	$ 4898	$ 0	$ 0	$ 0	$ +0	$ 0	$ 385899
27	$ 10511	$ 672	$ 5177	$ 0	$ 0	$ 0	$ +0	$ 0	$ 402259
28	$ 10511	$ 672	$ 5472	$ 0	$ 0	$ 0	$ +0	$ 0	$ 418914
29	$ 10511	$ 672	$ 5784	$ 0	$ 0	$ 0	$ +0	$ 0	$ 435881
30	$ 10511	$ 672	$ 6114	$ 1323	$ 5590	$17842	$ +0	$ 0	$ 477933

**** = BREAKEVEN YEAR

CASE NUMBER: 16 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 85000	$ 93500
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8500	$ 18700
LOAN ORIG. FEE.	$ 765	$ 748
PRIVATE MORT. INS.	$ 383	$ 0
PREPAID INS.	$ 406	$ 419
MORTGAGE POINTS	$ 1148	$ 1496
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11563	$ 21724

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11563	$ 21724			
1	$ 23290	$ 33375	16	$230445	$222353
2	$ 35089	$ 45102	17	$244602	$235675
3	$ 46980	$ 56907	18	$258928	$249129
4	$ 58981	$ 68805	19	$273434	$262722
5	$ 71427	$ 80805	20	$292100	$277752
6	$ 84273	$ 92910	21	$306995	$291647
7	$ 97250	$105127	22	$322102	$305706
8	$110364	$117463	23	$337432	$319938
9	$123613	$129921	24	$352999	$334354
10	$139285	$143243	25	$369818	$348964
11	$152791	$155913	26	$385899	$363778
12	$166419	$168677	27	$402259	$378809
13	$180176	$181541	28	$418914	$394069
14	$194068	$194510	29	$435881	$409571
15	$216448	$209155	30	$477933	$431167

BREAKEVEN YEAR = 15 BREAK-EVEN AT AHT:

SUMMARY OF ALL ANNUAL COSTS: EARTH SHELTER: CASE NUMBER: 16

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 21724
1	$ 10278	$ 423	$ 950	$ 0	$ 0	$ 0	$ +0	$ 0	$ 33375
2	$ 10278	$ 445	$ 1004	$ 0	$ 0	$ 0	$ +0	$ 0	$ 45102
3	$ 10278	$ 466	$ 1061	$ 0	$ 0	$ 0	$ +0	$ 0	$ 56907
4	$ 10278	$ 499	$ 1122	$ 0	$ 0	$ 0	$ +0	$ 0	$ 68805
5	$ 10278	$ 536	$ 1186	$ 0	$ 0	$ 0	$ +0	$ 0	$ 80805
6	$ 10278	$ 574	$ 1253	$ 0	$ 0	$ 0	$ +0	$ 0	$ 92910
7	$ 10278	$ 613	$ 1325	$ 0	$ 0	$ 0	$ +0	$ 0	$ 105127
8	$ 10278	$ 658	$ 1400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 117463
9	$ 10278	$ 700	$ 1480	$ 0	$ 0	$ 0	$ +0	$ 0	$ 129921
10	$ 10278	$ 738	$ 1565	$ 0	$ 741	$ 0	$ +0	$ 0	$ 143243
11	$ 10278	$ 738	$ 1654	$ 0	$ 0	$ 0	$ +0	$ 0	$ 155913
12	$ 10278	$ 738	$ 1748	$ 0	$ 0	$ 0	$ +0	$ 0	$ 168677
13	$ 10278	$ 738	$ 1848	$ 0	$ 0	$ 0	$ +0	$ 0	$ 181541
14	$ 10278	$ 738	$ 1953	$ 0	$ 0	$ 0	$ +0	$ 0	$ 194510
****	$ 10278	$ 738	$ 2064	$ 0	$ 0	$ 1565	$ +0	$ 0	$ 209155
16	$ 10278	$ 738	$ 2182	$ 0	$ 0	$ 0	$ +0	$ 0	$ 222353
17	$ 10278	$ 738	$ 2306	$ 0	$ 0	$ 0	$ +0	$ 0	$ 235675
18	$ 10278	$ 738	$ 2438	$ 0	$ 0	$ 0	$ +0	$ 0	$ 249129
19	$ 10278	$ 738	$ 2577	$ 0	$ 0	$ 0	$ +0	$ 0	$ 262722
20	$ 10278	$ 738	$ 2724	$ 0	$ 1290	$ 0	$ +0	$ 0	$ 277752
21	$ 10278	$ 738	$ 2879	$ 0	$ 0	$ 0	$ +0	$ 0	$ 291647
22	$ 10278	$ 738	$ 3043	$ 0	$ 0	$ 0	$ +0	$ 0	$ 305706
23	$ 10278	$ 738	$ 3216	$ 0	$ 0	$ 0	$ +0	$ 0	$ 319938
24	$ 10278	$ 738	$ 3400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 334354
25	$ 10278	$ 738	$ 3594	$ 0	$ 0	$ 0	$ +0	$ 0	$ 348964
26	$ 10278	$ 738	$ 3798	$ 0	$ 0	$ 0	$ +0	$ 0	$ 363778
27	$ 10278	$ 738	$ 4015	$ 0	$ 0	$ 0	$ +0	$ 0	$ 378809
28	$ 10278	$ 738	$ 4244	$ 0	$ 0	$ 0	$ +0	$ 0	$ 394069
29	$ 10278	$ 738	$ 4486	$ 0	$ 0	$ 0	$ +0	$ 0	$ 409571
30	$ 10278	$ 738	$ 4741	$ 0	$ 2246	$ 3593	$ +0	$ 0	$ 431167

**** = BREAKEVEN YEAR

CASE NUMBER: 17 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 85000	$ 93500
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8500	$ 18700
LOAN ORIG. FEE.	$ 765	$ 748
PRIVATE MORT. INS.	$ 383	$ 0
PREPAID INS.	$ 406	$ 419
MORTGAGE POINTS	$ 1148	$ 1496
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11563	$ 21724

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11563	$ 21724			
1	$ 23290	$ 33375	16	$230445	$223367
2	$ 35089	$ 45102	17	$244602	$236689
3	$ 46980	$ 56907	18	$258928	$250143
4	$ 58981	$ 68805	19	$273434	$263736
5	$ 71427	$ 81055	20	$292100	$279339
6	$ 84273	$ 93160	21	$306995	$293234
7	$ 97250	$105377	22	$322102	$307293
8	$110364	$117713	23	$337432	$321525
9	$123613	$130171	24	$352999	$335941
10	$139285	$143822	25	$369818	$351308
11	$152791	$156492	26	$385899	$366122
12	$166419	$169256	27	$402259	$381153
13	$180176	$182120	28	$418914	$396413
14	$194068	$195089	29	$435881	$411915
15	$216448	$210169	30	$477933	$434509

BREAKEVEN YEAR = 15 BREAK-EVEN AT AHT:

SUMMARY OF ALL ANNUAL COSTS: CONVENTIONAL HOME: CASE NUMBER: 17

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 11563
1	$ 10511	$ 410	$ 1225	$ 0	$ 0	$ 0	$ -610	$ 191	$ 23290
2	$ 10511	$ 412	$ 1295	$ 0	$ 0	$ 0	$ -610	$ 191	$ 35089
3	$ 10511	$ 430	$ 1369	$ 0	$ 0	$ 0	$ -610	$ 191	$ 46980
4	$ 10511	$ 462	$ 1447	$ 0	$ 0	$ 0	$ -610	$ 191	$ 58981
5	$ 10511	$ 494	$ 1529	$ 331	$ 0	$ 0	$ -610	$ 191	$ 71427
6	$ 10511	$ 528	$ 1616	$ 0	$ 0	$ 0	$ +0	$ 191	$ 84273
7	$ 10511	$ 566	$ 1708	$ 0	$ 0	$ 0	$ +0	$ 191	$ 97250
8	$ 10511	$ 606	$ 1806	$ 0	$ 0	$ 0	$ +0	$ 191	$ 110364
9	$ 10511	$ 638	$ 1909	$ 0	$ 0	$ 0	$ +0	$ 191	$ 123613
10	$ 10511	$ 672	$ 2017	$ 436	$ 1845	$ 0	$ +0	$ 191	$ 139285
11	$ 10511	$ 672	$ 2132	$ 0	$ 0	$ 0	$ +0	$ 191	$ 152791
12	$ 10511	$ 672	$ 2254	$ 0	$ 0	$ 0	$ +0	$ 191	$ 166419
13	$ 10511	$ 672	$ 2383	$ 0	$ 0	$ 0	$ +0	$ 191	$ 180176
14	$ 10511	$ 672	$ 2518	$ 0	$ 0	$ 0	$ +0	$ 191	$ 194068
****	$ 10511	$ 672	$ 2662	$ 576	$ 0	$ 7768	$ +0	$ 191	$ 216448
16	$ 10511	$ 672	$ 2814	$ 0	$ 0	$ 0	$ +0	$ 0	$ 230445
17	$ 10511	$ 672	$ 2974	$ 0	$ 0	$ 0	$ +0	$ 0	$ 244602
18	$ 10511	$ 672	$ 3143	$ 0	$ 0	$ 0	$ +0	$ 0	$ 258928
19	$ 10511	$ 672	$ 3323	$ 0	$ 0	$ 0	$ +0	$ 0	$ 273434
20	$ 10511	$ 672	$ 3512	$ 760	$ 3211	$ 0	$ +0	$ 0	$ 292100
21	$ 10511	$ 672	$ 3712	$ 0	$ 0	$ 0	$ +0	$ 0	$ 306995
22	$ 10511	$ 672	$ 3924	$ 0	$ 0	$ 0	$ +0	$ 0	$ 322102
23	$ 10511	$ 672	$ 4147	$ 0	$ 0	$ 0	$ +0	$ 0	$ 337432
24	$ 10511	$ 672	$ 4384	$ 0	$ 0	$ 0	$ +0	$ 0	$ 352999
25	$ 10511	$ 672	$ 4634	$ 1002	$ 0	$ 0	$ +0	$ 0	$ 369818
26	$ 10511	$ 672	$ 4898	$ 0	$ 0	$ 0	$ +0	$ 0	$ 385899
27	$ 10511	$ 672	$ 5177	$ 0	$ 0	$ 0	$ +0	$ 0	$ 402259
28	$ 10511	$ 672	$ 5472	$ 0	$ 0	$ 0	$ +0	$ 0	$ 418914
29	$ 10511	$ 672	$ 5784	$ 0	$ 0	$ 0	$ +0	$ 0	$ 435881
30	$ 10511	$ 672	$ 6114	$ 1323	$ 5590	$17842	$ +0	$ 0	$ 477933

**** = BREAKEVEN YEAR

SUMMARY OF ALL ANNUAL COSTS: EARTH SHELTER: CASE NUMBER: 17

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 21724
1	$ 10278	$ 423	$ 950	$ 0	$ 0	$ 0	+0	$ 0	$ 33375
2	$ 10278	$ 445	$ 1004	$ 0	$ 0	$ 0	+0	$ 0	$ 45102
3	$ 10278	$ 466	$ 1061	$ 0	$ 0	$ 0	+0	$ 0	$ 56907
4	$ 10278	$ 499	$ 1122	$ 0	$ 0	$ 0	+0	$ 0	$ 68805
5	$ 10278	$ 536	$ 1186	$ 250	$ 0	$ 0	+0	$ 0	$ 81055
6	$ 10278	$ 574	$ 1253	$ 0	$ 0	$ 0	+0	$ 0	$ 93160
7	$ 10278	$ 613	$ 1325	$ 0	$ 0	$ 0	+0	$ 0	$ 105377
8	$ 10278	$ 658	$ 1400	$ 0	$ 0	$ 0	+0	$ 0	$ 117713
9	$ 10278	$ 700	$ 1480	$ 0	$ 0	$ 0	+0	$ 0	$ 130171
10	$ 10278	$ 738	$ 1565	$ 329	$ 741	$ 0	+0	$ 0	$ 143822
11	$ 10278	$ 738	$ 1654	$ 0	$ 0	$ 0	+0	$ 0	$ 156492
12	$ 10278	$ 738	$ 1748	$ 0	$ 0	$ 0	+0	$ 0	$ 169256
13	$ 10278	$ 738	$ 1848	$ 0	$ 0	$ 0	+0	$ 0	$ 182120
14	$ 10278	$ 738	$ 1953	$ 0	$ 0	$ 0	+0	$ 0	$ 195089
****	$ 10278	$ 738	$ 2064	$ 435	$ 0	$ 1565	+0	$ 0	$ 210169
16	$ 10278	$ 738	$ 2182	$ 0	$ 0	$ 0	+0	$ 0	$ 223367
17	$ 10278	$ 738	$ 2306	$ 0	$ 0	$ 0	+0	$ 0	$ 236689
18	$ 10278	$ 738	$ 2438	$ 0	$ 0	$ 0	+0	$ 0	$ 250143
19	$ 10278	$ 738	$ 2577	$ 0	$ 0	$ 0	+0	$ 0	$ 263736
20	$ 10278	$ 738	$ 2724	$ 573	$ 1290	$ 0	+0	$ 0	$ 279339
21	$ 10278	$ 738	$ 2879	$ 0	$ 0	$ 0	+0	$ 0	$ 293234
22	$ 10278	$ 738	$ 3043	$ 0	$ 0	$ 0	+0	$ 0	$ 307293
23	$ 10278	$ 738	$ 3216	$ 0	$ 0	$ 0	+0	$ 0	$ 321525
24	$ 10278	$ 738	$ 3400	$ 0	$ 0	$ 0	+0	$ 0	$ 335941
25	$ 10278	$ 738	$ 3594	$ 757	$ 0	$ 0	+0	$ 0	$ 351308
26	$ 10278	$ 738	$ 3798	$ 0	$ 0	$ 0	+0	$ 0	$ 366122
27	$ 10278	$ 738	$ 4015	$ 0	$ 0	$ 0	+0	$ 0	$ 381153
28	$ 10278	$ 738	$ 4244	$ 0	$ 0	$ 0	+0	$ 0	$ 396413
29	$ 10278	$ 738	$ 4486	$ 0	$ 0	$ 0	+0	$ 0	$ 411915
30	$ 10278	$ 738	$ 4741	$ 998	$ 2246	$ 3593	+0	$ 0	$ 434509

**** = BREAKEVEN YEAR

CASE NUMBER: 18 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 85000	$ 93500
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8500	$ 18700
LOAN ORIG. FEE.	$ 765	$ 748
PRIVATE MORT. INS.	$ 383	$ 0
PREPAID INS.	$ 406	$ 419
MORTGAGE POINTS	$ 1148	$ 1496
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11563	$ 21724

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11563	$ 21724			
1	$ 23290	$ 33375	16	$230445	$221026
2	$ 35089	$ 45102	17	$244602	$234348
3	$ 46980	$ 56907	18	$258928	$247802
4	$ 58981	$ 68805	19	$273434	$261395
5	$ 71427	$ 80864	20	$292100	$276560
6	$ 84273	$ 92969	21	$306995	$290455
7	$ 97250	$105186	22	$322102	$304514
8	$110364	$117522	23	$337432	$318746
9	$123613	$129980	24	$352999	$333162
10	$139285	$143379	25	$369818	$347950
11	$152791	$156049	26	$385899	$362764
12	$166419	$168813	27	$402259	$377795
13	$180176	$181677	28	$418914	$393055
14	$194068	$194646	29	$435881	$408557
15	$216448	$207828	30	$477933	$426795

BREAKEVEN YEAR = 15 BREAK-EVEN AT AHT:

SUMMARY OF ALL ANNUAL COSTS: EARTH SHELTER: CASE NUMBER: 18

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 21724
1	$ 10278	$ 423	$ 950	$ 0	$ 0	$ 0	+0	$ 0	$ 33375
2	$ 10278	$ 445	$ 1004	$ 0	$ 0	$ 0	+0	$ 0	$ 45102
3	$ 10278	$ 466	$ 1061	$ 0	$ 0	$ 0	+0	$ 0	$ 56907
4	$ 10278	$ 499	$ 1122	$ 0	$ 0	$ 0	+0	$ 0	$ 68805
5	$ 10278	$ 536	$ 1186	$ 59	$ 0	$ 0	+0	$ 0	$ 80864
6	$ 10278	$ 574	$ 1253	$ 0	$ 0	$ 0	+0	$ 0	$ 92969
7	$ 10278	$ 613	$ 1325	$ 0	$ 0	$ 0	+0	$ 0	$ 105186
8	$ 10278	$ 658	$ 1400	$ 0	$ 0	$ 0	+0	$ 0	$ 117522
9	$ 10278	$ 700	$ 1480	$ 0	$ 0	$ 0	+0	$ 0	$ 129980
10	$ 10278	$ 738	$ 1565	$ 77	$ 741	$ 0	+0	$ 0	$ 143379
11	$ 10278	$ 738	$ 1654	$ 0	$ 0	$ 0	+0	$ 0	$ 156049
12	$ 10278	$ 738	$ 1748	$ 0	$ 0	$ 0	+0	$ 0	$ 168813
13	$ 10278	$ 738	$ 1848	$ 0	$ 0	$ 0	+0	$ 0	$ 181677
14	$ 10278	$ 738	$ 1953	$ 0	$ 0	$ 0	+0	$ 0	$ 194646
****	$ 10278	$ 738	$ 2064	$ 102	$ 0	$ 0	+0	$ 0	$ 207828
16	$ 10278	$ 738	$ 2182	$ 0	$ 0	$ 0	+0	$ 0	$ 221026
17	$ 10278	$ 738	$ 2306	$ 0	$ 0	$ 0	+0	$ 0	$ 234348
18	$ 10278	$ 738	$ 2438	$ 0	$ 0	$ 0	+0	$ 0	$ 247802
19	$ 10278	$ 738	$ 2577	$ 0	$ 0	$ 0	+0	$ 0	$ 261395
20	$ 10278	$ 738	$ 2724	$ 135	$ 1290	$ 0	+0	$ 0	$ 276560
21	$ 10278	$ 738	$ 2879	$ 0	$ 0	$ 0	+0	$ 0	$ 290455
22	$ 10278	$ 738	$ 3043	$ 0	$ 0	$ 0	+0	$ 0	$ 304514
23	$ 10278	$ 738	$ 3216	$ 0	$ 0	$ 0	+0	$ 0	$ 318746
24	$ 10278	$ 738	$ 3400	$ 0	$ 0	$ 0	+0	$ 0	$ 333162
25	$ 10278	$ 738	$ 3594	$ 178	$ 0	$ 0	+0	$ 0	$ 347950
26	$ 10278	$ 738	$ 3798	$ 0	$ 0	$ 0	+0	$ 0	$ 362764
27	$ 10278	$ 738	$ 4015	$ 0	$ 0	$ 0	+0	$ 0	$ 377795
28	$ 10278	$ 738	$ 4244	$ 0	$ 0	$ 0	+0	$ 0	$ 393055
29	$ 10278	$ 738	$ 4486	$ 0	$ 0	$ 0	+0	$ 0	$ 408557
30	$ 10278	$ 738	$ 4741	$ 235	$ 2246	$ 0	+0	$ 0	$ 426795

**** = BREAKEVEN YEAR

SUMMARY OF ALL ANNUAL COSTS: CONVENTIONAL HOME: CASE NUMBER: 18

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 11563
1	$ 10511	$ 410	$ 1225	$ 0	$ 0	$ 0	$ -610	$ 191	$ 23290
2	$ 10511	$ 412	$ 1295	$ 0	$ 0	$ 0	$ -610	$ 191	$ 35089
3	$ 10511	$ 430	$ 1369	$ 0	$ 0	$ 0	$ -610	$ 191	$ 46980
4	$ 10511	$ 462	$ 1447	$ 0	$ 0	$ 0	$ -610	$ 191	$ 58981
5	$ 10511	$ 494	$ 1529	$ 331	$ 0	$ 0	$ -610	$ 191	$ 71427
6	$ 10511	$ 528	$ 1616	$ 0	$ 0	$ 0	$ +0	$ 191	$ 84273
7	$ 10511	$ 566	$ 1708	$ 0	$ 0	$ 0	$ +0	$ 191	$ 97250
8	$ 10511	$ 606	$ 1806	$ 0	$ 0	$ 0	$ +0	$ 191	$ 110364
9	$ 10511	$ 638	$ 1909	$ 0	$ 0	$ 0	$ +0	$ 191	$ 123613
10	$ 10511	$ 672	$ 2017	$ 436	$ 1845	$ 0	$ +0	$ 191	$ 139285
11	$ 10511	$ 672	$ 2132	$ 0	$ 0	$ 0	$ +0	$ 191	$ 152791
12	$ 10511	$ 672	$ 2254	$ 0	$ 0	$ 0	$ +0	$ 191	$ 166419
13	$ 10511	$ 672	$ 2383	$ 0	$ 0	$ 0	$ +0	$ 191	$ 180176
14	$ 10511	$ 672	$ 2518	$ 0	$ 0	$ 0	$ +0	$ 191	$ 194068
****	$ 10511	$ 672	$ 2662	$ 576	$ 0	$ 7768	$ +0	$ 191	$ 216448
16	$ 10511	$ 672	$ 2814	$ 0	$ 0	$ 0	$ +0	$ 0	$ 230445
17	$ 10511	$ 672	$ 2974	$ 0	$ 0	$ 0	$ +0	$ 0	$ 244602
18	$ 10511	$ 672	$ 3143	$ 0	$ 0	$ 0	$ +0	$ 0	$ 258928
19	$ 10511	$ 672	$ 3323	$ 0	$ 0	$ 0	$ +0	$ 0	$ 273434
20	$ 10511	$ 672	$ 3512	$ 760	$ 3211	$ 0	$ +0	$ 0	$ 292100
21	$ 10511	$ 672	$ 3712	$ 0	$ 0	$ 0	$ +0	$ 0	$ 306995
22	$ 10511	$ 672	$ 3924	$ 0	$ 0	$ 0	$ +0	$ 0	$ 322102
23	$ 10511	$ 672	$ 4147	$ 0	$ 0	$ 0	$ +0	$ 0	$ 337432
24	$ 10511	$ 672	$ 4384	$ 0	$ 0	$ 0	$ +0	$ 0	$ 352999
25	$ 10511	$ 672	$ 4634	$ 1002	$ 0	$ 0	$ +0	$ 0	$ 369818
26	$ 10511	$ 672	$ 4898	$ 0	$ 0	$ 0	$ +0	$ 0	$ 385899
27	$ 10511	$ 672	$ 5177	$ 0	$ 0	$ 0	$ +0	$ 0	$ 402259
28	$ 10511	$ 672	$ 5472	$ 0	$ 0	$ 0	$ +0	$ 0	$ 418914
29	$ 10511	$ 672	$ 5784	$ 0	$ 0	$ 0	$ +0	$ 0	$ 435881
30	$ 10511	$ 672	$ 6114	$ 1323	$ 5590	$17842	$ +0	$ 0	$ 477933

**** = BREAKEVEN YEAR

CASE NUMBER: 19 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 85000	$ 93500
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8500	$ 18700
LOAN ORIG. FEE.	$ 765	$ 748
PRIVATE MORT. INS.	$ 383	$ 0
PREPAID INS.	$ 406	$ 419
MORTGAGE POINTS	$ 1148	$ 1496
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11563	$ 21724

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11563	$ 21724			
1	$ 23290	$ 33375	16	$230445	$225372
2	$ 35089	$ 45102	17	$244602	$238694
3	$ 46980	$ 56907	18	$258928	$252148
4	$ 58981	$ 68805	19	$273434	$265741
5	$ 71427	$ 80864	20	$292100	$280906
6	$ 84273	$ 92969	21	$306995	$294801
7	$ 97250	$105186	22	$322102	$308860
8	$110364	$117522	23	$337432	$323092
9	$123613	$129980	24	$352999	$337508
10	$139285	$143379	25	$369818	$352296
11	$152791	$156049	26	$385899	$367110
12	$166419	$168813	27	$402259	$382141
13	$180176	$181677	28	$418914	$397401
14	$194068	$194646	29	$435881	$412903
15	$216448	$212174	30	$477933	$441123

BREAKEVEN YEAR = 15 BREAK-EVEN AT AHT:

SUMMARY OF ALL ANNUAL COSTS: CONVENTIONAL HOME: CASE NUMBER: 19

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 11563
1	$ 10511	$ 410	$ 1225	$ 0	$ 0	$ 0	$ -610	$ 191	$ 23290
2	$ 10511	$ 412	$ 1295	$ 0	$ 0	$ 0	$ -610	$ 191	$ 35039
3	$ 10511	$ 430	$ 1369	$ 0	$ 0	$ 0	$ -610	$ 191	$ 46980
4	$ 10511	$ 462	$ 1447	$ 0	$ 0	$ 0	$ -610	$ 191	$ 58981
5	$ 10511	$ 494	$ 1529	$ 331	$ 0	$ 0	$ -610	$ 191	$ 71427
6	$ 10511	$ 528	$ 1616	$ 0	$ 0	$ 0	$ +0	$ 191	$ 84273
7	$ 10511	$ 566	$ 1708	$ 0	$ 0	$ 0	$ +0	$ 191	$ 97250
8	$ 10511	$ 606	$ 1806	$ 0	$ 0	$ 0	$ +0	$ 191	$ 110364
9	$ 10511	$ 638	$ 1909	$ 0	$ 0	$ 0	$ +0	$ 191	$ 123613
10	$ 10511	$ 672	$ 2017	$ 436	$ 1845	$ 0	$ +0	$ 191	$ 139285
11	$ 10511	$ 672	$ 2132	$ 0	$ 0	$ 0	$ +0	$ 191	$ 152791
12	$ 10511	$ 672	$ 2254	$ 0	$ 0	$ 0	$ +0	$ 191	$ 166419
13	$ 10511	$ 672	$ 2383	$ 0	$ 0	$ 0	$ +0	$ 191	$ 180176
14	$ 10511	$ 672	$ 2518	$ 0	$ 0	$ 0	$ +0	$ 191	$ 194068
****	$ 10511	$ 672	$ 2662	$ 576	$ 0	$ 7768	$ +0	$ 191	$ 216448
16	$ 10511	$ 672	$ 2814	$ 0	$ 0	$ 0	$ +0	$ 0	$ 230445
17	$ 10511	$ 672	$ 2974	$ 0	$ 0	$ 0	$ +0	$ 0	$ 244602
18	$ 10511	$ 672	$ 3143	$ 0	$ 0	$ 0	$ +0	$ 0	$ 258928
19	$ 10511	$ 672	$ 3323	$ 0	$ 0	$ 0	$ +0	$ 0	$ 273434
20	$ 10511	$ 672	$ 3512	$ 760	$ 3211	$ 0	$ +0	$ 0	$ 292100
21	$ 10511	$ 672	$ 3712	$ 0	$ 0	$ 0	$ +0	$ 0	$ 306995
22	$ 10511	$ 672	$ 3924	$ 0	$ 0	$ 0	$ +0	$ 0	$ 322102
23	$ 10511	$ 672	$ 4147	$ 0	$ 0	$ 0	$ +0	$ 0	$ 337432
24	$ 10511	$ 672	$ 4384	$ 0	$ 0	$ 0	$ +0	$ 0	$ 352999
25	$ 10511	$ 672	$ 4634	$ 1002	$ 0	$ 0	$ +0	$ 0	$ 369818
26	$ 10511	$ 672	$ 4898	$ 0	$ 0	$ 0	$ +0	$ 0	$ 385899
27	$ 10511	$ 672	$ 5177	$ 0	$ 0	$ 0	$ +0	$ 0	$ 402259
28	$ 10511	$ 672	$ 5472	$ 0	$ 0	$ 0	$ +0	$ 0	$ 418914
29	$ 10511	$ 672	$ 5784	$ 0	$ 0	$ 0	$ +0	$ 0	$ 435881
30	$ 10511	$ 672	$ 6114	$ 1323	$ 5590	$17842	$ +0	$ 0	$ 477933

**** = BREAKEVEN YEAR

SUMMARY OF ALL ANNUAL COSTS: EARTH SHELTER: CASE NUMBER: 19

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 21724
1	$ 10278	$ 423	$ 950	$ 0	$ 0	$ 0	$ +0	$ 0	$ 33375
2	$ 10278	$ 445	$ 1004	$ 0	$ 0	$ 0	$ +0	$ 0	$ 45102
3	$ 10278	$ 466	$ 1061	$ 0	$ 0	$ 0	$ +0	$ 0	$ 56907
4	$ 10278	$ 499	$ 1122	$ 0	$ 0	$ 0	$ +0	$ 0	$ 68805
5	$ 10278	$ 536	$ 1186	$ 59	$ 0	$ 0	$ +0	$ 0	$ 80864
6	$ 10278	$ 574	$ 1253	$ 0	$ 0	$ 0	$ +0	$ 0	$ 92969
7	$ 10278	$ 613	$ 1325	$ 0	$ 0	$ 0	$ +0	$ 0	$ 105186
8	$ 10278	$ 658	$ 1400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 117522
9	$ 10278	$ 700	$ 1480	$ 0	$ 0	$ 0	$ +0	$ 0	$ 129980
10	$ 10278	$ 738	$ 1565	$ 77	$ 741	$ 0	$ +0	$ 0	$ 143379
11	$ 10278	$ 738	$ 1654	$ 0	$ 0	$ 0	$ +0	$ 0	$ 156049
12	$ 10278	$ 738	$ 1748	$ 0	$ 0	$ 0	$ +0	$ 0	$ 168813
13	$ 10278	$ 738	$ 1848	$ 0	$ 0	$ 0	$ +0	$ 0	$ 181677
14	$ 10278	$ 738	$ 1953	$ 0	$ 0	$ 0	$ +0	$ 0	$ 194646
****	$ 10278	$ 738	$ 2064	$ 102	$ 0	$ 4346	$ +0	$ 0	$ 212174
16	$ 10278	$ 738	$ 2182	$ 0	$ 0	$ 0	$ +0	$ 0	$ 225372
17	$ 10278	$ 738	$ 2306	$ 0	$ 0	$ 0	$ +0	$ 0	$ 238694
18	$ 10278	$ 738	$ 2438	$ 0	$ 0	$ 0	$ +0	$ 0	$ 252148
19	$ 10278	$ 738	$ 2577	$ 0	$ 0	$ 0	$ +0	$ 0	$ 265741
20	$ 10278	$ 738	$ 2724	$ 135	$ 1290	$ 0	$ +0	$ 0	$ 280906
21	$ 10278	$ 738	$ 2879	$ 0	$ 0	$ 0	$ +0	$ 0	$ 294801
22	$ 10278	$ 738	$ 3043	$ 0	$ 0	$ 0	$ +0	$ 0	$ 308860
23	$ 10278	$ 738	$ 3216	$ 0	$ 0	$ 0	$ +0	$ 0	$ 323092
24	$ 10278	$ 738	$ 3400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 337508
25	$ 10278	$ 738	$ 3594	$ 178	$ 0	$ 0	$ +0	$ 0	$ 352296
26	$ 10278	$ 738	$ 3798	$ 0	$ 0	$ 0	$ +0	$ 0	$ 367110
27	$ 10278	$ 738	$ 4015	$ 0	$ 0	$ 0	$ +0	$ 0	$ 382141
28	$ 10278	$ 738	$ 4244	$ 0	$ 0	$ 0	$ +0	$ 0	$ 397401
29	$ 10278	$ 738	$ 4486	$ 0	$ 0	$ 0	$ +0	$ 0	$ 412903
30	$ 10278	$ 738	$ 4741	$ 235	$ 2246	$ 9982	$ +0	$ 0	$ 441123

**** = BREAKEVEN YEAR

CASE NUMBER: 20 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 85000	$ 93500
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	10.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8500	$ 18700
LOAN ORIG. FEE.	$ 765	$ 748
PRIVATE MORT. INS.	$ 383	$ 0
PREPAID INS.	$ 406	$ 419
MORTGAGE POINTS	$ 1148	$ 1496
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11563	$ 21724

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11563	$ 21724			
1	$ 23290	$ 33375	16	$233065	$225548
2	$ 35100	$ 45112	17	$247490	$239172
3	$ 47016	$ 56946	18	$262084	$252928
4	$ 59061	$ 68893	19	$276858	$266823
5	$ 71571	$ 81019	20	$295792	$282290
6	$ 84506	$ 93227	21	$310955	$296487
7	$ 97606	$105591	22	$326330	$310848
8	$110890	$118125	23	$341928	$325382
9	$124357	$130823	24	$357763	$340100
10	$140297	$144524	25	$374850	$355190
11	$154071	$157496	26	$391199	$370306
12	$167967	$170562	27	$407827	$385639
13	$181992	$183728	28	$424750	$401201
14	$196152	$196999	29	$441985	$417005
15	$218800	$212048	30	$484305	$439138

BREAKEVEN YEAR = 15 BREAK-EVEN AT AHT:

SUMMARY OF ALL ANNUAL COSTS: CONVENTIONAL HOME: CASE NUMBER: 20

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 11563
1	$ 10511	$ 410	$ 1225	$ 0	$ 0	$ 0	$ -610	$ 191	$ 23290
2	$ 10511	$ 423	$ 1295	$ 0	$ 0	$ 0	$ -610	$ 191	$ 35100
3	$ 10511	$ 455	$ 1369	$ 0	$ 0	$ 0	$ -610	$ 191	$ 47016
4	$ 10511	$ 506	$ 1447	$ 0	$ 0	$ 0	$ -610	$ 191	$ 59061
5	$ 10511	$ 558	$ 1529	$ 331	$ 0	$ 0	$ -610	$ 191	$ 71571
6	$ 10511	$ 616	$ 1616	$ 0	$ 0	$ 0	$ +0	$ 191	$ 84506
7	$ 10511	$ 691	$ 1708	$ 0	$ 0	$ 0	$ +0	$ 191	$ 97606
8	$ 10511	$ 776	$ 1806	$ 0	$ 0	$ 0	$ +0	$ 191	$ 110890
9	$ 10511	$ 856	$ 1909	$ 0	$ 0	$ 0	$ +0	$ 191	$ 124357
10	$ 10511	$ 940	$ 2017	$ 436	$ 1845	$ 0	$ +0	$ 191	$ 140297
11	$ 10511	$ 940	$ 2132	$ 0	$ 0	$ 0	$ +0	$ 191	$ 154071
12	$ 10511	$ 940	$ 2254	$ 0	$ 0	$ 0	$ +0	$ 191	$ 167967
13	$ 10511	$ 940	$ 2383	$ 0	$ 0	$ 0	$ +0	$ 191	$ 181992
14	$ 10511	$ 940	$ 2518	$ 0	$ 0	$ 0	$ +0	$ 191	$ 196152
****	$ 10511	$ 940	$ 2662	$ 576	$ 0	$ 7768	$ +0	$ 191	$ 218800
16	$ 10511	$ 940	$ 2814	$ 0	$ 0	$ 0	$ +0	$ 0	$ 233065
17	$ 10511	$ 940	$ 2974	$ 0	$ 0	$ 0	$ +0	$ 0	$ 247490
18	$ 10511	$ 940	$ 3143	$ 0	$ 0	$ 0	$ +0	$ 0	$ 262084
19	$ 10511	$ 940	$ 3323	$ 0	$ 0	$ 0	$ +0	$ 0	$ 276858
20	$ 10511	$ 940	$ 3512	$ 760	$ 3211	$ 0	$ +0	$ 0	$ 295792
21	$ 10511	$ 940	$ 3712	$ 0	$ 0	$ 0	$ +0	$ 0	$ 310955
22	$ 10511	$ 940	$ 3924	$ 0	$ 0	$ 0	$ +0	$ 0	$ 326330
23	$ 10511	$ 940	$ 4147	$ 0	$ 0	$ 0	$ +0	$ 0	$ 341928
24	$ 10511	$ 940	$ 4384	$ 0	$ 0	$ 0	$ +0	$ 0	$ 357763
25	$ 10511	$ 940	$ 4634	$ 1002	$ 0	$ 0	$ +0	$ 0	$ 374850
26	$ 10511	$ 940	$ 4898	$ 0	$ 0	$ 0	$ +0	$ 0	$ 391199
27	$ 10511	$ 940	$ 5177	$ 0	$ 0	$ 0	$ +0	$ 0	$ 407827
28	$ 10511	$ 940	$ 5472	$ 0	$ 0	$ 0	$ +0	$ 0	$ 424750
29	$ 10511	$ 940	$ 5784	$ 0	$ 0	$ 0	$ +0	$ 0	$ 441985
30	$ 10511	$ 940	$ 6114	$ 1323	$ 5590	$17842	$ +0	$ 0	$ 484305

**** = BREAKEVEN YEAR

SUMMARY OF ALL ANNUAL COSTS: EARTH SHELTER: CASE NUMBER: 20

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 21724
1	$ 10278	$ 423	$ 950	$ 0	$ 0	$ 0	$ +0	$ 0	$ 33375
2	$ 10278	$ 455	$ 1004	$ 0	$ 0	$ 0	$ +0	$ 0	$ 45112
3	$ 10278	$ 495	$ 1061	$ 0	$ 0	$ 0	$ +0	$ 0	$ 56946
4	$ 10278	$ 546	$ 1122	$ 0	$ 0	$ 0	$ +0	$ 0	$ 68893
5	$ 10278	$ 603	$ 1186	$ 59	$ 0	$ 0	$ +0	$ 0	$ 81019
6	$ 10278	$ 677	$ 1253	$ 0	$ 0	$ 0	$ +0	$ 0	$ 93227
7	$ 10278	$ 760	$ 1325	$ 0	$ 0	$ 0	$ +0	$ 0	$ 105591
8	$ 10278	$ 856	$ 1400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 118125
9	$ 10278	$ 940	$ 1480	$ 0	$ 0	$ 0	$ +0	$ 0	$ 130823
10	$ 10278	$1040	$ 1565	$ 77	$ 741	$ 0	$ +0	$ 0	$ 144524
11	$ 10278	$1040	$ 1654	$ 0	$ 0	$ 0	$ +0	$ 0	$ 157496
12	$ 10278	$1040	$ 1748	$ 0	$ 0	$ 0	$ +0	$ 0	$ 170562
13	$ 10278	$1040	$ 1848	$ 0	$ 0	$ 0	$ +0	$ 0	$ 183728
14	$ 10278	$1040	$ 1953	$ 0	$ 0	$ 0	$ +0	$ 0	$ 196999
****	$ 10278	$1040	$ 2064	$ 102	$ 0	$ 1565	$ +0	$ 0	$ 212048
16	$ 10278	$1040	$ 2182	$ 0	$ 0	$ 0	$ +0	$ 0	$ 225548
17	$ 10278	$1040	$ 2306	$ 0	$ 0	$ 0	$ +0	$ 0	$ 239172
18	$ 10278	$1040	$ 2438	$ 0	$ 0	$ 0	$ +0	$ 0	$ 252928
19	$ 10278	$1040	$ 2577	$ 0	$ 0	$ 0	$ +0	$ 0	$ 266823
20	$ 10278	$1040	$ 2724	$ 135	$ 1290	$ 0	$ +0	$ 0	$ 282290
21	$ 10278	$1040	$ 2879	$ 0	$ 0	$ 0	$ +0	$ 0	$ 296487
22	$ 10278	$1040	$ 3043	$ 0	$ 0	$ 0	$ +0	$ 0	$ 310848
23	$ 10278	$1040	$ 3216	$ 0	$ 0	$ 0	$ +0	$ 0	$ 325382
24	$ 10278	$1040	$ 3400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 340100
25	$ 10278	$1040	$ 3594	$ 178	$ 0	$ 0	$ +0	$ 0	$ 355190
26	$ 10278	$1040	$ 3798	$ 0	$ 0	$ 0	$ +0	$ 0	$ 370306
27	$ 10278	$1040	$ 4015	$ 0	$ 0	$ 0	$ +0	$ 0	$ 385639
28	$ 10278	$1040	$ 4244	$ 0	$ 0	$ 0	$ +0	$ 0	$ 401201
29	$ 10278	$1040	$ 4486	$ 0	$ 0	$ 0	$ +0	$ 0	$ 417005
30	$ 10278	$1040	$ 4741	$ 235	$ 2246	$ 3593	$ +0	$ 0	$ 439138

**** = BREAKEVEN YEAR

CASE NUMBER: 21 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 85000	$ 93500
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	11.40%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8500	$ 18700
LOAN ORIG. FEE.	$ 765	$ 748
PRIVATE MORT. INS.	$ 383	$ 0
PREPAID INS.	$ 406	$ 419
MORTGAGE POINTS	$ 1148	$ 1496
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11563	$ 21724

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11563	$ 21724			
1	$ 23290	$ 33375	16	$240963	$224909
2	$ 35089	$ 45102	17	$255120	$238231
3	$ 46980	$ 56907	18	$269446	$251685
4	$ 58981	$ 68805	19	$283952	$265278
5	$ 71504	$ 80877	20	$309418	$282884
6	$ 84350	$ 92982	21	$324313	$296779
7	$ 97327	$105199	22	$339420	$310838
8	$110441	$117535	23	$354750	$325070
9	$123690	$129993	24	$370317	$339486
10	$140740	$143887	25	$389670	$354723
11	$154246	$156557	26	$405751	$369537
12	$167874	$169321	27	$422111	$384568
13	$181631	$182185	28	$438766	$399828
14	$195523	$195154	29	$455733	$415330
15	$226966	$211711	30	$586570	$458946

BREAKEVEN YEAR = 14 BREAK-EVEN AT AHT:

SUMMARY OF ALL ANNUAL COSTS: CONVENTIONAL HOME: CASE NUMBER: 21

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 11563
1	$ 10511	$ 410	$ 1225	$ 0	$ 0	$ 0	$ -610	$ 191	$ 23290
2	$ 10511	$ 412	$ 1295	$ 0	$ 0	$ 0	$ -610	$ 191	$ 35089
3	$ 10511	$ 430	$ 1369	$ 0	$ 0	$ 0	$ -610	$ 191	$ 46980
4	$ 10511	$ 462	$ 1447	$ 0	$ 0	$ 0	$ -610	$ 191	$ 58981
5	$ 10511	$ 494	$ 1529	$ 408	$ 0	$ 0	$ -610	$ 191	$ 71504
6	$ 10511	$ 528	$ 1616	$ 0	$ 0	$ 0	$ +0	$ 191	$ 84350
7	$ 10511	$ 566	$ 1708	$ 0	$ 0	$ 0	$ +0	$ 191	$ 97327
8	$ 10511	$ 606	$ 1806	$ 0	$ 0	$ 0	$ +0	$ 191	$ 110441
9	$ 10511	$ 638	$ 1909	$ 0	$ 0	$ 0	$ +0	$ 191	$ 123690
10	$ 10511	$ 672	$ 2017	$ 700	$ 2959	$ 0	$ +0	$ 191	$ 140740
11	$ 10511	$ 672	$ 2132	$ 0	$ 0	$ 0	$ +0	$ 191	$ 154246
12	$ 10511	$ 672	$ 2254	$ 0	$ 0	$ 0	$ +0	$ 191	$ 167874
13	$ 10511	$ 672	$ 2383	$ 0	$ 0	$ 0	$ +0	$ 191	$ 181631
****	$ 10511	$ 672	$ 2518	$ 0	$ 0	$ 0	$ +0	$ 191	$ 195523
15	$ 10511	$ 672	$ 2662	$ 1201	$ 0	$16206	$ +0	$ 191	$ 226966
16	$ 10511	$ 672	$ 2814	$ 0	$ 0	$ 0	$ +0	$ 0	$ 240963
17	$ 10511	$ 672	$ 2974	$ 0	$ 0	$ 0	$ +0	$ 0	$ 255120
18	$ 10511	$ 672	$ 3143	$ 0	$ 0	$ 0	$ +0	$ 0	$ 269446
19	$ 10511	$ 672	$ 3323	$ 0	$ 0	$ 0	$ +0	$ 0	$ 283952
20	$ 10511	$ 672	$ 3512	$ 2061	$ 8710	$ 0	$ +0	$ 0	$ 309418
21	$ 10511	$ 672	$ 3712	$ 0	$ 0	$ 0	$ +0	$ 0	$ 324313
22	$ 10511	$ 672	$ 3924	$ 0	$ 0	$ 0	$ +0	$ 0	$ 339420
23	$ 10511	$ 672	$ 4147	$ 0	$ 0	$ 0	$ +0	$ 0	$ 354750
24	$ 10511	$ 672	$ 4384	$ 0	$ 0	$ 0	$ +0	$ 9	$ 370317
25	$ 10511	$ 672	$ 4634	$ 3536	$ 0	$ 0	$ +0	$ 0	$ 389670
26	$ 10511	$ 672	$ 4898	$ 0	$ 0	$ 0	$ +0	$ 0	$ 405751
27	$ 10511	$ 672	$ 5177	$ 0	$ 0	$ 0	$ +0	$ 0	$ 422111
28	$ 10511	$ 672	$ 5472	$ 0	$ 0	$ 0	$ +0	$ 0	$ 438766
29	$ 10511	$ 672	$ 5784	$ 0	$ 0	$ 0	$ +0	$ 0	$ 455733
30	$ 10511	$ 672	$ 6114	$ 6066	$25638	$81836	$ +0	$ 0	$ 586570

**** = BREAKEVEN YEAR

SUMMARY OF ALL ANNUAL COSTS: EARTH SHELTER: CASE NUMBER: 21

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 21724
1	$ 10278	$ 423	$ 950	$ 0	$ 0	$ 0	+0	$ 0	$ 33375
2	$ 10278	$ 445	$ 1004	$ 0	$ 0	$ 0	+0	$ 0	$ 45102
3	$ 10278	$ 466	$ 1061	$ 0	$ 0	$ 0	+0	$ 0	$ 56907
4	$ 10278	$ 499	$ 1122	$ 0	$ 0	$ 0	+0	$ 0	$ 68805
5	$ 10278	$ 536	$ 1186	$ 72	$ 0	$ 0	+0	$ 0	$ 80877
6	$ 10278	$ 574	$ 1253	$ 0	$ 0	$ 0	+0	$ 0	$ 92982
7	$ 10278	$ 613	$ 1325	$ 0	$ 0	$ 0	+0	$ 0	$ 105199
8	$ 10278	$ 658	$ 1400	$ 0	$ 0	$ 0	+0	$ 0	$ 117535
9	$ 10278	$ 700	$ 1480	$ 0	$ 0	$ 0	+0	$ 0	$ 129993
10	$ 10278	$ 738	$ 1565	$ 124	$ 1189	$ 0	+0	$ 0	$ 143887
11	$ 10278	$ 738	$ 1654	$ 0	$ 0	$ 0	+0	$ 0	$ 156557
12	$ 10278	$ 738	$ 1748	$ 0	$ 0	$ 0	+0	$ 0	$ 169321
13	$ 10278	$ 738	$ 1848	$ 0	$ 0	$ 0	+0	$ 0	$ 182185
****	$ 10278	$ 738	$ 1953	$ 0	$ 0	$ 0	+0	$ 0	$ 195154
15	$ 10278	$ 738	$ 2064	$ 213	$ 0	$ 3264	+0	$ 0	$ 211711
16	$ 10278	$ 738	$ 2182	$ 0	$ 0	$ 0	+0	$ 0	$ 224909
17	$ 10278	$ 738	$ 2306	$ 0	$ 0	$ 0	+0	$ 0	$ 238231
18	$ 10278	$ 738	$ 2438	$ 0	$ 0	$ 0	+0	$ 0	$ 251685
19	$ 10278	$ 738	$ 2577	$ 0	$ 0	$ 0	+0	$ 0	$ 265278
20	$ 10278	$ 738	$ 2724	$ 366	$ 3500	$ 0	+0	$ 0	$ 282884
21	$ 10278	$ 738	$ 2879	$ 0	$ 0	$ 0	+0	$ 0	$ 296779
22	$ 10278	$ 738	$ 3043	$ 0	$ 0	$ 0	+0	$ 0	$ 310838
23	$ 10278	$ 738	$ 3216	$ 0	$ 0	$ 0	+0	$ 0	$ 325070
24	$ 10278	$ 738	$ 3400	$ 0	$ 0	$ 0	+0	$ 0	$ 339486
25	$ 10278	$ 738	$ 3594	$ 627	$ 0	$ 0	+0	$ 0	$ 354723
26	$ 10278	$ 738	$ 3798	$ 0	$ 0	$ 0	+0	$ 0	$ 369537
27	$ 10278	$ 738	$ 4015	$ 0	$ 0	$ 0	+0	$ 0	$ 384568
28	$ 10278	$ 738	$ 4244	$ 0	$ 0	$ 0	+0	$ 0	$ 399828
29	$ 10278	$ 738	$ 4486	$ 0	$ 0	$ 0	+0	$ 0	$ 415330
30	$ 10278	$ 738	$ 4741	$ 1076	$10301	$16482	+0	$ 0	$ 458946

**** = BREAKEVEN YEAR

CASE NUMBER: 22 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 85000	$ 93500
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	11.40%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8500	$ 18700
LOAN ORIG. FEE.	$ 765	$ 748
PRIVATE MORT. INS.	$ 383	$ 0
PREPAID INS.	$ 406	$ 419
MORTGAGE POINTS	$ 1148	$ 1496
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11563	$ 21724

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11563	$ 21724			
1	$ 23290	$ 33375	16	$249467	$237341
2	$ 35159	$ 45156	17	$267541	$253701
3	$ 47201	$ 57079	18	$286401	$270670
4	$ 59449	$ 69168	19	$306136	$288318
5	$ 72253	$ 81504	20	$330817	$308147
6	$ 85585	$ 93986	21	$352613	$327394
7	$ 99195	$106694	22	$375619	$347579
8	$113111	$119653	23	$399973	$368809
9	$127356	$132884	24	$425828	$391203
10	$144248	$147228	25	$454358	$415073
11	$159228	$161040	26	$483749	$440210
12	$174619	$175171	27	$515216	$466956
13	$190468	$189657	28	$548995	$495496
14	$206827	$204539	29	$585350	$526033
15	$232098	$221528	30	$649330	$564870

BREAKEVEN YEAR = 13 BREAK-EVEN AT AHT:

SUMMARY OF ALL ANNUAL COSTS: CONVENTIONAL HOME: CASE NUMBER: 22

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 11563
1	$ 10511	$ 410	$ 1225	$ 0	$ 0	$ 0	$ -610	$ 191	$ 23290
2	$ 10511	$ 412	$ 1365	$ 0	$ 0	$ 0	$ -610	$ 191	$ 35159
3	$ 10511	$ 430	$ 1520	$ 0	$ 0	$ 0	$ -610	$ 191	$ 47201
4	$ 10511	$ 462	$ 1694	$ 0	$ 0	$ 0	$ -610	$ 191	$ 59449
5	$ 10511	$ 494	$ 1887	$ 331	$ 0	$ 0	$ -610	$ 191	$ 72253
6	$ 10511	$ 528	$ 2102	$ 0	$ 0	$ 0	$ +0	$ 191	$ 85585
7	$ 10511	$ 566	$ 2341	$ 0	$ 0	$ 0	$ +0	$ 191	$ 99195
8	$ 10511	$ 606	$ 2608	$ 0	$ 0	$ 0	$ +0	$ 191	$ 113111
9	$ 10511	$ 638	$ 2905	$ 0	$ 0	$ 0	$ +0	$ 191	$ 127356
10	$ 10511	$ 672	$ 3237	$ 436	$ 1845	$ 0	$ +0	$ 191	$ 144248
11	$ 10511	$ 672	$ 3606	$ 0	$ 0	$ 0	$ +0	$ 191	$ 159228
12	$ 10511	$ 672	$ 4017	$ 0	$ 0	$ 0	$ +0	$ 191	$ 174619
****	$ 10511	$ 672	$ 4475	$ 0	$ 0	$ 0	$ +0	$ 191	$ 190468
14	$ 10511	$ 672	$ 4985	$ 0	$ 0	$ 0	$ +0	$ 191	$ 206827
15	$ 10511	$ 672	$ 5553	$ 576	$ 0	$ 7768	$ +0	$ 191	$ 232098
16	$ 10511	$ 672	$ 6186	$ 0	$ 0	$ 0	$ +0	$ 0	$ 249467
17	$ 10511	$ 672	$ 6891	$ 0	$ 0	$ 0	$ +0	$ 0	$ 267541
18	$ 10511	$ 672	$ 7677	$ 0	$ 0	$ 0	$ +0	$ 0	$ 286431
19	$ 10511	$ 672	$ 8552	$ 0	$ 0	$ 0	$ +0	$ 0	$ 306136
20	$ 10511	$ 672	$ 9527	$ 760	$ 3211	$ 0	$ +0	$ 0	$ 330817
21	$ 10511	$ 672	$10613	$ 0	$ 0	$ 0	$ +0	$ 0	$ 352613
22	$ 10511	$ 672	$11823	$ 0	$ 0	$ 0	$ +0	$ 0	$ 375619
23	$ 10511	$ 672	$13171	$ 0	$ 0	$ 0	$ +0	$ 0	$ 399973
24	$ 10511	$ 672	$14672	$ 0	$ 0	$ 0	$ +0	$ 0	$ 425828
25	$ 10511	$ 672	$16345	$ 1002	$ 0	$ 0	$ +0	$ 0	$ 454358
26	$ 10511	$ 672	$18208	$ 0	$ 0	$ 0	$ +0	$ 0	$ 483749
27	$ 10511	$ 672	$20284	$ 0	$ 0	$ 0	$ +0	$ 0	$ 515216
28	$ 10511	$ 672	$22596	$ 0	$ 0	$ 0	$ +0	$ 0	$ 548995
29	$ 10511	$ 672	$25172	$ 0	$ 0	$ 0	$ +0	$ 0	$ 585350
30	$ 10511	$ 672	$28042	$ 1323	$ 5590	$17842	$ +0	$ 0	$ 649330

**** = BREAKEVEN YEAR

SUMMARY OF ALL ANNUAL COSTS: EARTH SHELTER: CASE NUMBER: 22

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 21724
1	$ 10278	$ 423	$ 950	$ 0	$ 0	$ 0	$ +0	$ 0	$ 33375
2	$ 10278	$ 445	$ 1058	$ 0	$ 0	$ 0	$ +0	$ 0	$ 45156
3	$ 10278	$ 466	$ 1179	$ 0	$ 0	$ 0	$ +0	$ 0	$ 57079
4	$ 10278	$ 499	$ 1313	$ 0	$ 0	$ 0	$ +0	$ 0	$ 69168
5	$ 10278	$ 536	$ 1463	$ 59	$ 0	$ 0	$ +0	$ 0	$ 81504
6	$ 10278	$ 574	$ 1630	$ 0	$ 0	$ 0	$ +0	$ 0	$ 93986
7	$ 10278	$ 613	$ 1816	$ 0	$ 0	$ 0	$ +0	$ 0	$ 106694
8	$ 10278	$ 658	$ 2023	$ 0	$ 0	$ 0	$ +0	$ 0	$ 119653
9	$ 10278	$ 700	$ 2253	$ 0	$ 0	$ 0	$ +0	$ 0	$ 132884
10	$ 10278	$ 738	$ 2510	$ 77	$ 741	$ 0	$ +0	$ 0	$ 147228
11	$ 10278	$ 738	$ 2796	$ 0	$ 0	$ 0	$ +0	$ 0	$ 161040
12	$ 10278	$ 738	$ 3115	$ 0	$ 0	$ 0	$ +0	$ 0	$ 175171
****	$ 10278	$ 738	$ 3470	$ 0	$ 0	$ 0	$ +0	$ 0	$ 189657
14	$ 10278	$ 738	$ 3866	$ 0	$ 0	$ 0	$ +0	$ 0	$ 204539
15	$ 10278	$ 738	$ 4306	$ 102	$ 0	$ 1565	$ +0	$ 0	$ 221528
16	$ 10278	$ 738	$ 4797	$ 0	$ 0	$ 0	$ +0	$ 0	$ 237341
17	$ 10278	$ 738	$ 5344	$ 0	$ 0	$ 0	$ +0	$ 0	$ 253701
18	$ 10278	$ 738	$ 5953	$ 0	$ 0	$ 0	$ +0	$ 0	$ 270670
19	$ 10278	$ 738	$ 6632	$ 0	$ 0	$ 0	$ +0	$ 0	$ 288318
20	$ 10278	$ 738	$ 7388	$ 135	$ 1290	$ 0	$ +0	$ 0	$ 308147
21	$ 10278	$ 738	$ 8231	$ 0	$ 0	$ 0	$ +0	$ 0	$ 327394
22	$ 10278	$ 738	$ 9169	$ 0	$ 0	$ 0	$ +0	$ 0	$ 347579
23	$ 10278	$ 738	$10214	$ 0	$ 0	$ 0	$ +0	$ 0	$ 368809
24	$ 10278	$ 738	$11378	$ 0	$ 0	$ 0	$ +0	$ 0	$ 391203
25	$ 10278	$ 738	$12676	$ 178	$ 0	$ 0	$ +0	$ 0	$ 415073
26	$ 10278	$ 738	$14121	$ 0	$ 0	$ 0	$ +0	$ 0	$ 440210
27	$ 10278	$ 738	$15730	$ 0	$ 0	$ 0	$ +0	$ 0	$ 466956
28	$ 10278	$ 738	$17524	$ 0	$ 0	$ 0	$ +0	$ 0	$ 495496
29	$ 10278	$ 738	$19521	$ 0	$ 0	$ 0	$ +0	$ 0	$ 526033
30	$ 10278	$ 738	$21747	$ 235	$ 2246	$ 3593	$ +0	$ 0	$ 564870

**** = BREAKEVEN YEAR

APPENDIX E

DETAILED SUMMARIES FROM LCCA

CASE NUMBER: MN PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 94960	$100720
ANNUAL ENERGY COST	$ 1225	$ 605
FINANCING RATE	90.00%	90.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	10.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	11.40%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 9496	$ 10072
LOAN ORIG. FEE.	$ 855	$ 906
PRIVATE MORT. INS.	$ 427	$ 453
PREPAID INS.	$ 423	$ 400
MORTGAGE POINTS	$ 1282	$ 1813
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 12844	$ 14005

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 12844	$ 14005			
1	$ 26383	$ 27695	16	$274489	$251212
2	$ 40083	$ 41474	17	$293875	$268016
3	$ 53960	$ 55353	18	$314047	$284981
4	$ 68047	$ 69346	19	$335094	$302379
5	$ 82691	$ 83473	20	$361087	$320259
6	$ 97332	$ 97740	21	$384195	$338675
7	$112251	$112168	22	$408513	$357688
8	$127484	$126777	23	$434179	$377367
9	$143056	$141570	24	$461346	$397787
10	$161283	$156571	25	$491188	$419033
11	$177598	$171753	26	$521891	$441200
12	$194324	$187138	27	$554670	$464392
13	$211508	$202749	28	$589761	$488726
14	$229202	$218612	29	$627428	$514332
15	$255808	$234756	30	$692720	$541356

BREAKEVEN YEAR = 7 BREAK-EVEN AT AHT: Y

CASE NUMBER: MX PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 73040	$ 81200
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	70.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 7304	$ 24360
LOAN ORIG. FEE.	$ 657	$ 568
PRIVATE MORT. INS.	$ 329	$ 0
PREPAID INS.	$ 348	$ 379
MORTGAGE POINTS	$ 986	$ 1137
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 9985	$ 26805

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 9985	$ 26805			
1	$ 19748	$ 35948	16	$201709	$190516
2	$ 29597	$ 45172	17	$214305	$201278
3	$ 39542	$ 54459	18	$227070	$212172
4	$ 49596	$ 63834	19	$240015	$223205
5	$ 60081	$ 73468	20	$257120	$237338
6	$ 71359	$ 83040	21	$270454	$248673
7	$ 82763	$ 92721	22	$284000	$260172
8	$ 94299	$102517	23	$297769	$271844
9	$105966	$112421	24	$311775	$283700
10	$120050	$124138	25	$327033	$296242
11	$131968	$134248	26	$341553	$308496
12	$144008	$144452	27	$356352	$320967
13	$156177	$154756	28	$371446	$333667
14	$168481	$165165	29	$386852	$346609
15	$189273	$179878	30	$427343	$373931

BREAKEVEN YEAR = 13 BREAK-EVEN AT AHT: Y

CASE NUMBER: 1 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 94960	$100720
ANNUAL ENERGY COST	$ 1225	$ 605
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	10.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	11.40%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 9496	$ 20144
LOAN ORIG. FEE.	$ 855	$ 806
PRIVATE MORT. INS.	$ 427	$ 0
PREPAID INS.	$ 423	$ 400
MORTGAGE POINTS	$ 1282	$ 1612
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 12844	$ 23323

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 12844	$ 23323			
1	$ 25824	$ 35402	16	$271694	$237298
2	$ 38965	$ 47570	17	$291080	$252491
3	$ 52283	$ 59838	18	$311252	$268072
4	$ 65811	$ 72220	19	$332299	$284086
5	$ 79896	$ 84795	20	$358292	$302007
6	$ 94537	$ 97451	21	$381400	$319039
7	$109456	$110268	22	$405718	$336668
8	$124689	$123266	23	$431384	$354963
9	$140261	$136448	24	$458551	$373999
10	$158488	$150656	25	$488393	$394039
11	$174803	$164227	26	$519096	$414822
12	$191529	$178001	27	$551875	$436630
13	$208713	$192001	28	$586966	$459580
14	$226407	$206253	29	$624633	$483802
15	$253013	$222453	30	$689925	$515516

BREAKEVEN YEAR = 8 BREAK-EVEN AT AHT: 7

CASE NUMBER: 2 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 94960	$100720
ANNUAL ENERGY COST	$ 1225	$ 605
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	10.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 9496	$ 20144
LOAN ORIG. FEE.	$ 855	$ 806
PRIVATE MORT. INS.	$ 427	$ 0
PREPAID INS.	$ 423	$ 400
MORTGAGE POINTS	$ 1282	$ 1612
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 12844	$ 23323

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 12844	$ 23323			
1	$ 25824	$ 35402	16	$252672	$227903
2	$ 38895	$ 47535	17	$268141	$241162
3	$ 52062	$ 59728	18	$283779	$254504
4	$ 65343	$ 71988	19	$299597	$267935
5	$ 79070	$ 84386	20	$319575	$282886
6	$ 93225	$ 96802	21	$335782	$296509
7	$107511	$109307	22	$352201	$310237
8	$121942	$121909	23	$368843	$324075
9	$136518	$134599	24	$385722	$338030
10	$153525	$148204	25	$403853	$352287
11	$168366	$161047	26	$421246	$366496
12	$183329	$173950	27	$438918	$380843
13	$198421	$186917	28	$456885	$395336
14	$213648	$199951	29	$475164	$409983
15	$237363	$214723	30	$518528	$430867

BREAKEVEN YEAR = 8 BREAK-EVEN AT AHT: Y

CASE NUMBER: 3 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 94960	$100720
ANNUAL ENERGY COST	$ 1225	$ 605
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	11.40%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 9496	$ 20144
LOAN ORIG. FEE.	$ 855	$ 806
PRIVATE MORT. INS.	$ 427	$ 0
PREPAID INS.	$ 423	$ 444
MORTGAGE POINTS	$ 1282	$ 1612
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 12844	$ 23367

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 12844	$ 23367			
1	$ 25822	$ 35491	16	$271684	$238425
2	$ 38961	$ 47706	17	$291070	$253698
3	$ 52277	$ 60023	18	$311242	$269359
4	$ 65803	$ 72458	19	$332289	$285453
5	$ 79886	$ 85090	20	$358282	$303453
6	$ 94527	$ 97807	21	$381390	$320565
7	$109446	$110689	22	$405708	$338274
8	$124679	$123758	23	$431374	$356649
9	$140251	$137016	24	$458541	$375765
10	$158478	$151303	25	$488383	$395885
11	$174793	$164954	26	$519086	$416748
12	$191519	$178808	27	$551865	$438636
13	$208703	$192888	28	$586956	$461666
14	$226397	$207220	29	$624623	$485968
15	$253003	$223500	30	$689915	$517761

BREAKEVEN YEAR = 8 BREAK-EVEN AT AHT: Y

CASE NUMBER: 4 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 94960	$100720
ANNUAL ENERGY COST	$ 1225	$ 605
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 9496	$ 20144
LOAN ORIG. FEE.	$ 855	$ 806
PRIVATE MORT. INS.	$ 427	$ 0
PREPAID INS.	$ 423	$ 444
MORTGAGE POINTS	$ 1282	$ 1612
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 12844	$ 23367

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 12844	$ 23367			
1	$ 25822	$ 35491	16	$252662	$229030
2	$ 38891	$ 47671	17	$268131	$242369
3	$ 52056	$ 59913	18	$283769	$255791
4	$ 65335	$ 72226	19	$299587	$269302
5	$ 79060	$ 84681	20	$319565	$284332
6	$ 93215	$ 97158	21	$335772	$298035
7	$107501	$109728	22	$352191	$311843
8	$121932	$122401	23	$368833	$325761
9	$136508	$135167	24	$385712	$339796
10	$153515	$148851	25	$403843	$354133
11	$168356	$161774	26	$421236	$368422
12	$183319	$174757	27	$438908	$382849
13	$198411	$187804	28	$456875	$397422
14	$213638	$200918	29	$475154	$412149
15	$237353	$215770	30	$518518	$433112

BREAKEVEN YEAR = 9 BREAK-EVEN AT AHT: Y

CASE NUMBER: 5 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 94960	$100720
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	10.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	11.40%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 9496	$ 20144
LOAN ORIG. FEE.	$ 855	$ 806
PRIVATE MORT. INS.	$ 427	$ 0
PREPAID INS.	$ 423	$ 400
MORTGAGE POINTS	$ 1282	$ 1612
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 12844	$ 23323

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 12844	$ 23323			
1	$ 25824	$ 35747	16	$271694	$251294
2	$ 38965	$ 48299	17	$291080	$268428
3	$ 52283	$ 60995	18	$311252	$286171
4	$ 65811	$ 73854	19	$332299	$304593
5	$ 79896	$ 86960	20	$358292	$325197
6	$ 94537	$100208	21	$381400	$345218
7	$109456	$113685	22	$405718	$366177
8	$124689	$127418	23	$431384	$388181
9	$140261	$141418	24	$458551	$411349
10	$158488	$156537	25	$488393	$435993
11	$174803	$171123	26	$519096	$461904
12	$191529	$186028	27	$551875	$489424
13	$208713	$201288	28	$586966	$518738
14	$226407	$216944	29	$624633	$550049
15	$253013	$234707	30	$689925	$589661

BREAKEVEN YEAR = 10 BREAK-EVEN AT AHT: Y

CASE NUMBER: 6 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 94960	$100720
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	10.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 9496	$ 20144
LOAN ORIG. FEE.	$ 855	$ 806
PRIVATE MORT. INS.	$ 427	$ 0
PREPAID INS.	$ 423	$ 400
MORTGAGE POINTS	$ 1282	$ 1612
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 12844	$ 23323

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 12844	$ 23323			
1	$ 25824	$ 35747	16	$252672	$236544
2	$ 38895	$ 48245	17	$268141	$250640
3	$ 52062	$ 60823	18	$283779	$264868
4	$ 65343	$ 73491	19	$299597	$279235
5	$ 79070	$ 86320	20	$319575	$295175
6	$ 93225	$ 99191	21	$335782	$309844
7	$107511	$112177	22	$352201	$324677
8	$121942	$125287	23	$368843	$339683
9	$136518	$138514	24	$385722	$354873
10	$153525	$152688	25	$403853	$370435
11	$168366	$166132	26	$421246	$386023
12	$183329	$179670	27	$438918	$401828
13	$198421	$193308	28	$456885	$417862
14	$213648	$207051	29	$475164	$434138
15	$237363	$222572	30	$518528	$456744

BREAKEVEN YEAR = 10 BREAK-EVEN AT AHT: 7

CASE NUMBER: 7 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 94960	$100720
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	11.40%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 9496	$ 20144
LOAN ORIG. FEE.	$ 855	$ 806
PRIVATE MORT. INS.	$ 427	$ 0
PREPAID INS.	$ 423	$ 444
MORTGAGE POINTS	$ 1282	$ 1612
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 12844	$ 23367

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 12844	$ 23367			
1	$ 25822	$ 35836	16	$271684	$252421
2	$ 38961	$ 48435	17	$291070	$269635
3	$ 52277	$ 61180	18	$311242	$287458
4	$ 65803	$ 74092	19	$332289	$305960
5	$ 79886	$ 87255	20	$358282	$326643
6	$ 94527	$100564	21	$381390	$346744
7	$109446	$114106	22	$405708	$367783
8	$124679	$127910	23	$431374	$389867
9	$140251	$141986	24	$458541	$413115
10	$158478	$157184	25	$488383	$437839
11	$174793	$171850	26	$519086	$463830
12	$191519	$186835	27	$551865	$491430
13	$208703	$202175	28	$586956	$520824
14	$226397	$217911	29	$624623	$552215
15	$253003	$235754	30	$689915	$591906

BREAKEVEN YEAR = 10 BREAK-EVEN AT AHT: Y

CASE NUMBER: 8 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 94960	$100720
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 9496	$ 20144
LOAN ORIG. FEE.	$ 855	$ 806
PRIVATE MORT. INS.	$ 427	$ 0
PREPAID INS.	$ 423	$ 444
MORTGAGE POINTS	$ 1282	$ 1612
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 12844	$ 23367

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 12844	$ 23367			
1	$ 25822	$ 35836	16	$252662	$237671
2	$ 38891	$ 48381	17	$268131	$251847
3	$ 52056	$ 61008	18	$283769	$266155
4	$ 65335	$ 73729	19	$299587	$280602
5	$ 79060	$ 86615	20	$319565	$296621
6	$ 93215	$ 99547	21	$335772	$311370
7	$107501	$112598	22	$352191	$326283
8	$121932	$125779	23	$368833	$341369
9	$136508	$139082	24	$385712	$356639
10	$153515	$153335	25	$403843	$372281
11	$168356	$166859	26	$421236	$387949
12	$183319	$180477	27	$438908	$403834
13	$198411	$194195	28	$456875	$419948
14	$213638	$208018	29	$475154	$436304
15	$237353	$223619	30	$518518	$458989

BREAKEVEN YEAR = 10 BREAK-EVEN AT AHT: Y

CASE NUMBER: 9 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 84000	$ 90960
ANNUAL ENERGY COST	$ 1225	$ 605
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	10.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	11.40%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8400	$ 18192
LOAN ORIG. FEE.	$ 756	$ 728
PRIVATE MORT. INS.	$ 378	$ 0
PREPAID INS.	$ 400	$ 368
MORTGAGE POINTS	$ 1134	$ 1455
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11429	$ 21104

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11429	$ 21104			
1	$ 23052	$ 32078	16	$247363	$217005
2	$ 34824	$ 43140	17	$265304	$231053
3	$ 46765	$ 54299	18	$284031	$245489
4	$ 58912	$ 65572	19	$303633	$260358
5	$ 71616	$ 77030	20	$328181	$277133
6	$ 84818	$ 88569	21	$349844	$293020
7	$ 98298	$100264	22	$372717	$309505
8	$112084	$112128	23	$396938	$326655
9	$126195	$124170	24	$422660	$344546
10	$142952	$137232	25	$451057	$363441
11	$157797	$149658	26	$480315	$383079
12	$173053	$162288	27	$511649	$403742
13	$188767	$175143	28	$545295	$425547
14	$204991	$188250	29	$581517	$448624
15	$230127	$203305	30	$645364	$479192

BREAKEVEN YEAR = 9 BREAK-EVEN AT AHT: Y

CASE NUMBER: 10 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 84000	$ 90960
ANNUAL ENERGY COST	$ 1225	$ 605
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	10.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8400	$ 18192
LOAN ORIG. FEE.	$ 756	$ 728
PRIVATE MORT. INS.	$ 378	$ 0
PREPAID INS.	$ 400	$ 368
MORTGAGE POINTS	$ 1134	$ 1455
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11429	$ 21104

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11429	$ 21104			
1	$ 23052	$ 32078	16	$228341	$207610
2	$ 34754	$ 43105	17	$242365	$219724
3	$ 46544	$ 54189	18	$256558	$231921
4	$ 58444	$ 65340	19	$270931	$244207
5	$ 70790	$ 76621	20	$289464	$258012
6	$ 83506	$ 87920	21	$304226	$270490
7	$ 96353	$ 99303	22	$319200	$283074
8	$109337	$110771	23	$334397	$295767
9	$122452	$122321	24	$349831	$308577
10	$137989	$134780	25	$366517	$321689
11	$151360	$146478	26	$382465	$334753
12	$164853	$158237	27	$398692	$347955
13	$178475	$170059	28	$415214	$361303
14	$192232	$181948	29	$432048	$374805
15	$214477	$195575	30	$473967	$394543

BREAKEVEN YEAR = 9 BREAK-EVEN AT AHT: Y

CASE NUMBER: 11 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 84000	$ 90960
ANNUAL ENERGY COST	$ 1225	$ 605
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	11.40%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8400	$ 18192
LOAN ORIG. FEE.	$ 756	$ 728
PRIVATE MORT. INS.	$ 378	$ 0
PREPAID INS.	$ 400	$ 409
MORTGAGE POINTS	$ 1134	$ 1455
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11429	$ 21145

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11429	$ 21145			
1	$ 23050	$ 32160	16	$247353	$218028
2	$ 34820	$ 43266	17	$265294	$232148
3	$ 46759	$ 54470	18	$284021	$246656
4	$ 58904	$ 65792	19	$303623	$261597
5	$ 71606	$ 77302	20	$328171	$278444
6	$ 84808	$ 88896	21	$349834	$294403
7	$ 98288	$100652	22	$372707	$310959
8	$112074	$112580	23	$396928	$328181
9	$126185	$124690	24	$422650	$346144
10	$142942	$137824	25	$451047	$365111
11	$157787	$150322	26	$480305	$384821
12	$173043	$163023	27	$511639	$405556
13	$188757	$175950	28	$545285	$427433
14	$204981	$189129	29	$581507	$450582
15	$230117	$204256	30	$645354	$481222

BREAKEVEN YEAR = 9 BREAK-EVEN AT AHT: Y

CASE NUMBER: 12 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 84000	$ 90960
ANNUAL ENERGY COST	$ 1225	$ 605
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8400	$ 18192
LOAN ORIG. FEE.	$ 756	$ 728
PRIVATE MORT. INS.	$ 378	$ 0
PREPAID INS.	$ 400	$ 409
MORTGAGE POINTS	$ 1134	$ 1455
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11429	$ 21145

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11429	$ 21145			
1	$ 23050	$ 32160	16	$228331	$208633
2	$ 34750	$ 43231	17	$242355	$220819
3	$ 46538	$ 54360	18	$256548	$233088
4	$ 58436	$ 65560	19	$270921	$245446
5	$ 70780	$ 76893	20	$289454	$259323
6	$ 83496	$ 88247	21	$304216	$271873
7	$ 96343	$ 99691	22	$319190	$284528
8	$109327	$111223	23	$334387	$297293
9	$122442	$122841	24	$349821	$310175
10	$137979	$135372	25	$366507	$323359
11	$151350	$147142	26	$382455	$336495
12	$164843	$158972	27	$398682	$349769
13	$178465	$170866	28	$415204	$363189
14	$192222	$182827	29	$432038	$376763
15	$214467	$196526	30	$473957	$396573

BREAKEVEN YEAR = 10 BREAK-EVEN AT AHT: Y

CASE NUMBER: 13 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 84000	$ 90960
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	10.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	11.40%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8400	$ 18192
LOAN ORIG. FEE.	$ 756	$ 728
PRIVATE MORT. INS.	$ 378	$ 0
PREPAID INS.	$ 400	$ 368
MORTGAGE POINTS	$ 1134	$ 1455
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11429	$ 21104

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11429	$ 21104			
1	$ 23052	$ 32423	16	$247363	$231001
2	$ 34824	$ 43869	17	$265304	$246990
3	$ 46765	$ 55456	18	$284031	$263588
4	$ 58912	$ 67206	19	$303633	$280865
5	$ 71616	$ 79195	20	$328181	$300323
6	$ 84818	$ 91326	21	$349844	$319199
7	$ 98298	$103681	22	$372717	$339014
8	$112084	$116280	23	$396938	$359873
9	$126195	$129140	24	$422660	$381896
10	$142952	$143113	25	$451057	$405395
11	$157797	$156554	26	$480315	$430161
12	$173053	$170315	27	$511649	$456536
13	$188767	$184430	28	$545295	$484705
14	$204991	$198941	29	$581517	$514871
15	$230127	$215559	30	$645364	$553337

BREAKEVEN YEAR = 11 BREAK-EVEN AT AHT: Y

CASE NUMBER: 14 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 84000	$ 90960
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	10.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8400	$ 18192
LOAN ORIG. FEE.	$ 756	$ 728
PRIVATE MORT. INS.	$ 378	$ 0
PREPAID INS.	$ 400	$ 368
MORTGAGE POINTS	$ 1134	$ 1455
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11429	$ 21104

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11429	$ 21104			
1	$ 23052	$ 32423	16	$228341	$216251
2	$ 34754	$ 43815	17	$242365	$229202
3	$ 46544	$ 55284	18	$256558	$242285
4	$ 58444	$ 66843	19	$270931	$255507
5	$ 70790	$ 78555	20	$289464	$270301
6	$ 83506	$ 90309	21	$304226	$283825
7	$ 96353	$102173	22	$319200	$297514
8	$109337	$114149	23	$334397	$311375
9	$122452	$126236	24	$349831	$325420
10	$137989	$139264	25	$366517	$339837
11	$151360	$151563	26	$382465	$354280
12	$164853	$163957	27	$398692	$368940
13	$178475	$176450	28	$415214	$383829
14	$192232	$189048	29	$432048	$398960
15	$214477	$203424	30	$473967	$420420

BREAKEVEN YEAR = 12 BREAK-EVEN AT AHT: Y

CASE NUMBER: 15 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 84000	$ 90960
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	11.40%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8400	$ 18192
LOAN ORIG. FEE.	$ 756	$ 728
PRIVATE MORT. INS.	$ 378	$ 0
PREPAID INS.	$ 400	$ 409
MORTGAGE POINTS	$ 1134	$ 1455
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11429	$ 21145

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11429	$ 21145			
1	$ 23050	$ 32505	16	$247353	$232024
2	$ 34820	$ 43995	17	$265294	$248085
3	$ 46759	$ 55627	18	$284021	$264755
4	$ 58904	$ 67426	19	$303623	$282104
5	$ 71606	$ 79467	20	$328171	$301634
6	$ 84808	$ 91653	21	$349834	$320582
7	$ 98288	$104069	22	$372707	$340468
8	$112074	$116732	23	$396928	$361399
9	$126185	$129660	24	$422650	$383494
10	$142942	$143705	25	$451047	$407065
11	$157787	$157218	26	$480305	$431903
12	$173043	$171050	27	$511639	$458350
13	$188757	$185237	28	$545285	$486591
14	$204981	$199820	29	$581507	$516829
15	$230117	$216510	30	$645354	$555367

BREAKEVEN YEAR = 11 BREAK-EVEN AT AHT: Y

CASE NUMBER: 16 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 84000	$ 90960
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8400	$ 18192
LOAN ORIG. FEE.	$ 756	$ 728
PRIVATE MORT. INS.	$ 378	$ 0
PREPAID INS.	$ 400	$ 409
MORTGAGE POINTS	$ 1134	$ 1455
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11429	$ 21145

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11429	$ 21145			
1	$ 23050	$ 32505	16	$228331	$217274
2	$ 34750	$ 43941	17	$242355	$230297
3	$ 46538	$ 55455	18	$256548	$243452
4	$ 58436	$ 67063	19	$270921	$256746
5	$ 70780	$ 78827	20	$289454	$271612
6	$ 83496	$ 90636	21	$304216	$285209
7	$ 96343	$102561	22	$319190	$298968
8	$109327	$114601	23	$334387	$312901
9	$122442	$126756	24	$349821	$327018
10	$137979	$139856	25	$366507	$341507
11	$151350	$152227	26	$382455	$356022
12	$164843	$164692	27	$398682	$370754
13	$178465	$177257	28	$415204	$385715
14	$192222	$189927	29	$432038	$400916
15	$214467	$204375	30	$473957	$422450

BREAKEVEN YEAR = 12 BREAK-EVEN AT AHT: Y

CASE NUMBER: 17 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 73040	$ 81200
ANNUAL ENERGY COST	$ 1225	$ 605
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	10.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	11.40%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 7304	$ 16240
LOAN ORIG. FEE.	$ 657	$ 650
PRIVATE MORT. INS.	$ 329	$ 0
PREPAID INS.	$ 348	$ 341
MORTGAGE POINTS	$ 986	$ 1299
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 9985	$ 18891

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 9985	$ 18891			
1	$ 20223	$ 28766	16	$223106	$196815
2	$ 30617	$ 38736	17	$239619	$209725
3	$ 41188	$ 48787	18	$256918	$223024
4	$ 51964	$ 58948	19	$275092	$236755
5	$ 63282	$ 69293	20	$298212	$252392
6	$ 75046	$ 79715	21	$318447	$267142
7	$ 87083	$ 90289	22	$339892	$282488
8	$ 99421	$101030	23	$362685	$298501
9	$112084	$111944	24	$386979	$315254
10	$127388	$123868	25	$413948	$333011
11	$140780	$135157	26	$441778	$351512
12	$154583	$146648	27	$471684	$371037
13	$168844	$158366	28	$503902	$391705
14	$183615	$170335	29	$538696	$413644
15	$207298	$184252	30	$601115	$443074

BREAKEVEN YEAR = 9 BREAK-EVEN AT AHT: Y

CASE NUMBER: 18 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 73040	$ 81200
ANNUAL ENERGY COST	$ 1225	$ 605
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	10.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 7304	$ 16240
LOAN ORIG. FEE.	$ 657	$ 650
PRIVATE MORT. INS.	$ 329	$ 0
PREPAID INS.	$ 348	$ 341
MORTGAGE POINTS	$ 986	$ 1299
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 9985	$ 18891

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 9985	$ 18891			
1	$ 20223	$ 28766	16	$204084	$187420
2	$ 30547	$ 38701	17	$216680	$198396
3	$ 40967	$ 48677	18	$229445	$209456
4	$ 51496	$ 58716	19	$242390	$220604
5	$ 62456	$ 68884	20	$259495	$233271
6	$ 73734	$ 79066	21	$272829	$244612
7	$ 85138	$ 89328	22	$286375	$256057
8	$ 96674	$ 99673	23	$300144	$267613
9	$108341	$110095	24	$314150	$279285
10	$122425	$121416	25	$329408	$291259
11	$134343	$131977	26	$343928	$303186
12	$146383	$142597	27	$358727	$315250
13	$158552	$153282	28	$373821	$327461
14	$170856	$164033	29	$389227	$339825
15	$191648	$176522	30	$429718	$358425

BREAKEVEN YEAR = 10 BREAK-EVEN AT AHT: Y

CASE NUMBER: 19 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 73040	$ 81200
ANNUAL ENERGY COST	$ 1225	$ 605
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	11.40%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 7304	$ 16240
LOAN ORIG. FEE.	$ 657	$ 650
PRIVATE MORT. INS.	$ 329	$ 0
PREPAID INS.	$ 348	$ 379
MORTGAGE POINTS	$ 986	$ 1299
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 9985	$ 18929

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 9985	$ 18929			
1	$ 20220	$ 28843	16	$223091	$197743
2	$ 30611	$ 38853	17	$239604	$210718
3	$ 41179	$ 48946	18	$256903	$224081
4	$ 51952	$ 59151	19	$275077	$237877
5	$ 63267	$ 69544	20	$298197	$253579
6	$ 75031	$ 80017	21	$318432	$268393
7	$ 87068	$ 90645	22	$339877	$283804
8	$ 99406	$101445	23	$362670	$299881
9	$112069	$112420	24	$386964	$316699
10	$127373	$124409	25	$413933	$334521
11	$140765	$135762	26	$441763	$353086
12	$154568	$147318	27	$471669	$372676
13	$168829	$159100	28	$503887	$393408
14	$183600	$171134	29	$538681	$415412
15	$207283	$185116	30	$601100	$444907

BREAKEVEN YEAR = 10 BREAK-EVEN AT AHT: Y

CASE NUMBER: 20 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 73040	$ 81200
ANNUAL ENERGY COST	$ 1225	$ 605
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 7304	$ 16240
LOAN ORIG. FEE.	$ 657	$ 650
PRIVATE MORT. INS.	$ 329	$ 0
PREPAID INS.	$ 348	$ 379
MORTGAGE POINTS	$ 986	$ 1299
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 9985	$ 18929

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 9985	$ 18929			
1	$ 20220	$ 28843	16	$204069	$188348
2	$ 30541	$ 38818	17	$216665	$199389
3	$ 40958	$ 48836	18	$229430	$210513
4	$ 51484	$ 58919	19	$242375	$221726
5	$ 62441	$ 69135	20	$259480	$234458
6	$ 73719	$ 79368	21	$272814	$245863
7	$ 85123	$ 89684	22	$286360	$257373
8	$ 96659	$100088	23	$300129	$268993
9	$108326	$110571	24	$314135	$280730
10	$122410	$121957	25	$329393	$292769
11	$134328	$132582	26	$343913	$304760
12	$146368	$143267	27	$358712	$316889
13	$158537	$154016	28	$373806	$329164
14	$170841	$164832	29	$389212	$341593
15	$191633	$177386	30	$429703	$360258

BREAKEVEN YEAR = 10 BREAK-EVEN AT AHT: Y

CASE NUMBER: 21 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 73040	$ 81200
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	10.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	11.40%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 7304	$ 16240
LOAN ORIG. FEE.	$ 657	$ 650
PRIVATE MORT. INS.	$ 329	$ 0
PREPAID INS.	$ 348	$ 341
MORTGAGE POINTS	$ 986	$ 1299
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 9985	$ 18891

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 9985	$ 18891			
1	$ 20223	$ 29111	16	$223106	$210811
2	$ 30617	$ 39465	17	$239619	$225662
3	$ 41188	$ 49944	18	$256918	$241123
4	$ 51964	$ 60582	19	$275092	$257262
5	$ 63282	$ 71458	20	$298212	$275582
6	$ 75046	$ 82472	21	$318447	$293321
7	$ 87083	$ 93706	22	$339892	$311997
8	$ 99421	$105182	23	$362685	$331719
9	$112084	$116914	24	$386979	$352604
10	$127388	$129749	25	$413948	$374965
11	$140780	$142053	26	$441778	$398594
12	$154583	$154675	27	$471684	$423831
13	$168844	$167653	28	$503902	$450863
14	$183615	$181026	29	$538696	$479891
15	$207298	$196506	30	$601115	$517219

BREAKEVEN YEAR = 13 BREAK-EVEN AT AHT: Y

CASE NUMBER: 22 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 73040	$ 81200
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	10.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 7304	$ 16240
LOAN ORIG. FEE.	$ 657	$ 650
PRIVATE MORT. INS.	$ 329	$ 0
PREPAID INS.	$ 348	$ 341
MORTGAGE POINTS	$ 986	$ 1299
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 9985	$ 18891

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 9985	$ 18891			
1	$ 20223	$ 29111	16	$204084	$196061
2	$ 30547	$ 39411	17	$216680	$207874
3	$ 40967	$ 49772	18	$229445	$219820
4	$ 51496	$ 60219	19	$242390	$231904
5	$ 62456	$ 70818	20	$259495	$245560
6	$ 73734	$ 81455	21	$272829	$257947
7	$ 85138	$ 92198	22	$286375	$270497
8	$ 96674	$103051	23	$300144	$283221
9	$108341	$114010	24	$314150	$296128
10	$122425	$125900	25	$329408	$309407
11	$134343	$137062	26	$343928	$322713
12	$146383	$148317	27	$358727	$336235
13	$158552	$159673	28	$373821	$349987
14	$170856	$171133	29	$389227	$363980
15	$191648	$184371	30	$429718	$384302

BREAKEVEN YEAR = 15 BREAK-EVEN AT AHT: Y

CASE NUMBER: 23 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 73040	$ 81200
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	11.40%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 7304	$ 16240
LOAN ORIG. FEE.	$ 657	$ 650
PRIVATE MORT. INS.	$ 329	$ 0
PREPAID INS.	$ 348	$ 379
MORTGAGE POINTS	$ 986	$ 1299
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 9985	$ 18929

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 9985	$ 18929			
1	$ 20220	$ 29188	16	$223091	$211739
2	$ 30611	$ 39582	17	$239604	$226655
3	$ 41179	$ 50103	18	$256903	$242180
4	$ 51952	$ 60785	19	$275077	$258384
5	$ 63267	$ 71709	20	$298197	$276769
6	$ 75031	$ 82774	21	$318432	$294572
7	$ 87068	$ 94062	22	$339877	$313313
8	$ 99406	$105597	23	$362670	$333099
9	$112069	$117390	24	$386964	$354049
10	$127373	$130290	25	$413933	$376475
11	$140765	$142658	26	$441763	$400168
12	$154568	$155345	27	$471669	$425470
13	$168829	$168387	28	$503887	$452566
14	$183600	$181825	29	$538681	$481659
15	$207283	$197370	30	$601100	$519052

BREAKEVEN YEAR = 13 BREAK-EVEN AT AHT: Y

CASE NUMBER: 24 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 73040	$ 81200
ANNUAL ENERGY COST	$ 1225	$ 950
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 7304	$ 16240
LOAN ORIG. FEE.	$ 657	$ 650
PRIVATE MORT. INS.	$ 329	$ 0
PREPAID INS.	$ 348	$ 379
MORTGAGE POINTS	$ 986	$ 1299
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 9985	$ 18929

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 9985	$ 18929			
1	$ 20220	$ 29188	16	$204069	$196989
2	$ 30541	$ 39528	17	$216665	$208867
3	$ 40958	$ 49931	18	$229430	$220877
4	$ 51484	$ 60422	19	$242375	$233026
5	$ 62441	$ 71069	20	$259480	$246747
6	$ 73719	$ 81757	21	$272814	$259198
7	$ 85123	$ 92554	22	$286360	$271813
8	$ 96659	$103466	23	$300129	$284601
9	$108326	$114486	24	$314135	$297573
10	$122410	$126441	25	$329393	$310917
11	$134328	$137667	26	$343913	$324287
12	$146368	$148987	27	$358712	$337874
13	$158537	$160407	28	$373806	$351690
14	$170841	$171932	29	$389212	$365748
15	$191633	$185235	30	$429703	$386135

BREAKEVEN YEAR = 15 BREAK-EVEN AT AHT: Y

APPENDIX F

DETAILED SUMMARIES FROM EXAMPLE CASE STUDIES

CASE NUMBER: X1 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 80000	$ 84000
ANNUAL ENERGY COST	$ 1200	$ 400
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	25.00%

COMMON PARAMETERS:

INFLATION RATE:	8.00%
ENERGY ESCALATION RATE:	14.00%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8000	$ 16800
LOAN ORIG. FEE.	$ 720	$ 672
PRIVATE MORT. INS.	$ 360	$ 0
PREPAID INS.	$ 372	$ 300
MORTGAGE POINTS	$ 1080	$ 1344
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 10893	$ 19477

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 10893	$ 19477			
1	$ 22026	$ 29412	16	$252813	$195959
2	$ 33356	$ 39410	17	$273109	$208944
3	$ 44885	$ 49483	18	$294772	$222386
4	$ 56661	$ 59652	19	$317993	$236346
5	$ 68986	$ 69929	20	$348170	$254135
6	$ 81874	$ 80326	21	$375193	$269362
7	$ 95120	$ 90858	22	$404525	$285360
8	$108774	$101544	23	$436489	$302234
9	$122876	$112390	24	$471454	$320109
10	$139888	$124921	25	$511108	$339124
11	$155048	$136134	26	$553393	$359440
12	$170830	$147554	27	$600124	$381237
13	$187322	$159211	28	$651923	$404723
14	$204624	$171139	29	$709499	$430135
15	$233716	$183374	30	$817452	$464731

BREAKEVEN YEAR = 6 BREAK-EVEN AT AHT: Y

SUMMARY OF ALL ANNUAL COSTS: CONVENTIONAL HOME: CASE NUMBER: X1

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 10893
1	$ 9893	$ 375	$ 1200	$ 0	$ 0	$ 0	$ -515	$ 180	$ 22026
2	$ 9893	$ 403	$ 1368	$ 0	$ 0	$ 0	$ -515	$ 180	$ 33356
3	$ 9893	$ 411	$ 1560	$ 0	$ 0	$ 0	$ -515	$ 180	$ 44885
4	$ 9893	$ 440	$ 1778	$ 0	$ 0	$ 0	$ -515	$ 180	$ 56661
5	$ 9893	$ 468	$ 2027	$ 272	$ 0	$ 0	$ -515	$ 180	$ 68986
****	$ 9893	$ 505	$ 2310	$ 0	$ 0	$ 0	$ +0	$ 180	$ 81874
7	$ 9893	$ 539	$ 2634	$ 0	$ 0	$ 0	$ +0	$ 180	$ 95120
8	$ 9893	$ 578	$ 3003	$ 0	$ 0	$ 0	$ +0	$ 180	$ 108774
9	$ 9893	$ 606	$ 3423	$ 0	$ 0	$ 0	$ +0	$ 180	$ 122876
10	$ 9893	$ 638	$ 3902	$ 400	$ 1999	$ 0	$ +0	$ 180	$ 139888
11	$ 9893	$ 638	$ 4449	$ 0	$ 0	$ 0	$ +0	$ 180	$ 155048
12	$ 9893	$ 638	$ 5071	$ 0	$ 0	$ 0	$ +0	$ 180	$ 170830
13	$ 9893	$ 638	$ 5781	$ 0	$ 0	$ 0	$ +0	$ 180	$ 187322
14	$ 9893	$ 638	$ 6591	$ 0	$ 0	$ 0	$ +0	$ 180	$ 204624
15	$ 9893	$ 638	$ 7514	$ 587	$ 0	$10280	$ +0	$ 180	$ 233716
16	$ 9893	$ 638	$ 8566	$ 0	$ 0	$ 0	$ +0	$ 0	$ 252813
17	$ 9893	$ 638	$ 9765	$ 0	$ 0	$ 0	$ +0	$ 0	$ 273109
18	$ 9893	$ 638	$11132	$ 0	$ 0	$ 0	$ +0	$ 0	$ 294772
19	$ 9893	$ 638	$12690	$ 0	$ 0	$ 0	$ +0	$ 0	$ 317993
20	$ 9893	$ 638	$14467	$ 863	$ 4316	$ 0	$ +0	$ 0	$ 348170
21	$ 9893	$ 638	$16492	$ 0	$ 0	$ 0	$ +0	$ 0	$ 375193
22	$ 9893	$ 638	$18801	$ 0	$ 0	$ 0	$ +0	$ 0	$ 404525
23	$ 9893	$ 638	$21433	$ 0	$ 0	$ 0	$ +0	$ 0	$ 436489
24	$ 9893	$ 638	$24434	$ 0	$ 0	$ 0	$ +0	$ 0	$ 471454
25	$ 9893	$ 638	$27855	$ 1268	$ 0	$ 0	$ +0	$ 0	$ 511108
26	$ 9893	$ 638	$31754	$ 0	$ 0	$ 0	$ +0	$ 0	$ 553393
27	$ 9893	$ 638	$36200	$ 0	$ 0	$ 0	$ +0	$ 0	$ 600124
28	$ 9893	$ 638	$41268	$ 0	$ 0	$ 0	$ +0	$ 0	$ 651923
29	$ 9893	$ 638	$47045	$ 0	$ 0	$ 0	$ +0	$ 0	$ 709499
30	$ 9893	$ 638	$53632	$ 1863	$ 9317	$32610	$ +0	$ 0	$ 817452

**** = BREAKEVEN YEAR

SUMMARY OF ALL ANNUAL COSTS: EARTH SHELTER: CASE NUMBER: X1

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 19477
1	$ 9233	$ 302	$ 400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 29412
2	$ 9233	$ 308	$ 456	$ 0	$ 0	$ 0	$ +0	$ 0	$ 39410
3	$ 9233	$ 320	$ 520	$ 0	$ 0	$ 0	$ +0	$ 0	$ 49483
4	$ 9233	$ 344	$ 593	$ 0	$ 0	$ 0	$ +0	$ 0	$ 59652
5	$ 9233	$ 368	$ 676	$ 0	$ 0	$ 0	$ +0	$ 0	$ 69929
****	$ 9233	$ 393	$ 770	$ 0	$ 0	$ 0	$ +0	$ 0	$ 80326
7	$ 9233	$ 422	$ 878	$ 0	$ 0	$ 0	$ +0	$ 0	$ 90858
8	$ 9233	$ 452	$ 1001	$ 0	$ 0	$ 0	$ +0	$ 0	$ 101544
9	$ 9233	$ 473	$ 1141	$ 0	$ 0	$ 0	$ +0	$ 0	$ 112390
10	$ 9233	$ 497	$ 1301	$ 0	$ 1499	$ 0	$ +0	$ 0	$ 124921
11	$ 9233	$ 497	$ 1483	$ 0	$ 0	$ 0	$ +0	$ 0	$ 136134
12	$ 9233	$ 497	$ 1690	$ 0	$ 0	$ 0	$ +0	$ 0	$ 147554
13	$ 9233	$ 497	$ 1927	$ 0	$ 0	$ 0	$ +0	$ 0	$ 159211
14	$ 9233	$ 497	$ 2197	$ 0	$ 0	$ 0	$ +0	$ 0	$ 171139
15	$ 9233	$ 497	$ 2505	$ 0	$ 0	$ 0	$ +0	$ 0	$ 183374
16	$ 9233	$ 497	$ 2855	$ 0	$ 0	$ 0	$ +0	$ 0	$ 195959
17	$ 9233	$ 497	$ 3255	$ 0	$ 0	$ 0	$ +0	$ 0	$ 208944
18	$ 9233	$ 497	$ 3711	$ 0	$ 0	$ 0	$ +0	$ 0	$ 222386
19	$ 9233	$ 497	$ 4230	$ 0	$ 0	$ 0	$ +0	$ 0	$ 236346
20	$ 9233	$ 497	$ 4822	$ 0	$ 3237	$ 0	$ +0	$ 0	$ 254135
21	$ 9233	$ 497	$ 5497	$ 0	$ 0	$ 0	$ +0	$ 0	$ 269362
22	$ 9233	$ 497	$ 6267	$ 0	$ 0	$ 0	$ +0	$ 0	$ 285360
23	$ 9233	$ 497	$ 7144	$ 0	$ 0	$ 0	$ +0	$ 0	$ 302234
24	$ 9233	$ 497	$ 8145	$ 0	$ 0	$ 0	$ +0	$ 0	$ 320109
25	$ 9233	$ 497	$ 9285	$ 0	$ 0	$ 0	$ +0	$ 0	$ 339124
26	$ 9233	$ 497	$10585	$ 0	$ 0	$ 0	$ +0	$ 0	$ 359440
27	$ 9233	$ 497	$12067	$ 0	$ 0	$ 0	$ +0	$ 0	$ 381237
28	$ 9233	$ 497	$13756	$ 0	$ 0	$ 0	$ +0	$ 0	$ 404723
29	$ 9233	$ 497	$15682	$ 0	$ 0	$ 0	$ +0	$ 0	$ 430135
30	$ 9233	$ 497	$17877	$ 0	$ 6988	$ 0	$ +0	$ 0	$ 464731

**** = BREAKEVEN YEAR

CASE NUMBER: X2 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 90000	$100800
ANNUAL ENERGY COST	$ 1000	$ 450
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	15.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.00%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 9000	$ 20160
LOAN ORIG. FEE.	$ 810	$ 806
PRIVATE MORT. INS.	$ 405	$ 0
PREPAID INS.	$ 409	$ 378
MORTGAGE POINTS	$ 1215	$ 1613
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 12200	$ 23318

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 12200	$ 23318			
1	$ 24277	$ 35229	16	$237100	$230646
2	$ 36422	$ 47181	17	$251127	$243387
3	$ 48642	$ 59178	18	$265263	$256177
4	$ 60949	$ 71231	19	$279514	$269019
5	$ 74096	$ 83841	20	$299045	$285929
6	$ 87259	$ 96013	21	$313542	$298883
7	$100525	$108252	22	$328172	$311896
8	$113902	$120569	23	$342941	$324971
9	$127383	$132953	24	$357857	$338112
10	$143945	$147716	25	$375196	$352835
11	$157621	$160208	26	$390426	$366118
12	$171378	$172737	27	$405826	$379477
13	$185221	$185304	28	$421403	$392917
14	$199154	$197912	29	$437167	$406440
15	$223177	$217951	30	$482074	$442011

BREAKEVEN YEAR = 14 BREAK-EVEN AT AHT: Y

SUMMARY OF ALL ANNUAL COSTS: CONVENTIONAL HOME: CASE NUMBER: X2

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 12200
1	$ 11129	$ 412	$ 1000	$ 0	$ 0	$ 0	$ -667	$ 203	$ 24277
2	$ 11129	$ 430	$ 1050	$ 0	$ 0	$ 0	$ -667	$ 203	$ 36422
3	$ 11129	$ 452	$ 1103	$ 0	$ 0	$ 0	$ -667	$ 203	$ 48642
4	$ 11129	$ 484	$ 1158	$ 0	$ 0	$ 0	$ -667	$ 203	$ 60949
5	$ 11129	$ 517	$ 1216	$ 749	$ 0	$ 0	$ -667	$ 203	$ 74096
6	$ 11129	$ 555	$ 1276	$ 0	$ 0	$ 0	$ +0	$ 203	$ 87259
7	$ 11129	$ 594	$ 1340	$ 0	$ 0	$ 0	$ +0	$ 203	$ 100525
8	$ 11129	$ 638	$ 1407	$ 0	$ 0	$ 0	$ +0	$ 203	$ 113902
9	$ 11129	$ 672	$ 1477	$ 0	$ 0	$ 0	$ +0	$ 203	$ 127383
10	$ 11129	$ 715	$ 1551	$ 988	$ 1976	$ 0	$ +0	$ 203	$ 143945
11	$ 11129	$ 715	$ 1629	$ 0	$ 0	$ 0	$ +0	$ 203	$ 157621
12	$ 11129	$ 715	$ 1710	$ 0	$ 0	$ 0	$ +0	$ 203	$ 171378
13	$ 11129	$ 715	$ 1796	$ 0	$ 0	$ 0	$ +0	$ 203	$ 185221
****	$ 11129	$ 715	$ 1886	$ 0	$ 0	$ 0	$ +0	$ 203	$ 199154
15	$ 11129	$ 715	$ 1980	$ 1304	$ 0	$ 8692	$ +0	$ 203	$ 223177
16	$ 11129	$ 715	$ 2079	$ 0	$ 0	$ 0	$ +0	$ 0	$ 237100
17	$ 11129	$ 715	$ 2183	$ 0	$ 0	$ 0	$ +0	$ 0	$ 251127
18	$ 11129	$ 715	$ 2292	$ 0	$ 0	$ 0	$ +0	$ 0	$ 265263
19	$ 11129	$ 715	$ 2407	$ 0	$ 0	$ 0	$ +0	$ 0	$ 279514
20	$ 11129	$ 715	$ 2527	$ 1720	$ 3440	$ 0	$ +0	$ 0	$ 299045
21	$ 11129	$ 715	$ 2653	$ 0	$ 0	$ 0	$ +0	$ 0	$ 313542
22	$ 11129	$ 715	$ 2786	$ 0	$ 0	$ 0	$ +0	$ 0	$ 328172
23	$ 11129	$ 715	$ 2925	$ 0	$ 0	$ 0	$ +0	$ 0	$ 342941
24	$ 11129	$ 715	$ 3072	$ 0	$ 0	$ 0	$ +0	$ 0	$ 357857
25	$ 11129	$ 715	$ 3225	$ 2270	$ 0	$ 0	$ +0	$ 0	$ 375196
26	$ 11129	$ 715	$ 3386	$ 0	$ 0	$ 0	$ +0	$ 0	$ 390426
27	$ 11129	$ 715	$ 3556	$ 0	$ 0	$ 0	$ +0	$ 0	$ 405826
28	$ 11129	$ 715	$ 3733	$ 0	$ 0	$ 0	$ +0	$ 0	$ 421403
29	$ 11129	$ 715	$ 3920	$ 0	$ 0	$ 0	$ +0	$ 0	$ 437167
30	$ 11129	$ 715	$ 4116	$ 2995	$ 5989	$19963	$ +0	$ 0	$ 482074

**** = BREAKEVEN YEAR

SUMMARY OF ALL ANNUAL COSTS: EARTH SHELTER: CASE NUMBER: X2

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 23318
1	$ 11080	$ 381	$ 450	$ 0	$ 0	$ 0	$ +0	$ 0	$ 35229
2	$ 11080	$ 399	$ 473	$ 0	$ 0	$ 0	$ +0	$ 0	$ 47181
3	$ 11080	$ 421	$ 496	$ 0	$ 0	$ 0	$ +0	$ 0	$ 59178
4	$ 11080	$ 452	$ 521	$ 0	$ 0	$ 0	$ +0	$ 0	$ 71231
5	$ 11080	$ 484	$ 547	$ 499	$ 0	$ 0	$ +0	$ 0	$ 83841
6	$ 11080	$ 517	$ 574	$ 0	$ 0	$ 0	$ +0	$ 0	$ 96013
7	$ 11080	$ 556	$ 603	$ 0	$ 0	$ 0	$ +0	$ 0	$ 108252
8	$ 11080	$ 604	$ 633	$ 0	$ 0	$ 0	$ +0	$ 0	$ 120569
9	$ 11080	$ 639	$ 665	$ 0	$ 0	$ 0	$ +0	$ 0	$ 132953
10	$ 11080	$ 679	$ 698	$ 659	$ 1647	$ 0	$ +0	$ 0	$ 147716
11	$ 11080	$ 679	$ 733	$ 0	$ 0	$ 0	$ +0	$ 0	$ 160208
12	$ 11080	$ 679	$ 770	$ 0	$ 0	$ 0	$ +0	$ 0	$ 172737
13	$ 11080	$ 679	$ 808	$ 0	$ 0	$ 0	$ +0	$ 0	$ 185304
****	$ 11080	$ 679	$ 849	$ 0	$ 0	$ 0	$ +0	$ 0	$ 197912
15	$ 11080	$ 679	$ 891	$ 869	$ 0	$ 6519	$ +0	$ 0	$ 217951
16	$ 11080	$ 679	$ 936	$ 0	$ 0	$ 0	$ +0	$ 0	$ 230646
17	$ 11080	$ 679	$ 982	$ 0	$ 0	$ 0	$ +0	$ 0	$ 243387
18	$ 11080	$ 679	$ 1031	$ 0	$ 0	$ 0	$ +0	$ 0	$ 256177
19	$ 11080	$ 679	$ 1083	$ 0	$ 0	$ 0	$ +0	$ 0	$ 269019
20	$ 11080	$ 679	$ 1137	$ 1147	$ 2867	$ 0	$ +0	$ 0	$ 285929
21	$ 11080	$ 679	$ 1194	$ 0	$ 0	$ 0	$ +0	$ 0	$ 298883
22	$ 11080	$ 679	$ 1254	$ 0	$ 0	$ 0	$ +0	$ 0	$ 311896
23	$ 11080	$ 679	$ 1316	$ 0	$ 0	$ 0	$ +0	$ 0	$ 324971
24	$ 11080	$ 679	$ 1382	$ 0	$ 0	$ 0	$ +0	$ 0	$ 338112
25	$ 11080	$ 679	$ 1451	$ 1513	$ 0	$ 0	$ +0	$ 0	$ 352835
26	$ 11080	$ 679	$ 1524	$ 0	$ 0	$ 0	$ +0	$ 0	$ 366118
27	$ 11080	$ 679	$ 1600	$ 0	$ 0	$ 0	$ +0	$ 0	$ 379477
28	$ 11080	$ 679	$ 1680	$ 0	$ 0	$ 0	$ +0	$ 0	$ 392917
29	$ 11080	$ 679	$ 1764	$ 0	$ 0	$ 0	$ +0	$ 0	$ 406440
30	$ 11080	$ 679	$ 1852	$ 1996	$ 4991	$14973	$ +0	$ 0	$ 442011

**** = BREAKEVEN YEAR

CASE NUMBER: X3 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 85000	$ 85000
ANNUAL ENERGY COST	$ 1225	$ 605
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	13.50%	13.50%
MORTGAGE POINTS	1.50%	2.00%
INS. REDUCTION	0.00%	0.00%

COMMON PARAMETERS:

INFLATION RATE:	5.70%
ENERGY ESCALATION RATE:	5.70%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8500	$ 17000
LOAN ORIG. FEE.	$ 765	$ 680
PRIVATE MORT. INS.	$ 383	$ 0
PREPAID INS.	$ 406	$ 406
MORTGAGE POINTS	$ 1148	$ 1360
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11563	$ 19807

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11563	$ 19807			
1	$ 23405	$ 30165	16	$231020	$196244
2	$ 35319	$ 40559	17	$245177	$207728
3	$ 47325	$ 51008	18	$259503	$219295
4	$ 59441	$ 61527	19	$274009	$230951
5	$ 72002	$ 72178	20	$292675	$244126
6	$ 84848	$ 82847	21	$307570	$255974
7	$ 97825	$ 93601	22	$322677	$267927
8	$110939	$104442	23	$338007	$279990
9	$124188	$115366	24	$353574	$292170
10	$139860	$127195	25	$370393	$304652
11	$153366	$138263	26	$386474	$317086
12	$166994	$149391	27	$402834	$329658
13	$180751	$160583	28	$419489	$342376
14	$194643	$171842	29	$436456	$355248
15	$217023	$184839	30	$478508	$374356

BREAKEVEN YEAR = 6 BREAK-EVEN AT AHT: Y

SUMMARY OF ALL ANNUAL COSTS: CONVENTIONAL HOME: CASE NUMBER: X3

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 11563
1	$ 10511	$ 410	$ 1225	$ 0	$ 0	$ 0	$ -495	$ 191	$ 23405
2	$ 10511	$ 412	$ 1295	$ 0	$ 0	$ 0	$ -495	$ 191	$ 35319
3	$ 10511	$ 430	$ 1369	$ 0	$ 0	$ 0	$ -495	$ 191	$ 47325
4	$ 10511	$ 462	$ 1447	$ 0	$ 0	$ 0	$ -495	$ 191	$ 59441
5	$ 10511	$ 494	$ 1529	$ 331	$ 0	$ 0	$ -495	$ 191	$ 72002
****	$ 10511	$ 528	$ 1616	$ 0	$ 0	$ 0	$ +0	$ 191	$ 84848
7	$ 10511	$ 566	$ 1708	$ 0	$ 0	$ 0	$ +0	$ 191	$ 97825
8	$ 10511	$ 606	$ 1806	$ 0	$ 0	$ 0	$ +0	$ 191	$ 110939
9	$ 10511	$ 638	$ 1909	$ 0	$ 0	$ 0	$ +0	$ 191	$ 124188
10	$ 10511	$ 672	$ 2017	$ 436	$ 1845	$ 0	$ +0	$ 191	$ 139860
11	$ 10511	$ 672	$ 2132	$ 0	$ 0	$ 0	$ +0	$ 191	$ 153366
12	$ 10511	$ 672	$ 2254	$ 0	$ 0	$ 0	$ +0	$ 191	$ 166994
13	$ 10511	$ 672	$ 2383	$ 0	$ 0	$ 0	$ +0	$ 191	$ 180751
14	$ 10511	$ 672	$ 2518	$ 0	$ 0	$ 0	$ +0	$ 191	$ 194643
15	$ 10511	$ 672	$ 2662	$ 576	$ 0	$ 7768	$ +0	$ 191	$ 217023
16	$ 10511	$ 672	$ 2814	$ 0	$ 0	$ 0	$ +0	$ 0	$ 231020
17	$ 10511	$ 672	$ 2974	$ 0	$ 0	$ 0	$ +0	$ 0	$ 245177
18	$ 10511	$ 672	$ 3143	$ 0	$ 0	$ 0	$ +0	$ 0	$ 259503
19	$ 10511	$ 672	$ 3323	$ 0	$ 0	$ 0	$ +0	$ 0	$ 274009
20	$ 10511	$ 672	$ 3512	$ 760	$ 3211	$ 0	$ +0	$ 0	$ 292675
21	$ 10511	$ 672	$ 3712	$ 0	$ 0	$ 0	$ +0	$ 0	$ 307570
22	$ 10511	$ 672	$ 3924	$ 0	$ 0	$ 0	$ +0	$ 0	$ 322677
23	$ 10511	$ 672	$ 4147	$ 0	$ 0	$ 0	$ +0	$ 0	$ 338007
24	$ 10511	$ 672	$ 4384	$ 0	$ 0	$ 0	$ +0	$ 0	$ 353574
25	$ 10511	$ 672	$ 4634	$ 1002	$ 0	$ 0	$ +0	$ 0	$ 370393
26	$ 10511	$ 672	$ 4898	$ 0	$ 0	$ 0	$ +0	$ 0	$ 386474
27	$ 10511	$ 672	$ 5177	$ 0	$ 0	$ 0	$ +0	$ 0	$ 402834
28	$ 10511	$ 672	$ 5472	$ 0	$ 0	$ 0	$ +0	$ 0	$ 419489
29	$ 10511	$ 672	$ 5784	$ 0	$ 0	$ 0	$ +0	$ 0	$ 436456
30	$ 10511	$ 672	$ 6114	$ 1323	$ 5590	$17842	$ +0	$ 0	$ 478508

**** = BREAKEVEN YEAR

SUMMARY OF ALL ANNUAL COSTS: EARTH SHELTER: CASE NUMBER: X3

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 19807
1	$ 9343	$ 410	$ 605	$ 0	$ 0	$ 0	$ +0	$ 0	$ 30165
2	$ 9343	$ 412	$ 639	$ 0	$ 0	$ 0	$ +0	$ 0	$ 40559
3	$ 9343	$ 430	$ 676	$ 0	$ 0	$ 0	$ +0	$ 0	$ 51008
4	$ 9343	$ 462	$ 714	$ 0	$ 0	$ 0	$ +0	$ 0	$ 61527
5	$ 9343	$ 494	$ 755	$ 59	$ 0	$ 0	$ +0	$ 0	$ 72178
****	$ 9343	$ 528	$ 798	$ 0	$ 0	$ 0	$ +0	$ 0	$ 82847
7	$ 9343	$ 566	$ 844	$ 0	$ 0	$ 0	$ +0	$ 0	$ 93601
8	$ 9343	$ 606	$ 892	$ 0	$ 0	$ 0	$ +0	$ 0	$ 104442
9	$ 9343	$ 638	$ 943	$ 0	$ 0	$ 0	$ +0	$ 0	$ 115366
10	$ 9343	$ 672	$ 996	$ 77	$ 741	$ 0	$ +0	$ 0	$ 127195
11	$ 9343	$ 672	$ 1053	$ 0	$ 0	$ 0	$ +0	$ 0	$ 138263
12	$ 9343	$ 672	$ 1113	$ 0	$ 0	$ 0	$ +0	$ 0	$ 149391
13	$ 9343	$ 672	$ 1177	$ 0	$ 0	$ 0	$ +0	$ 0	$ 160583
14	$ 9343	$ 672	$ 1244	$ 0	$ 0	$ 0	$ +0	$ 0	$ 171842
15	$ 9343	$ 672	$ 1315	$ 102	$ 0	$ 1565	$ +0	$ 0	$ 184839
16	$ 9343	$ 672	$ 1390	$ 0	$ 0	$ 0	$ +0	$ 0	$ 196244
17	$ 9343	$ 672	$ 1469	$ 0	$ 0	$ 0	$ +0	$ 0	$ 207728
18	$ 9343	$ 672	$ 1552	$ 0	$ 0	$ 0	$ +0	$ 0	$ 219295
19	$ 9343	$ 672	$ 1641	$ 0	$ 0	$ 0	$ +0	$ 0	$ 230951
20	$ 9343	$ 672	$ 1735	$ 135	$ 1290	$ 0	$ +0	$ 0	$ 244126
21	$ 9343	$ 672	$ 1833	$ 0	$ 0	$ 0	$ +0	$ 0	$ 255974
22	$ 9343	$ 672	$ 1938	$ 0	$ 0	$ 0	$ +0	$ 0	$ 267927
23	$ 9343	$ 672	$ 2048	$ 0	$ 0	$ 0	$ +0	$ 0	$ 279990
24	$ 9343	$ 672	$ 2165	$ 0	$ 0	$ 0	$ +0	$ 0	$ 292170
25	$ 9343	$ 672	$ 2289	$ 178	$ 0	$ 0	$ +0	$ 0	$ 304652
26	$ 9343	$ 672	$ 2419	$ 0	$ 0	$ 0	$ +0	$ 0	$ 317086
27	$ 9343	$ 672	$ 2557	$ 0	$ 0	$ 0	$ +0	$ 0	$ 329658
28	$ 9343	$ 672	$ 2703	$ 0	$ 0	$ 0	$ +0	$ 0	$ 342376
29	$ 9343	$ 672	$ 2857	$ 0	$ 0	$ 0	$ +0	$ 0	$ 355248
30	$ 9343	$ 672	$ 3019	$ 235	$ 2246	$ 3593	$ +0	$ 0	$ 374356

**** = BREAKEVEN YEAR

CASE NUMBER: X4 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 85000	$ 80000
ANNUAL ENERGY COST	$ 1225	$ 200
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	15.00%	15.00%
MORTGAGE POINTS	1.50%	3.00%
INS. REDUCTION	0.00%	25.00%

COMMON PARAMETERS:

INFLATION RATE:	12.00%
ENERGY ESCALATION RATE:	12.00%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8500	$ 16000
LOAN ORIG. FEE.	$ 765	$ 640
PRIVATE MORT. INS.	$ 383	$ 0
PREPAID INS.	$ 406	$ 279
MORTGAGE POINTS	$ 1148	$ 1920
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11563	$ 19200

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11563	$ 19200			
1	$ 24535	$ 29389	16	$282642	$192387
2	$ 37656	$ 39624	17	$302428	$203799
3	$ 50960	$ 49891	18	$323115	$215359
4	$ 64480	$ 60210	19	$344811	$227083
5	$ 78656	$ 70584	20	$379566	$242869
6	$ 93138	$ 81023	21	$403659	$254984
7	$107918	$ 91530	22	$429170	$267332
8	$123027	$102114	23	$456269	$279938
9	$138493	$112771	24	$485147	$292835
10	$158198	$124761	25	$520039	$306057
11	$174470	$135568	26	$553140	$319644
12	$191198	$146451	27	$588740	$333638
13	$208438	$157416	28	$627139	$348090
14	$226250	$168476	29	$668673	$363053
15	$263470	$181105	30	$846398	$398652

BREAKEVEN YEAR = 3 BREAK-EVEN AT AHT: -

SUMMARY OF ALL ANNUAL COSTS: CONVENTIONAL HOME: CASE NUMBER: X4

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 11563
1	$ 11604	$ 410	$ 1225	$ 0	$ 0	$ 0	$ -458	$ 191	$ 24535
2	$ 11604	$ 412	$ 1372	$ 0	$ 0	$ 0	$ -458	$ 191	$ 37656
****	$ 11604	$ 430	$ 1537	$ 0	$ 0	$ 0	$ -458	$ 191	$ 50960
4	$ 11604	$ 462	$ 1721	$ 0	$ 0	$ 0	$ -458	$ 191	$ 64480
5	$ 11604	$ 494	$ 1928	$ 417	$ 0	$ 0	$ -458	$ 191	$ 78656
6	$ 11604	$ 528	$ 2159	$ 0	$ 0	$ 0	$ +0	$ 191	$ 93138
7	$ 11604	$ 566	$ 2418	$ 0	$ 0	$ 0	$ +0	$ 191	$ 107918
8	$ 11604	$ 606	$ 2708	$ 0	$ 0	$ 0	$ +0	$ 191	$ 123027
9	$ 11604	$ 638	$ 3033	$ 0	$ 0	$ 0	$ +0	$ 191	$ 138493
10	$ 11604	$ 672	$ 3397	$ 735	$ 3106	$ 0	$ +0	$ 191	$ 158198
11	$ 11604	$ 672	$ 3805	$ 0	$ 0	$ 0	$ +0	$ 191	$ 174470
12	$ 11604	$ 672	$ 4261	$ 0	$ 0	$ 0	$ +0	$ 191	$ 191198
13	$ 11604	$ 672	$ 4773	$ 0	$ 0	$ 0	$ +0	$ 191	$ 208438
14	$ 11604	$ 672	$ 5345	$ 0	$ 0	$ 0	$ +0	$ 191	$ 226250
15	$ 11604	$ 672	$ 5987	$ 1295	$ 0	$17471	$ +0	$ 191	$ 263470
16	$ 11604	$ 672	$ 6705	$ 0	$ 0	$ 0	$ +0	$ 191	$ 282642
17	$ 11604	$ 672	$ 7510	$ 0	$ 0	$ 0	$ +0	$ 0	$ 302428
18	$ 11604	$ 672	$ 8411	$ 0	$ 0	$ 0	$ +0	$ 0	$ 323115
19	$ 11604	$ 672	$ 9420	$ 0	$ 0	$ 0	$ +0	$ 0	$ 344811
20	$ 11604	$ 672	$10551	$ 2282	$ 9646	$ 0	$ +0	$ 0	$ 379566
21	$ 11604	$ 672	$11817	$ 0	$ 0	$ 0	$ +0	$ 0	$ 403659
22	$ 11604	$ 672	$13235	$ 0	$ 0	$ 0	$ +0	$ 0	$ 429170
23	$ 11604	$ 672	$14823	$ 0	$ 0	$ 0	$ +0	$ 0	$ 456269
24	$ 11604	$ 672	$16602	$ 0	$ 0	$ 0	$ +0	$ 0	$ 485147
25	$ 11604	$ 672	$18594	$ 4022	$ 0	$ 0	$ +0	$ 0	$ 520039
26	$ 11604	$ 672	$20825	$ 0	$ 0	$ 0	$ +0	$ 0	$ 553140
27	$ 11604	$ 672	$23324	$ 0	$ 0	$ 0	$ +0	$ 0	$ 588740
28	$ 11604	$ 672	$26123	$ 0	$ 0	$ 0	$ +0	$ 0	$ 627139
29	$ 11604	$ 672	$29258	$ 0	$ 0	$ 0	$ +0	$ 0	$ 668673
30	$ 11604	$ 672	$32769	$ 7089	$29960	$95631	$ +0	$ 0	$ 846398

**** = BREAKEVEN YEAR

SUMMARY OF ALL ANNUAL COSTS: EARTH SHELTER: CASE NUMBER: X4

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 19200
1	$ 9708	$ 281	$ 200	$ 0	$ 0	$ 0	$ +0	$ 0	$ 29389
2	$ 9708	$ 302	$ 224	$ 0	$ 0	$ 0	$ +0	$ 0	$ 39624
****	$ 9708	$ 308	$ 251	$ 0	$ 0	$ 0	$ +0	$ 0	$ 49891
4	$ 9708	$ 330	$ 281	$ 0	$ 0	$ 0	$ +0	$ 0	$ 60210
5	$ 9708	$ 351	$ 315	$ 0	$ 0	$ 0	$ +0	$ 0	$ 70584
6	$ 9708	$ 379	$ 352	$ 0	$ 0	$ 0	$ +0	$ 0	$ 81023
7	$ 9708	$ 404	$ 395	$ 0	$ 0	$ 0	$ +0	$ 0	$ 91530
8	$ 9708	$ 434	$ 442	$ 0	$ 0	$ 0	$ +0	$ 0	$ 102114
9	$ 9708	$ 455	$ 495	$ 0	$ 0	$ 0	$ +0	$ 0	$ 112771
10	$ 9708	$ 479	$ 555	$ 0	$ 1248	$ 0	$ +0	$ 0	$ 124761
11	$ 9708	$ 479	$ 621	$ 0	$ 0	$ 0	$ +0	$ 0	$ 135568
12	$ 9708	$ 479	$ 696	$ 0	$ 0	$ 0	$ +0	$ 0	$ 146451
13	$ 9708	$ 479	$ 779	$ 0	$ 0	$ 0	$ +0	$ 0	$ 157416
14	$ 9708	$ 479	$ 873	$ 0	$ 0	$ 0	$ +0	$ 0	$ 168476
15	$ 9708	$ 479	$ 977	$ 0	$ 0	$ 1466	$ +0	$ 0	$ 181105
16	$ 9708	$ 479	$ 1095	$ 0	$ 0	$ 0	$ +0	$ 0	$ 192387
17	$ 9708	$ 479	$ 1226	$ 0	$ 0	$ 0	$ +0	$ 0	$ 203799
18	$ 9708	$ 479	$ 1373	$ 0	$ 0	$ 0	$ +0	$ 0	$ 215359
19	$ 9708	$ 479	$ 1538	$ 0	$ 0	$ 0	$ +0	$ 0	$ 227083
20	$ 9708	$ 479	$ 1723	$ 0	$ 3876	$ 0	$ +0	$ 0	$ 242869
21	$ 9708	$ 479	$ 1929	$ 0	$ 0	$ 0	$ +0	$ 0	$ 254984
22	$ 9708	$ 479	$ 2161	$ 0	$ 0	$ 0	$ +0	$ 0	$ 267332
23	$ 9708	$ 479	$ 2420	$ 0	$ 0	$ 0	$ +0	$ 0	$ 279938
24	$ 9708	$ 479	$ 2710	$ 0	$ 0	$ 0	$ +0	$ 0	$ 292835
25	$ 9708	$ 479	$ 3036	$ 0	$ 0	$ 0	$ +0	$ 0	$ 306057
26	$ 9708	$ 479	$ 3400	$ 0	$ 0	$ 0	$ +0	$ 0	$ 319644
27	$ 9708	$ 479	$ 3808	$ 0	$ 0	$ 0	$ +0	$ 0	$ 333638
28	$ 9708	$ 479	$ 4265	$ 0	$ 0	$ 0	$ +0	$ 0	$ 348090
29	$ 9708	$ 479	$ 4777	$ 0	$ 0	$ 0	$ +0	$ 0	$ 363053
30	$ 9708	$ 479	$ 5350	$ 0	$12037	$ 8025	$ +0	$ 0	$ 398652

**** = BREAKEVEN YEAR

CASE NUMBER: X5 PARAMETERS ARE AS FOLLOWS:

COST FACTOR	ABOVE GROUND	EARTH SHELTER
FIRST COST	$ 85000	$ 75000
ANNUAL ENERGY COST	$ 1225	$ 150
FINANCING RATE	90.00%	80.00%
MORTGAGE RATE	14.00%	14.00%
MORTGAGE POINTS	1.50%	3.00%
INS. REDUCTION	0.00%	25.00%

COMMON PARAMETERS:

INFLATION RATE:	10.00%
ENERGY ESCALATION RATE:	10.00%
REAL ESTATE APP. RATE:	6.00%

BREAKDOWN OF FIRST COSTS:

DOWNPAYMENT	$ 8500	$ 15000
LOAN ORIG. FEE.	$ 765	$ 600
PRIVATE MORT. INS.	$ 383	$ 0
PREPAID INS.	$ 406	$ 268
MORTGAGE POINTS	$ 1148	$ 1800
GEN.CLOSING COSTS	$ 361	$ 361
TOTAL UPFRONT COST	$ 11563	$ 18029

COMPARATIVE SUMMARY OF RUNNING TOTALS AHT YEAR = 8

YEAR	A/G	E/S	YEAR	A/G	E/S
0	$ 11563	$ 18029			
1	$ 23879	$ 26982	16	$258061	$167242
2	$ 36320	$ 35957	17	$275240	$176915
3	$ 48913	$ 44974	18	$292982	$186656
4	$ 61686	$ 54021	19	$311343	$196474
5	$ 75043	$ 63107	20	$338856	$209126
6	$ 88613	$ 72240	21	$358647	$219119
7	$102419	$ 81422	22	$379262	$229212
8	$116481	$ 90655	23	$400784	$239417
9	$130814	$ 99940	24	$423303	$249743
10	$148709	$110338	25	$449529	$260204
11	$163627	$119711	26	$474352	$270812
12	$178863	$129122	27	$500502	$281584
13	$194449	$138577	28	$528112	$292533
14	$210419	$148078	29	$557328	$303680
15	$241394	$157632	30	$666992	$322180

BREAKEVEN YEAR = 2 BREAK-EVEN AT AHT:

SUMMARY OF ALL ANNUAL COSTS: CONVENTIONAL HOME: CASE NUMBER: X5

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 11563
1	$ 10878	$ 410	$ 1225	$ 0	$ 0	$ 0	$ -388	$ 191	$ 23879
****	$ 10878	$ 412	$ 1348	$ 0	$ 0	$ 0	$ -388	$ 191	$ 36320
3	$ 10878	$ 430	$ 1482	$ 0	$ 0	$ 0	$ -388	$ 191	$ 48913
4	$ 10878	$ 462	$ 1630	$ 0	$ 0	$ 0	$ -388	$ 191	$ 61686
5	$ 10878	$ 494	$ 1794	$ 388	$ 0	$ 0	$ -388	$ 191	$ 75043
6	$ 10878	$ 528	$ 1973	$ 0	$ 0	$ 0	$ +0	$ 191	$ 88613
7	$ 10878	$ 566	$ 2170	$ 0	$ 0	$ 0	$ +0	$ 191	$ 102419
8	$ 10878	$ 606	$ 2387	$ 0	$ 0	$ 0	$ +0	$ 191	$ 116481
9	$ 10878	$ 638	$ 2626	$ 0	$ 0	$ 0	$ +0	$ 191	$ 130814
10	$ 10878	$ 672	$ 2888	$ 625	$ 2641	$ 0	$ +0	$ 191	$ 148709
11	$ 10878	$ 672	$ 3177	$ 0	$ 0	$ 0	$ +0	$ 191	$ 163627
12	$ 10878	$ 672	$ 3495	$ 0	$ 0	$ 0	$ +0	$ 191	$ 178863
13	$ 10878	$ 672	$ 3845	$ 0	$ 0	$ 0	$ +0	$ 191	$ 194449
14	$ 10878	$ 672	$ 4229	$ 0	$ 0	$ 0	$ +0	$ 191	$ 210419
15	$ 10878	$ 672	$ 4652	$ 1006	$ 0	$13576	$ +0	$ 191	$ 241394
16	$ 10878	$ 672	$ 5117	$ 0	$ 0	$ 0	$ +0	$ 0	$ 258061
17	$ 10878	$ 672	$ 5629	$ 0	$ 0	$ 0	$ +0	$ 0	$ 275240
18	$ 10878	$ 672	$ 6192	$ 0	$ 0	$ 0	$ +0	$ 0	$ 292982
19	$ 10878	$ 672	$ 6811	$ 0	$ 0	$ 0	$ +0	$ 0	$ 311343
20	$ 10878	$ 672	$ 7492	$ 1621	$ 6850	$ 0	$ +0	$ 0	$ 338856
21	$ 10878	$ 672	$ 8241	$ 0	$ 0	$ 0	$ +0	$ 0	$ 358647
22	$ 10878	$ 672	$ 9065	$ 0	$ 0	$ 0	$ +0	$ 0	$ 379262
23	$ 10878	$ 672	$ 9972	$ 0	$ 0	$ 0	$ +0	$ 0	$ 400784
24	$ 10878	$ 672	$10969	$ 0	$ 0	$ 0	$ +0	$ 0	$ 423303
25	$ 10878	$ 672	$12066	$ 2610	$ 0	$ 0	$ +0	$ 0	$ 449529
26	$ 10878	$ 672	$13273	$ 0	$ 0	$ 0	$ +0	$ 0	$ 474352
27	$ 10878	$ 672	$14600	$ 0	$ 0	$ 0	$ +0	$ 0	$ 500502
28	$ 10878	$ 672	$16060	$ 0	$ 0	$ 0	$ +0	$ 0	$ 528112
29	$ 10878	$ 672	$17666	$ 0	$ 0	$ 0	$ +0	$ 0	$ 557328
30	$ 10878	$ 672	$19432	$ 4204	$17767	$56711	$ +0	$ 0	$ 666992

**** = BREAKEVEN YEAR

SUMMARY OF ALL ANNUAL COSTS: EARTH SHELTER: CASE NUMBER: X5

YEAR	MORTGAGE COST	HOMEOWNERS INSURANCE	ANNUAL ENERGY	EXTERIOR PAINTING	HVAC REPLACE.	ROOF MAINT.	OPP. COST	AN. PMI	RUNNING TOTAL
0									$ 18029
1	$ 8532	$ 271	$ 150	$ 0	$ 0	$ 0	$ +0	$ 0	$ 26982
****	$ 8532	$ 279	$ 165	$ 0	$ 0	$ 0	$ +0	$ 0	$ 35957
3	$ 8532	$ 302	$ 182	$ 0	$ 0	$ 0	$ +0	$ 0	$ 44974
4	$ 8532	$ 315	$ 200	$ 0	$ 0	$ 0	$ +0	$ 0	$ 54021
5	$ 8532	$ 334	$ 220	$ 0	$ 0	$ 0	$ +0	$ 0	$ 63107
6	$ 8532	$ 359	$ 242	$ 0	$ 0	$ 0	$ +0	$ 0	$ 72240
7	$ 8532	$ 384	$ 266	$ 0	$ 0	$ 0	$ +0	$ 0	$ 81422
8	$ 8532	$ 410	$ 292	$ 0	$ 0	$ 0	$ +0	$ 0	$ 90655
9	$ 8532	$ 431	$ 322	$ 0	$ 0	$ 0	$ +0	$ 0	$ 99940
10	$ 8532	$ 452	$ 354	$ 0	$ 1061	$ 0	$ +0	$ 0	$ 110338
11	$ 8532	$ 452	$ 389	$ 0	$ 0	$ 0	$ +0	$ 0	$ 119711
12	$ 8532	$ 452	$ 428	$ 0	$ 0	$ 0	$ +0	$ 0	$ 129122
13	$ 8532	$ 452	$ 471	$ 0	$ 0	$ 0	$ +0	$ 0	$ 138577
14	$ 8532	$ 452	$ 518	$ 0	$ 0	$ 0	$ +0	$ 0	$ 148078
15	$ 8532	$ 452	$ 570	$ 0	$ 0	$ 0	$ +0	$ 0	$ 157632
16	$ 8532	$ 452	$ 627	$ 0	$ 0	$ 0	$ +0	$ 0	$ 167242
17	$ 8532	$ 452	$ 689	$ 0	$ 0	$ 0	$ +0	$ 0	$ 176915
18	$ 8532	$ 452	$ 758	$ 0	$ 0	$ 0	$ +0	$ 0	$ 186656
19	$ 8532	$ 452	$ 834	$ 0	$ 0	$ 0	$ +0	$ 0	$ 196474
20	$ 8532	$ 452	$ 917	$ 0	$ 2752	$ 0	$ +0	$ 0	$ 209126
21	$ 8532	$ 452	$ 1009	$ 0	$ 0	$ 0	$ +0	$ 0	$ 219119
22	$ 8532	$ 452	$ 1110	$ 0	$ 0	$ 0	$ +0	$ 0	$ 229212
23	$ 8532	$ 452	$ 1221	$ 0	$ 0	$ 0	$ +0	$ 0	$ 239417
24	$ 8532	$ 452	$ 1343	$ 0	$ 0	$ 0	$ +0	$ 0	$ 249743
25	$ 8532	$ 452	$ 1477	$ 0	$ 0	$ 0	$ +0	$ 0	$ 260204
26	$ 8532	$ 452	$ 1625	$ 0	$ 0	$ 0	$ +0	$ 0	$ 270812
27	$ 8532	$ 452	$ 1788	$ 0	$ 0	$ 0	$ +0	$ 0	$ 281584
28	$ 8532	$ 452	$ 1966	$ 0	$ 0	$ 0	$ +0	$ 0	$ 292533
29	$ 8532	$ 452	$ 2163	$ 0	$ 0	$ 0	$ +0	$ 0	$ 303680
30	$ 8532	$ 452	$ 2379	$ 0	$ 7138	$ 0	$ +0	$ 0	$ 322180

**** = BREAKEVEN YEAR

VITA

Allen Dale Jones

Candidate for the Degree of

Master of Architectural Engineering

Thesis: A LIFE CYCLE COST COMPARISON BETWEEN EARTH SHELTER AND CONVENTIONAL HOUSING IN OKLAHOMA

Major Field: Architectural Engineering

Biographical:

Personal Data: Born in Oklahoma City, Oklahoma, August 23, 1958, the son of Melvin E. and Georgia L. Jones. Married to Natalie D. Edmunds on August 6, 1983.

Education: Graduated from Yukon High School, Yukon, Oklahoma, in May 1976; received Bachelor of Architectural Studies from Oklahoma State University in May, 1981; completed requirements for the Master of Architectural Engineering Degree, Environmental Control Option, at Oklahoma State University in July 1984.

Professional Experience: Teaching Assistant, School of Architecture, Oklahoma State University, August 1982 to May 1983; Research Assistant dealing with Environmental Control Laboratory development, School of Architecture, Oklahoma State University, April 1981 to July 1981, and May 1983 to December 1983. Draftsman for Cunningham Consultants Inc., civil engineers, May 1981 to December 1981.

Professional Organizations: Charter Member, Oklahoma State University student chapter, National Society of Architectural Engineers, 1982 to present; American Society of Heating, Refrigerating, and Air-Conditioning Engineers, 1980 to present; Construction Specifications Institute, 1983 to present; Oklahoma Society of Professional Engineers, 1981 to present; National Society of Professional Engineers, 1981 to present.