A COST DESIGN SYSTEM
FOR
RESIDENTIAL BUILDING SYSTEMS

by

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A Cost Design System for Residential Building Systems

Norman Quon

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degree of Master of Architecture.

Too often the designer of housing is forced to compromise his final design solution because of lack of realistic knowledge in cost constraints and ignorance of the working components in the housing industry. The architect, in particular, should be more aware of the total housing process and his role in the process. Further, the architect must be more aware of the changing trends in design constraints - costs, political and social factors are becoming increasingly important. The products of industrialization - systems design approach, modular coordination and design, standardization of parts, and mass market approach - should be harnessed by the architect in order to reach and satisfy the needs of a larger clientele - the low income and middle income groups.

This study provides the designer of housing with a system to collect, evaluate and actually use costs in the design process.

The entire housing industry has been considered in this study - from traditional on-site construction to componentized construction to box construction. The producer of housing will find the system extremely helpful in assessing and improving the cost control of his construction or production operations.

It is the author's conclusion that the key to an effective cost design system is the cost accounting system that is used. Thus, a major portion of the time was spent investigating and developing the cost accounting systems proposed in this study.

Thesis Supervisor: John Steffian

Title: Associate Professor of Architecture

Acknowledgements

The research for this project made possible under a Graham Foundation Grant.

Special thanks is due to Professor John A. Steffian for supervising the project; Professor Arthur D. Bernhardt for his immense help in providing background information on the housing industry and in developing the set of questionnaires on housing costs; and Miss June Druley for preparing and typing the final draft.

Preface

The Cost Design System shall be divided into three separate volumes: 1) Introduction & Cost System Development; 2) The Cost Design System; 3) Designer's Workbook.

The Introduction and Cost System Development shall state the background, purpose, problem, focus, scope, and give a short synopsis of the methods employed in forming this system.

The Cost Design System will provide the methods and hardware for a cost analysis of a given set of performance requirements. The author hopes the Designer's Workbook and the Cost Design System will be used hand-in-hand to more rationally approach the design of a building system.

The Designer's Workbook is intended to be used directly with the Cost Design System. It will provide background information to enable the user to understand the economic trends and constraints affecting the design of a building system. This information should be updated periodically with an analysis of the present conditions and a prediction of future trends.

VOLUME I:

INTRODUCTION
&
COST SYSTEM DEVELOPMENT

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VOLUME I INTRODUCTION & COST SYSTEM DEVELOPMENT

1.0 INTRODUCTION

1.1 Background

Skills of the manufacturer, builder, designer, and user must be blended together to form a realistic design process that will make an environment more responsive to the needs of the user. To do this, the methods and tools used in design selection must be changed. This process must be made more explicit. Clear bases should be established so the designer knows exactly what the tradeoffs are in choosing one parameter over another. The purpose of this study is to make the cost criteria aspect of the selection process as explicit as possible.

The crucial issue in getting a project built or in designing a successful building system, is the cost feasibility of that particular project or building system. Presently, there exists no rational basis of selecting designs in those terms. Moreover, it is impossible to find any consistent set of building cost data for both the conventional and industrialized construction field. An entirely new set of data must be generated to establish cost consistency throughout the entire housing construction industry. Since this type of research or study has never been done before, much information must be collected and tied together in a consistent fashion to compare all the numerous conventional and industrialized construction processes together. Once this base set of comparable cost data has been collected and established, a system must be designed for continually updating the costs. From this formulated system, a tool must be devised so that manufacturers, builders, and designers can make more accurate decisions in determining materials, production methods, labor, transportation, structural systems, housing types, and other needed parameters for specific design requirements.

It should be emphasized that the economic criteria aspect, although playing a primary role in system selection, is still only one aspect of the total criteria required in designing a building system for housing. To complete the process, one must do cultural, economic, and aesthetic studies for the client groups to be served. One would then match building processes, dwelling types, and economic constraints of the client with the product. The designer would use the cost breakdowns resulting from this study as a base from which to start the selection process. He would then extrapolate a design by constantly fusing cost constraints with user needs and other design parameters.

1.2 Purpose of Study

1) Establish a base set of comparable construction cost data for the entire housing industry - from traditional

on-site construction to componentized construction to mobile and modular homes.

2) Formulate a system to evaluate and classify the cost information for continuous updating of the costs.

3) From the formulated system, establish a tool which the user may use for evaluating economic cost criteria for:

   a) Architectural or Engineering Design

   b) Cost Control of Construction, Production, and Transportation

   c) Bidding or construction Cost Estimating

1.3 Focus of Study

The proposed Cost Design System is intended to be highly flexible in its usage. The following participants will benefit from using the system:

The Designer of Housing

The proposed tool will integrate the design process for the architect, engineer, or designer more directly with the realistic constraints of cost. Under present conditions, the first real estimate of costs is at the working drawing stage or bidding stage of a project. However, at this stage, major decisions have already been made and too much time and money have been spent developing the design to retrace the original steps and reassess any major point in the design. Consequently, if the design is over the budget, what usually happens is that the original design is cut in half, quarter, or in even smaller portions. The result is a final product looking nothing like the design that was originally envisioned. If the designer had some realistic way of measuring costs at the offset of the project, perhaps another route might have been taken and a richer, more realistic design would have been formulated.

From the proposed tool, the designer will know the costs and manhours of each design component, and thus be able to make more realistic design decisions by actually incorporating costs in his design process.

The Producer of Housing

The proposed tool will enable builders and manufacturers to more realistically assess their operations and compare themselves with other manufacturers in their own sector of the industry or with other sectors. It will enable the manufacturer to have greater cost control of his factory operations.

The Owner of Housing

Better cooperation will result between the designer and builder because the designer will be more aware of the builder's or manufacturer's cost. The risks will be reduced and better, more efficient economical construction will result.

The Construction Estimators of Housing

A uniform cost accounting system will result if a system such as the one I am proposing is adopted on a large scale basis. The result will be a larger data bank from which to draw information. Presently, there are numerous types of cost accounting systems, making it impossible to correlate any costs. With a uniform system, estimators and bidders will be able to draw from a larger data bank and the result will be a more exact bidding. Thus, the total cost of building a project will be lower since a smaller portion of the project will be alloted to risk.

1.4 The Problem

The present problems encountered in formulating the proposed system can be summed up in two critical areas. First, the problems related to the actual questionnaire design, formulation, and evaluation. Second, the problems related to the actual formulation of the Cost Design System.

The formulation of the Cost Design System is meaningless without an adequate data bank from which to work. The questionnaire results will provide the working information for the system. Thus, the design of the questionnaires for the entire housing construction industry must be in a consistent, comparable format so the data bank can be renewed periodically.

Problems in the Questionnaire Design

The questionnaire design starts with the problem of analyzing the field of conventional and industrialized building construction. The existing problems may be summarized as:

1) Need For A Classification System

There exists no up to date literature on building systems which rationally survey and interpret the entire field. There is a need for a classification system that will catagorize the many different types of systems in order to obtain a quick overview of what is happening in:

a. Module Development or Component Development
b. Factory Production, Transportation, and

Erection Methods

c. On-Site or Off-Site Construction Methods

2) Need To Evaluate the Merits of Each System

There is a need to formulate criteria and to evaluate the merits of a system in order to quickly pick out the best systems. The categories should include:

a. Cost of Structure: On-Site & Off-Site Costs

b. Efficiency of Production: Cost of Production ($/sf), Rates of Production (du/day), Plant Size (sf)

c. Cost of Transportation ($/mile) ($/sq.ft.) (Fixed Cost) (Increment Cost)

d. Cost of Erection ($/sf)

e. System Flexibility: Available Module Groupings, Maximum Height Restrictions, Ease of Site Adaption, Module Expansion or Contraction for Time Change Requirements, Adaptability to Housing Types, Structure Mobility

3) Need for Comparable Figures for Industrialized Construction and Conventional Construction

These comparable costs are needed as an index so that anyone from manufacturing, construction, or design can extrapolate these figures to:

a. Accurately choose materials, structural systems, production methods, and other design parameters.
b. Accurately predict future costs of a designed unit and cost trends of various components which make up the unit with their cost trends over time.
c. Accurately compare different types of factory produced and conventionally produced building systems.

Problems in the Formulation of the Cost Design System

In order to have a useful tool for evaluating costs, the cost system must satisfy a number of needs. The existing needs may be summarized as:

1) Need For A Uniform Cost Accounting System

There exist numerous cost accounting systems, none of which are used extensively. In order to develop a good data bank from which to analyze costs of construction, a good uniform cost accounting system is needed.

2) Need To Coordinate My Data Bank With Other Cost Studies & Systems

Devise categories to make my cost study compatible with other cost studies in order to gain a larger and continuing data bank of cost information.

3) Need For Use Of Costs In Design

Devising categories to provide cost guidelines for architects, engineers, and designers to follow in designing a building - to integrate cost constraints more explicitly into the design process by providing an efficient, rational method of selecting building components.

4) Need For Use In Analyzing Efficiency In Production And Construction Of Housing

Establish categories to analyze building systems and spot inefficiencies in the production and construction process.

5) Need For Use In Construction Estimating

There exists a need for estimating construction in all phases of the housing design and construction process. Presently, the only stage where an adequate cost estimation of a project can be performed is after the working drawing phase is completed and quantity takeoffs can be done.

1.5 Scope of Study

Any valid cost study must clearly define the constraints under which the costs will be evaluated and determined. The following is a list of constraints I used in determining the costs for the Cost Design System:

1) The study will include both the traditional on-site housing construction sector and the industrialized housing sector.

2) The emphasis will be placed on the three main building materials (wood, concrete, & steel) with special provisions in the classification system for inclusion of other innovative building materials as they become economically competitive.

3) No value judgements will be made about the character and appropriateness of the design for these dwelling units.

4) For greater cost consistency of labor, materials, and transportation, the main emphasis will be on building systems and construction costs for projects found in the United States.

5) Since there exist extreme differences of land and foundation costs in different parts of the country, only the costs above the top of the foundation will be

included.

1.6 Methodology

The general approach to the study consisted of the following stages:

1) Establish a building classification system to order the numerous types of building systems in the entire housing industry.

2) Determine criteria for judging a building system.

3) Research and collect existing information on building systems for study.

4) Establish comparable definitions of costs for conventional on-site construction and industrialized construction.

5) Search available published literature for information on classification and cost accounting systems.

6) Update published information with interviews and letters to firms for unpublished studies recently completed and those still in progress.

7) Develop a cost classification system satisfying the purpose of the study.

8) Compare developed cost classification system with other

cost accounting or cost classification systems in use and make developed cost system compatible.

9) Formulate first version of the questionnaire set.
   a. Determine questionnaire length
   b. Determine content of questionnaire

10) Test questionnaire with local builders and manufacturers.

11) Re-evaluate and revise questionnaire.
   a. Check clarity of questionnaire
   b. Reassess relevancy of all questions
   c. Check for need of other questions not included but needed for analysis

12) Establish tactics and strategies for data collection.
   a. Work on presentation and format of questionnaire
   b. Work on transmittal letter to accompany each questionnaire
   c. Seek endorsements from major industry associations: NAHB, NABM, MHMA

13) Collection of addresses of builders and manufacturers with accompanying heads of companies.

14) Send questionnaires out to industry.

15) Collect support data for cost forcasting.

16) Finalize Cost Design System to satisfy purposes and focus of study.

17) Coordinate, analyze, and prepare for presentation all materials gathered.

18) Complete Report.

APPENDIX

CORRESPONDENCE

Date of Writing	Date of Reply	Person's Name	Title and Organization	Purpose
Nov. 3,'71	No Reply	Harold Finger	Assit. Sec. of Research and Tech. H.U.D.	Locate Research Contract To Standardize Collection of Cost Data
Nov.26,'71	No Reply	Donald Macdonald	Project Leader Computer Applications, Inc.	Locate Other Cost Studies: Department Housing Cost System
Nov.26,'71	Dec. 7	Jack Thomas	Vice-President, McKee, Berger, Mansueto, Inc.	Locate Other Cost Studies: Submission of Sq. Ft. Cost Data On Various Types of Construction
Nov.26,'71	Dec. 23	Jacob A. Stockfisch	Project Leader, Institute of Defense Analysis	Locate Other Cost Studies: Reduction of the Costs of Low Cost Housing
Nov.26,'71	No Reply	Philip O. Chen	General Engineer National Bureau of Standards	Locate Other Cost Studies: Building Economics
Nov.26,'71	No Reply	G.S. Birrell	Project Leader National Bureau of Standards	Locate Other Cost Studies: Cost Analysis/Cost Synthesis System for Construction Control
Nov.26,'71	No Reply	J.W. Fondahl	Project Leader Stanford University	Locate Other Cost Studies: Operations Research: Construction Costs
Dec.23,'71	Jan. 14	Richard L. Bullock	Exec. Vice-Pres. National Assoc. of Building Manf.	Obtain the endorsement from the NABM for my thesis
Dec.23,'71	Jan. 19	John M. Martin	President, Mobile Home Manufacturers Association	Obtain the endorsement from the MHMA for my thesis

CORRESPONDENCE

Date of Writing	Date of Reply	Person's Name	Title and Organization	Purpose
Jan. 7,'72	No Reply	Michael Sumichrast	Staff VP, Chief Economist, Nat'l Assoc. of Home Builders	Obtain the endorsement from the NAHB for my thesis
Jan.10,'72	March 3	Gene Scriven	Weyerhaeuser Corporation	Obtain Construction Cost Report Done By Weyerhauser For Dealer Marketing
Jan.13,'72	-	Cal Barr	V.P./Component Systems, Inc.	Thank you note
Jan.21,'72	Jan. 25	Wrote to: Marvin Goody Reply from: Robert Pelletier	Goody-Clancy, Architects	Obtain a copy of UDC Cost-Assessment System developed by Goody-Clancy & Tishman Research Corp. for UDC
Jan.26,'72	Feb. 18	Isreal Rafkin	Office of Deputy Under Sec., H.U.D.	Locate Other Cost Studies: Department Housing Cost Systems
Jan.26,'72	Feb. 4	Philip O. Chen	National Bureau of Standards	Locate Other Cost Studies: Building Economics
Jan.26,'72	No Reply	R.W. Blake	Project Monitor National Bureau of Standards	Locate Other Cost Studies: Cost Analysis/Cost Synthesis System For Construction Control
Jan.26,'72	Feb. 8	H.C. Lamb	Program Manager NAVFAC	Locate Other Cost Studies: Operations Research/Construction Costs
Feb. 9,'72	No Reply	Richard L. Bullock	Exec. V.P., NABM	Obtain Further Endorsement For My Study & Obtain NABM Mailing List

CORRESPONDENCE

Date of Writing	Date of Reply	Person's Name	Title and Organization	Purpose
Feb. 9,'72	Feb. 17	Wrote to: Charles Altman Reply from: Quinton R. Wells	Project Monitor, H.U.D.	Obtain Copy of: Estimate Sq. Ft. Costs For Dwelling Construction And Equipment Of Various Building Types
Feb.15,'72	Feb. 22	Michael Sumichrast	Staff VP,Chief Economist, NAHB	Obtain Endorsement from HAHB
-	Feb. 10	Jerry Bagley	Director, Public Relations, MHMA	Further Endorsement From MHMA
Mar.14,'72		Jerry Bagley	Director, Public Relations	Check for further Encorsement from MHMA
Mar.14,'72	Mar. 17	Richard L. Bullock	Exec. V.P. NABM	Get O.K. to Use Endorsement Letter From R. Bullock
Mar.20,'72	-	Manufactured Housing Assoc. of America	-	Obtain Address Book of 2,000 Manf. & Builders, Modular and Components

PERSONAL INTERVIEWS

Date	Person Interviewed	Title In Company	Company Name	Company Business
Nov.22,'71	John Bemis	President	Acorn Structures Concord, Mass.	Manufacturer, Component Wood Frame
Dec. 6,'71	Don Beam	Comptroller	Moduline Industries Derry, N.H.	Manufacturer, Mobile Homes
Dec. 6,'71	Rodney Wright	Assit. V.P., Production Manager	Continental Homes, Nashua, N.H.	Manufacturer, Modular Homes (Wood)
Dec.10,'71	John Marino	President	Marino Development Company, Somerville, Mass.	Builder-Developer, Modular Homes
Dec.10,'71	Lou Chaitman	Exec. V.P.	Home Builders Association of Greater Boston Boston, Mass.	Local Assoc. of Contractors of Conventional Construction
Jan. 3,'72	Cal Barr	Vice-Pres.	Component Systems Inc., Rogers, Minn.	Manufacturer, Component Wood Frame
Jan. 3,'72	Ed Shield	Plant Manager	Villaume Industries St.Paul, Minn.	Manufacturer, Custon Wood Frame Components
Jan. 4,'72	Don Huber	Member, Board of Directors	Capp Homes Minneapolis, Minn.	Manufacturer, Pre-Cut Custom Homes (Wood)
Jan. 4,'72	Steve O'Brien	Production Manager	Shelter Homes Minneapolis, Minn.	Manufacturer, Modular Homes (Wood)
Jan. 6,'72	Tom Reese	Production Manager	Pemtom Minneapolis, Minn.	Manufacturer, Mobile & Modular Homes (Wood)

PERSONAL INTERVIEWS

Date	Person Interviewed	Title In Company	Company Name	Company Business
Jan.28,'72	Jack Thomas	Vice-Pres.	McKee,Berger, Mansueto, Inc. New York & Boston	Consulting Engineer: Cost Consultants
Jan.28,'72	Richard Vanden Bosche	Director, Research & Development	MBM	Ibid.
Feb.10,'72	Robert J. Pelletier	Associate	Goody-Clancy Assoc. Boston, Mass.	Architects: Did Cost-Assessment System for UDC.

TELEPHONE INTERVIEWS

Date	Person	Title & Organization	Purpose
Nov. 3,'71	Charles Field	Special Assistant to Harold Finger, H.U.D.	Locate Research Contract To Standardize Collection Of Cost Data
Nov. 4,'71	Duane McGough	Office of Economic Analysis, H.U.D.	Ibid.
Nov. 5,'71	Ted Voss	Director of Statistics & Research Div. for Housing Production, H.U.D.	Ibid.
Nov. 5,'71	James McCullough	FHA Architecture Dept. H.U.D.	Ibid.
Jan.27,'72	John Bemis	President, Acorn Structures	Get A Manufacturer's Response Bullock's Letter
Jan.31,'72	Rodney Wright	Assit. V.P., Production Manager Continental Homes of N.H.	Ibid.
Mar.21,'72	Lou Chaitman	Home Builders of Greater Boston, HAHB	Get Address List of Stick Builders
Mar.21,'72	-	Associated General Contractors	Get List of General Contractors Addresses

FACTORY PLANT VISITS

Date	Company Name	Location	Housing Type
May '71	San Vel Concrete Corp.	Littleton, Mass.	Manufacturer of Post-Tensioned Concrete Panels, Prestressed Slabs, Tees.
Nov. 8,'71	Continental Homes	Nashua, New Hamp.	Manufacturer of Modular Wood Homes, Wood Components
Nov. 8,'71	Moduline Industries	Derry, New Hamp.	Manufacturer of Mobile Homes
Nov.15,'71	Marino Development Corp.	Development in Easten, Mass.	Builder-Developer of Modular Homes
Nov.22,'71	Acorn Structures	Concord, Mass.	Manufacturer of Wood Component Frame Panels
Jan. 3,'72	Component Systems,Inc.	Rogers, Minn.	Manufacturer of Wood Components: Trusses, Walls, Floors
Jan. 4,'72	Villaume Industries	St.Paul, Minn.	Manufacturer of Custom Components for Houses

VOLUME II:

THE COST DESIGN SYSTEM

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VOLUME II THE COST DESIGN SYSTEM

1.0 INTRODUCTION

1.1 Needs

a) The designer must have better tools to access his design choices more realistically.

b) The housing producer needs a fast and accurate method of cost control for his production or construction operations.

1.2 Existing Conditions Affecting Cost Evaluation

a) No established methods of cost evaluation in the design stage of the housing process.

b) No uniform cost accounting procedure established in the housing industry.

c) The first time a cost estimate of a housing design can be performed is after the working drawing stage of a project has been completed.

d) Most cost estimating systems are either too long and involved or too superficially simple to be of any value to the user.

1.3 Purpose of the Cost Design System

To develop a cost evaluation tool for the designer, architect, engineer, or housing producer to use in the design and production phase of the building process - in order to enrich the potentials of design and bridge the gap between the proposed stage of design and the actual construction phase.

2.0 THE COST DESIGN SYSTEM

2.1 System Description

The proposed Cost Design System is a systematic method of collecting, storing, and translating cost information to useful quantities for the designer, producer, or cost estimator of housing.

A. Data Collection: The data collection may come from three sources:

1) Correspondence: In the form of a questionnaire survey such as the method developed in this study.

2) Actual Field Collection: Direct cost collection of on-site and off-site construction methods.

3) Synthesized Information: Gathered information from other surveys, manuals, cost studies, & systems.

B. Data Base Storage: All the information gathered will be transferred to a uniform format in the category breakdown established in the Cost Model. In this form, all cost information can be systematically updated, translated, or manipulated in any desired form to compare, estimate, or evaluate costs for all types of:

1) Housing Producers: Traditional contractor, industrialized component builder or a manufacturer of components or boxes.

2) Construction Methods: Traditional construction, componentized construction, or box construction.

3) Housing Types: Single-family detached, row housing, low-rise multi-family apartments, medium-rise apartments or hi-rise apartments.

C. Cost Information Translation: The category breakdown developed in the Cost Model is sufficiently detailed so that a wide variety of needs can be satisfied. Three levels of accuracy are built in the system to satisfy the general needs of the designer or systems evaluator, the intermediate needs of the producer, and the detailed needs of the cost estimator. Three information translation subsystems have been developed in this study - a building cost accounting system, a designer's cost accounting system, and a housing producer's cost accounting system.

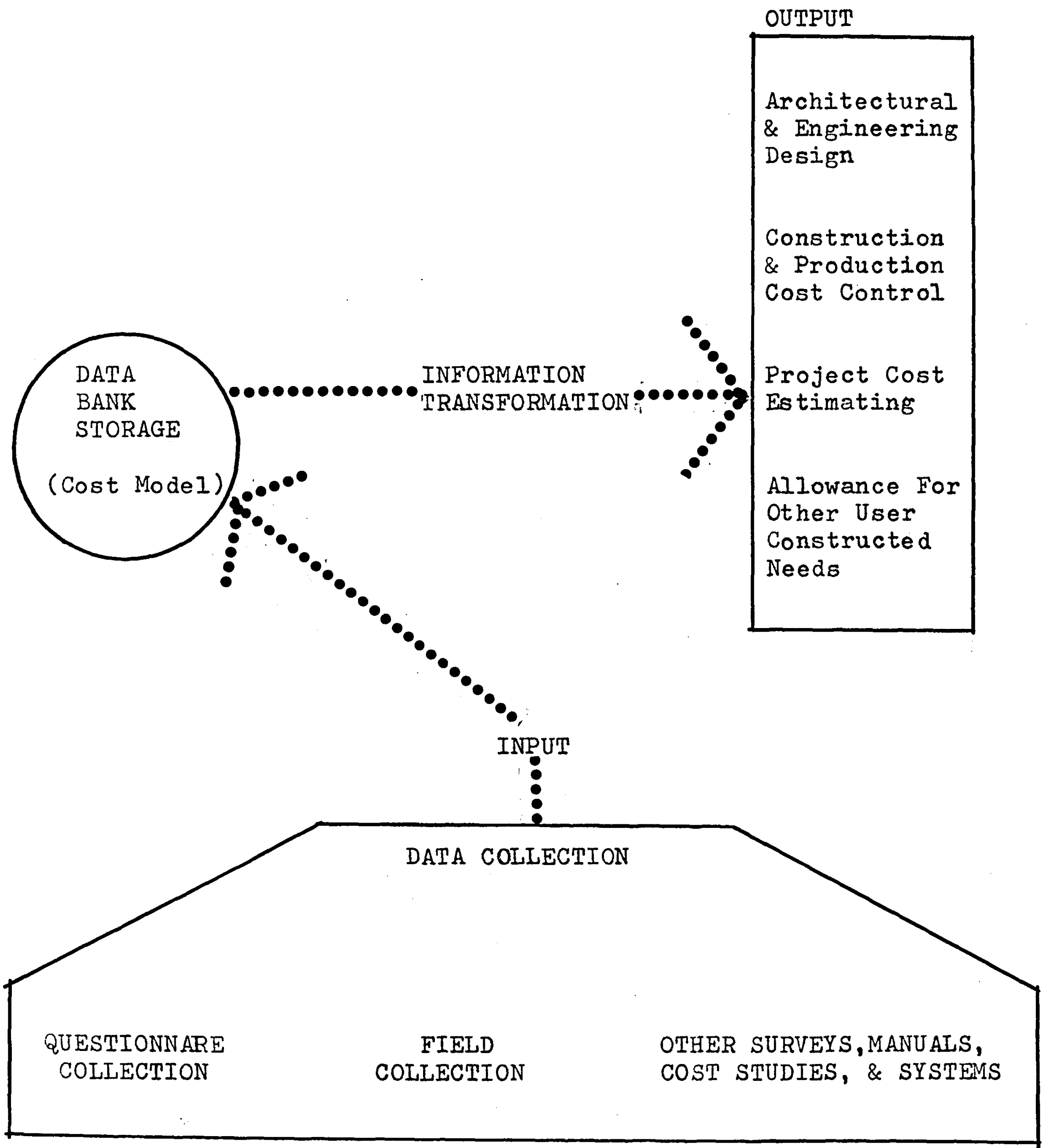
2.2 Form Of System For The User

To be of maximum use to the designer, producer, or cost estimator, the following system requirements were developed:

A. Visual.

B. Fast and efficient to use.

C. Flexible in degree of accuracy for use in the preliminary design, detailed design, bidding and cost control phases of housing production and construction.



COST DESIGN SYSTEM

D. Easily accessible to the designer or producer without any large investment in time or money for instalation or use.

The Cost Design System shall follow two types of classifications: 1) a classification system for residential building systems; 2) a regional classification system.

Costs can thus be assessed for different parts of the country and for any housing type, material type, structural type, construction method, or generic type.

The Cost Design System's final form to be used by the individual designer, producer, or cost estimator shall be a catalog with graphs and tables tailored specifically for a particular user's purpose. Each purpose shall be in accordance with the specific cost accounting systems developed for the special purpose or devised by the user for his particular needs.

Costs have three levels of accuracy: 1) Level 1 (General); 2) Level 2 (Intermediate); 3) Level 3 (Detailed).

The general catalog of cost classification shall follow:

Traditional Construction

1) Single-Family Detached
2) Row Housing (Townhouse)

3) Low-Rise Multi-Family (1-3 stories)

4) Medium-Rise (4-8 stories)

5) Hi-Rise (9+ stories)

Component Construction

1) Single-Family Detached

2) Row Housing (Townhouse)

3) Low-Rise Multi-Family (1-3 stories)

4) Medium-Rise (4-8 stories)

5) Hi-Rise (9+ stories)

Box Construction

1) Mobile Home

2) Modular Home

3) Row Housing (Townhouse)

4) Low-Rise Multi-Family (1-3 stories)

5) Medium-Rise (4-8 stories)

6) Hi-Rise (9+ stories)

2.3 DATA BANK STORAGE: THE COST MODEL

All the accumulated data must be stored in a systematic manner such that it may be easily accessible and manipulated. The format for storage will follow the guidelines established in the Cost Model.

2.3.1 Cost Model Introduction

The purpose of the Cost Model is to establish a format of cost uniformity for valid cost comparisons and provide a systematic means for: 1) evaluating costs for housing design; and 2) cost control of housing production and construction.

The cost model contains three types of cost breakdowns:

1) Sales Price Breakdown: Total selling price to the consumer. Includes development costs; structure costs; selling expenses; general & administrative expenses; financing expenses; and overhead & profit.

2) Construction Cost Breakdown: Includes structure cost (with or without foundation & excavation); selling expense; general & administrative expenses; financing expenses; and overhead & profit.

3) Structure Cost Breakdown:
Includes: Materials, labor, delivery, lift & secure.
Excludes: Selling, general & administration, financing

expenses, and overhead & profit.

2.3.2 Definition of Terms

Development Costs: Includes land acquisition, site improvements, and development fees.

Land Acquisition Costs: Includes cost to purchase land and all broker's, lawyer's, or any other fees required to purchase land.

Site Improvement Costs: Includes only the construction costs for site development work and utility hookup. Excludes foundation & excavation costs, all development fees and overhead expenses.

Development Fees: Includes all architectural, engineering, bonding, building permits, and all other fees connected with the project design and development.

Type Cost "A": Includes all foundation & excavation costs.

Construction Cost "A": Contains all construction costs including the structure costs for the foundation & excavation.

Structure Cost "A": Contains all structure costs including the structure costs for the foundation & excavation.

Type Cost "B": Excludes all foundation & excavation costs.

Construction Cost "B": Contains all construction costs excluding the construction costs for the foundation & excavation.

Structure Cost "B": Contains all structure costs excluding the structure cost for the foundation & excavation.

Revised Cost: Updated cost. Original cost modified by the cost index. Revised Cost =

$$\frac{\text{current cost index}}{\text{original project cost index}} \times \text{original project cost}$$

Small Builder: Builder who constructs 1-25 dwelling units per year.

Medium Builder: Builder who constructs 26-100 dwelling units per year.

Large Builder: Builder who constructs over 100 dwelling units per year.

Single-Family House: A detached dwelling unit for a single family having a private entrance and a private yard.

Row House: An attached dwelling unit for a single family having a private entrance and a private yard.

Low-Rise Apartment: A multi-family unit having a shared entrance. Located in a building 4-8 stories in height.

Hi-Rise Apartment: A multi-family unit having a shared entrance. Located in a building having 9 or more stories.

Elevator Apartment: An apartment located in a medium rise or hi-rise building.

2.3.3 Purpose Of My Cost Model Cost Accounting System:

1) To Fulfill A Need For A Uniform Cost Accounting System: There exists numerous cost accounting systems, none of which is used extensively. In order to develop a good data bank from which to analyze costs of construction, a good uniform cost accounting system is needed.

2) To Enlarge My Data Bank:
Devise categories to make my cost studies compatible with other cost studies to gain a larger and continuing data bank of cost information.

3) For Use In Design:
Devising categories to provide cost guidelines for architects, engineers, and designers to follow in designing a building - to integrate cost constraints more explicitly

into the design process by providing an efficient, rational method of selecting building components.

4) For Use In Analyzing Building Systems and Efficiency In Production & Construction:
Establish categories to analyze building systems and spot inefficiencies in the production and construction process.

2.3.4 Levels of Cost Model Evaluation

I. SALES PRICE

Level 1 (General)

	% of Sales Price	Total $	$ / Gross Sq. Ft.
1.0.0 DEVELOPMENT	______	______	______
2.0.0 STRUCTURE COST	______	______	______
3.0.0 SELLING EXPENSES	______	______	______
4.0.0 GENERAL & ADMINISTRATIVE EXPENSES	______	______	______
5.0.0 FINANCING EXPENSES	______	______	______
6.0.0 OVERHEAD & PROFIT	______	______	______

I. SALES PRICE

Level 2 (Intermediate)

		% of Sales Price	Total $	$ / Gross Sq. Ft.
1.0.0	DEVELOPMENT COST	______	______	______
1.1.0	Land Acquisition	______	______	______
1.2.0	Site Improvement	______	______	______
1.3.0	Development Fees	______	______	______
2.0.0	STRUCTURE COST	______	______	______
2.1.0	Foundation & Excavation	______	______	______
2.2.0	Structure Cost (excluding foundation & excavation)	______	______	______
3.0.0	SELLING EXPENSES	______	______	______
4.0.0	GENERAL & ADMINISTRATIVE EXPENSES	______	______	______
5.0.0	FINANCING EXPENSES	______	______	______
6.0.0	OVERHEAD & PROFIT	______	______	______
6.1.0	Overhead	______	______	______
6.2.0	Profit	______	______	______

I. SALES PRICE

Level 3 (Detailed)

		% of Sales Price	Total $	$ / Gross Sq. Ft.
1.0.0	DEVELOPMENT COST	______	______	______
1.1.0	Land Acquisition	______	______	______
1.2.0	Site Improvement	______	______	______
1.3.0	Development Fees	______	______	______
2.0.0	STRUCTURE COST	______	______	______
2.1.0	Foundation & Excavation	______	______	______
2.1.1	materials	______	______	______
2.1.2	equipment	______	______	______
2.1.3	labor	______	______	______
2.2.0	Structure Cost (excluding foundation & excavation)	______	______	______
2.2.1	materials	______	______	______
2.2.2	equipment	______	______	______
2.2.3	labor	______	______	______
3.0.0	SELLING EXPENSES	______	______	______
4.0.0	GENERAL & ADMINISTRATIVE EXPENSES	______	______	______
5.0.0	FINANCING EXPENSES	______	______	______
6.0.0	OVERHEAD & PROFIT	______	______	______
6.1.0	Overhead	______	______	______
6.2.0	Profit	______	______	______

II. CONSTRUCTION COST

Level 1 (General)

	% of Construction Cost	Total $	$ / Gross Sq. Ft.
1.0.0 STRUCTURE COST	______	______	______
2.0.0 SELLING EXPENSES	______	______	______
3.0.0 GENERAL & ADMINISTRATIVE EXPENSES	______	______	______
4.0.0 FINANCING EXPENSES	______	______	______
5.0.0 OVERHEAD & PROFIT	______	______	______

II. CONSTRUCTION COST

Level 2 (Intermediate)

		% of Construction Cost	Total $	$ / Gross Sq. Ft.
1.0.0	STRUCTURE COST	______	______	______
1.1.0	Foundation & Excavation	______	______	______
1.2.0	Structure Cost (excluding foundation & excavation)	______	______	______
2.0.0	SELLING EXPENSES	______	______	______
3.0.0	GENERAL & ADMINISTRATIVE EXPENSES	______	______	______
4.0.0	FINANCING EXPENSES	______	______	______
5.0.0	OVERHEAD & PROFIT	______	______	______
5.1.0	Overhead	______	______	______
5.2.0	Profit	______	______	______

II. CONSTRUCTION COST

Level 3 (Detailed)

		% of Construction Cost	Total $	$ / Gross Sq. Ft.
1.0.0	STRUCTURE COST	______	______	______
1.1.0	Foundation & Excavation	______	______	______
1.1.1	materials	______	______	______
1.1.2	equipment	______	______	______
1.1.3	labor	______	______	______
1.2.0	Structure Cost (excluding foundation & excavation)	______	______	______
1.2.1	materials	______	______	______
1.2.2	equipment	______	______	______
1.2.3	labor	______	______	______
2.0.0	SELLING EXPENSES	______	______	______
3.0.0	GENERAL & ADMINISTRATIVE EXPENSES	______	______	______
4.0.0	FINANCING EXPENSES	______	______	______
5.0.0	OVERHEAD & PROFIT	______	______	______
5.1.0	Overhead	______	______	______
5.2.0	Profit	______	______	______

III. STRUCTURE COST

Level 1 (General)

	% of Structure Cost	Total $	$ / Gross Sq. Ft.
1.0.0 FOUNDATION	______	______	______
2.0.0 SHELL	______	______	______
3.0.0 FINISHES	______	______	______
4.0.0 MECHANICAL	______	______	______
5.0.0 APPLIANCES & FURNISHINGS	______	______	______
6.0.0 DELIVERY	______	______	______
7.0.0 LIFT & SECURE	______	______	______

III. STRUCTURE COST

Level 2 (Intermediate)

		% of Structure Cost	Total $	$ / Gross Sq. Ft.
1.0.0	FOUNDATION	______	______	______
2.0.0	SHELL	______	______	______
2.1.0	Structural System	______	______	______
2.2.0	Exterior Closure	______	______	______
2.3.0	Roofing System	______	______	______
2.4.0	Interior Vertical	______	______	______
3.0.0	FINISHES	______	______	______
3.1.0	Exterior Finishes	______	______	______
3.2.0	Interior Finishes	______	______	______
4.0.0	MECHANICAL	______	______	______
4.1.0	Vertical Circulation	______	______	______
4.2.0	Plumbing	______	______	______
4.3.0	HVAC	______	______	______
4.4.0	Electrical	______	______	______
4.5.0	Refuse Disposal System	______	______	______
5.0.0	APPLIANCES & FURNISHINGS	______	______	______
6.0.0	DELIVERY	______	______	______
7.0.0	LIFT & SECURE	______	______	______

III. STRUCTURE COST

Level 3 (Detailed)

		% of Structure Cost	Total $	$ / Gross Sq. Ft.
1.0.0	FOUNDATION	______	______	______
1.0.1	excavation & fill	______	______	______
1.0.2	septic system	______	______	______
1.0.3	footings or piling	______	______	______
1.0.4	foundation	______	______	______
2.0.0	SHELL	______	______	______
2.1.0	Structural System	______	______	______
2.1.1	columns	______	______	______
2.1.2	exterior walls	______	______	______
2.1.3	interior walls	______	______	______
2.1.4	stairs	______	______	______
2.1.5	ceiling	______	______	______
2.1.6	roof	______	______	______
2.1.7	floors	______	______	______
2.1.8	other	______	______	______
2.2.0	Exterior Closure	______	______	______
2.2.1	exterior walls	______	______	______
2.2.2	exterior door	______	______	______
2.2.3	exterior windows	______	______	______
2.2.4	other	______	______	______
2.3.0	Roofing System	______	______	______

III. STRUCTURE COST

Level 3 (Detailed) continued

		% of Structure Cost	Total $	$ / Gross Sq. Ft.
2.4.0	Interior Vertical			
2.4.1	partitions			
2.4.2	interior doors			
2.4.3	interior windows			
2.4.4	other			
3.0.0	FINISHES			
3.1.0	Exterior Finishes			
3.1.1	exterior painting			
3.1.2	exterior trim & ornamentation			
3.2.0	Interior Finishes			
3.2.1	wall finish			
3.2.2	dry wall finish			
3.2.3	plaster wall finish			
3.2.4	ceramic wall tile			
3.2.5	other wall tile			
3.2.6	other wall finish			
3.2.7	ceiling finish			
3.2.8	plaster ceiling finish			
3.2.9	suspended ceiling			
3.2.10	other ceiling finish			
3.2.11	finish flooring			

III. STRUCTURE COST

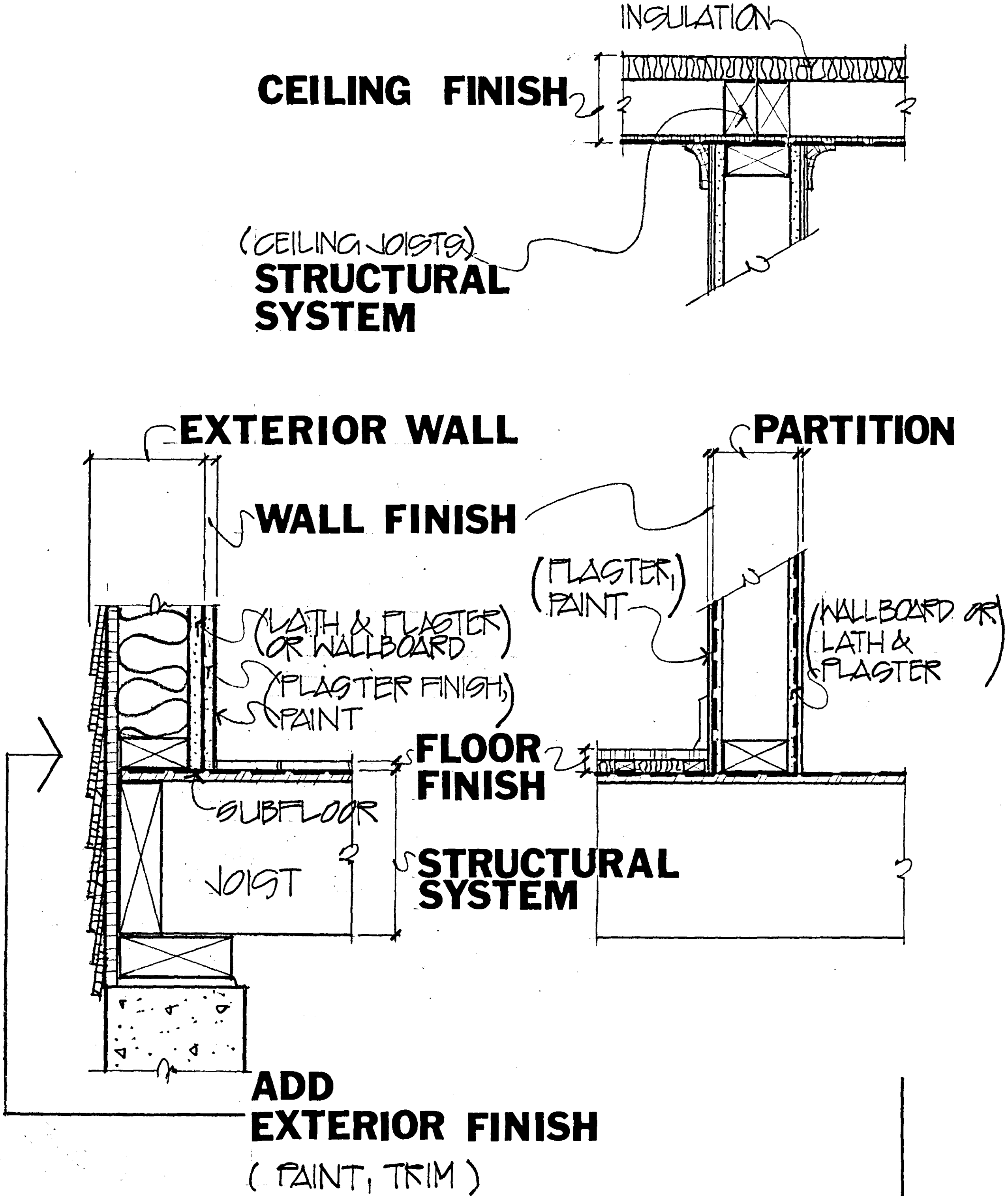
Level 3 (Detailed) continued

		% of Structure Cost	Total $	$ / Gross Sq. Ft.
3.2.12	wood flooring	______	______	______
3.2.13	ceramic floor tile	______	______	______
3.2.14	other floor tile	______	______	______
3.2.15	carpeting (only if no other floor finish)	______	______	______
3.2.16	other floor finish	______	______	______
3.2.17	interior painting	______	______	______
3.2.18	other interior trim & touch up	______	______	______
4.0.0	MECHANICAL	______	______	______
4.1.0	Vertical Circulation	______	______	______
4.1.1	stairs	______	______	______
4.1.2	elevators	______	______	______
4.2.0	Plumbing	______	______	______
4.2.1	distribution system	______	______	______
4.2.2	fixtures & hardware	______	______	______
4.3.0	HVAC	______	______	______
4.3.1	heating equipment	______	______	______
4.3.2	cooling equipment	______	______	______
4.3.3	fans, ventilating equipment	______	______	______
4.3.4	distribution system	______	______	______

III. STRUCTURE COST

Level 3 (Detailed) Continued

		% of Structure Cost	Total $	$ / Gross Sq. Ft.
4.3.5	hardware & fixtures	______	______	______
4.4.0	Electrical	______	______	______
4.4.1	distribution system	______	______	______
4.4.2	fixtures & hardware	______	______	______
4.5.0	Refuse Disposal System	______	______	______
4.5.1	bins & equipment	______	______	______
4.5.2	distribution system	______	______	______
5.0.0	APPLIANCES & FURNISHINGS	______	______	______
5.0.1	kitchen appliances	______	______	______
5.0.2	kitchen cabinets	______	______	______
5.0.3	utility equipment	______	______	______
5.0.4	bathroom furnishings	______	______	______
5.0.5	other cabinets & enclosures	______	______	______
6.0.0	DELIVERY	______	______	______
7.0.0	LIFT & SECURE	______	______	______



Definitions of Selected Detailed Structure Cost Categories

I. Sales Price Item Classification

1.0.0 DEVELOPMENT COST

1.1.0 Land Acquisition

a) broker's fee

b) lawyer's fee

c) land cost

1.2.0 Site Improvement

a) demolition of existing structure

b) clear & grade

c) drainage lines & sump

d) water hookup

e) utility hookup

f) instal sewage disposal system

g) instal water system

h) roads

i) curbs

j) sidewalks

k) paving driveways

l) landscaping

m) cleanup

n) miscellaneous roadwork

1.3.0 Development Fees

a) mapping

b) survey & layout

c) preliminary design

d) architectural design

e) engineering design

f) planning fees

g) building permit

h) miscellaneous fees & expenses

2.0.0 <u>STRUCTURE COST</u>

2.1.0 <u>Foundation & Excavation</u>

2.1.1 a) <u>materials</u>

2.1.2 b) <u>equipment</u>

2.1.3 c) <u>labor</u>

2.2.0 <u>Structure Cost</u> (exclude foundation & excavation)

2.2.1 a) <u>materials</u>

2.2.2 b) <u>equipment</u>

2.2.3 c) <u>labor</u>

3.0.0 <u>SELLING EXPENSES</u>

a) marketing

b) sales tax

c) prepare promotional material

4.0.0 <u>GENERAL & ADMINISTRATIVE EXPENSES</u>

a) schedule materials & labor

5.0.0 <u>FINANCING EXPENSES</u>

a) interim financing

b) mortgage points

6.0.0 <u>OVERHEAD & PROFIT</u>

6.1.0 <u>Overhead</u>

6.2.0 <u>Profit</u>

a) contractor's fees

III. Structure Cost Item Classification

1.0.0 FOUNDATION

1.0.1 excavation & fill

1.0.2 septic system

1.0.3 footing or piling

1.0.4 foundation

2.0.0 SHELL

2.1.0 Structural System (all items included are part of the load-bearing system)

- a) framing (structural frame or superstructure)
- b) rough hardware
- c) carpentry (frame)

2.1.1 columns

2.1.2 exterior walls (for stud walls include only framing, for load-bearing walls include interior wallboard or lath & plaster)

2.1.3 interior walls (load-bearing only)

2.1.4 stairs (load-bearing only, other non-load bearing stairs classified under Vertical Circulation 4.1.0)

2.1.5 ceiling (only structural portion)

2.1.6 roof (only structural portion)

2.1.7 floors (includes subfloor but not floor finish base)

- a) slab-on-grade
- b) other

2.1.8 others

- a) elevator shafts

2.2.0 Exterior Closure (all non-load bearing exterior closure elements, electrical, HVAC, plumbing, and other building equipment is excluded)

2.2.1 exterior walls

a) exterior siding

b) building paper

c) sheathing

d) insulation

e) moisture barrier

f) lath & plaster

g) wallboard

h) non-load bearing masonry

i) brick-facing

2.2.2 exterior doors

a) finish hardware

b) exterior entry door

c) door interviewer

2.2.3 exterior windows

a) metal windows & trim

b) glazing & caulking

c) double hung windows

d) fixed glazing

2.2.4 other

2.3.0 Roofing System

a) insulation

b) vapor barrier

c) roofing materials

2.4.0 <u>Interior Vertical</u> (<u>include</u>: only non-load bearing elements)

2.4.1 <u>partitions</u> (<u>exclude</u>: electrical, plumbing, HVAC, & other building equipment
<u>include</u>: wallboard or lath & plaster but not finish plastering or painting)

a) metal or wood studs and dry wall or lath & plaster

2.4.2 <u>interior doors</u>

a) hall doors

b) wood doors

c) folding doors

d) finish hardware

2.4.3 <u>interior windows</u>

2.4.4 <u>other</u>

3.0.0 <u>FINISHES</u>

3.1.0 <u>Exterior Finishes</u>

3.1.1 <u>exterior painting</u>

3.1.2 <u>exterior trim & ornamentation</u>

a) wood shutters

b) ornamental iron, miscellaneous iron

3.2.0 <u>Interior Finishes</u>

3.2.1 <u>wall finish</u> (excludes dry wall or plaster & lath includes finishing only)

3.2.2 <u>dry wall finish</u> (include <u>only finishing costs</u> except cost of dry wall and interior painting)

3.2.3 <u>plaster wall finish</u>

a) spackle & tape

3.2.4 <u>ceramic wall tile</u>

3.2.5 <u>other wall tile</u>

3.2.6 <u>other wall finish</u>

a) baseboard or base moulding

b) ceiling molding

3.2.7 <u>ceiling finish</u> (includes ceiling insulation)

3.2.8 <u>plaster ceiling finish</u>

3.2.9 <u>suspended ceiling</u>

3.2.10 <u>other ceiling finish</u>

a) insulation

3.2.11 <u>finish flooring</u> (includes insulation, finish base but not subfloor)

3.2.12 <u>wood flooring</u>

3.2.13 <u>ceramic floor tile</u>

3.2.14 <u>other floor tile</u>

a) vinyl-asbestos tile

b) linoleum tile

c) resilient flooring

d) terrazzo

3.2.15 <u>carpeting</u> (include only if there exists no other floor finish)

3.2.16 <u>other floor finish</u>

a) insulation

b) finish floor base

c) underlayment

3.2.17 <u>interior painting</u>

3.2.18 <u>other interior trim & touchup</u>

4.0.0 MECHANICAL

4.1.0 Vertical Circulation

4.1.1 stairs (non-load bearing only)

a) balcony rails

b) stair rails

4.1.2 elevators

4.2.0 Plumbing

4.2.1 distribution system (includes insulating elements)

a) rough plumbing

b) insulation for plumbing chase

c) sprinkler system

d) roof tank

e) fire line

f) fire stand pipe

g) testing

4.2.2 fixtures & hardware

a) finish plumbing

b) house pumps

c) fire rack & hose

d) sump pump

e) faucets, handles

4.3.0 HVAC

4.3.1 heating equipment

a) hot-water heater

b) boiler

c) furnaces

d) storage tanks

e) blower systems

f) tanks, burner

4.3.2 cooling equipment

a) A/C equipment

4.3.3 fans, ventilating equipment

a) fans

4.3.4 distribution system

a) rough heating

b) sheet metal

c) flue insulation

d) fire brick flue

e) tests

4.3.5 hardware & fixtures

a) grilles

b) registers

c) convectors & connection

d) A/C sleeves

e) temperature controls

f) louvers

4.4.0 Electrical

4.4.1 distribution system

a) rough electric

4.4.2 fixtures & hardware

a) finish electric

4.5.0 Refuge Disposal System

4.5.1 bins & equipment

a) bins

b) incinerator

4.5.2 distribution system

a) hollow metal work

5.0.0 APPLIANCES & FURNISHINGS

5.0.1 kitchen appliances

a) refrigerator

b) stove

c) kitchen sink

d) ventilating equipment for stove

5.0.2 kitchen cabinets & enclosures

a) kitchen cabinets

b) countertops (built-in)

5.0.3 utility equipment

a) utility sink

b) clothes dryer

c) washing machine

5.0.4 bathroom furnishings

a) bathtub

b) shower equipment

c) lavatory

d) water closet

e) medicine cabinet

f) vanities

g) toilet accessories (robe hooks, tumbler & brush, grab bar, towel bar, soap dish)

h) door thresholds

5.0.5 <u>other cabinets & enclosures</u>

a) other cabinets (except bathroom & kitchen cabinets)

b) closets (clothes poles, shelves, dividers)

c) built-in book-shelves

6.0.0 <u>DELIVERY</u>

7.0.0 <u>LIFT & SECURE</u>

2.4 COST INFORMATION TRANSLATION

To be of use to the designer or producer, all the unit cost items of a housing project must be translated to workable aggregate quantities. The cost accounting system thus employed becomes of critical importance in determining the final form of these costs.

Many cost breakdowns and cost accounting systems have been investigated and analyzed. (See Appendix 1.: Cost Accounting Systems). The cost accounting systems devised in this study follow a "building component orientation" rather than the traditional C.S.I. (Construction Specifications Institute) or NAHB "materials-oriented" breakdown. The materials-oriented cost accounting system is useless to the designer or producer. However, with a building component cost accounting system, the user is able to readily visualize and easily manipulate particular cost quantities, thus implimenting costs directly into the design or production process. The cost accounting system for data storage was presented in section 2.3, in the Cost Model. The reader is referred to Appendix 3.: Questionnaires for the cost accounting system devised for cost collection in a questionnaire survey being conducted by the author. In addition to these two cost accounting systems, three other types have been developed:

1) Designer's Cost Accounting System: Designed for the

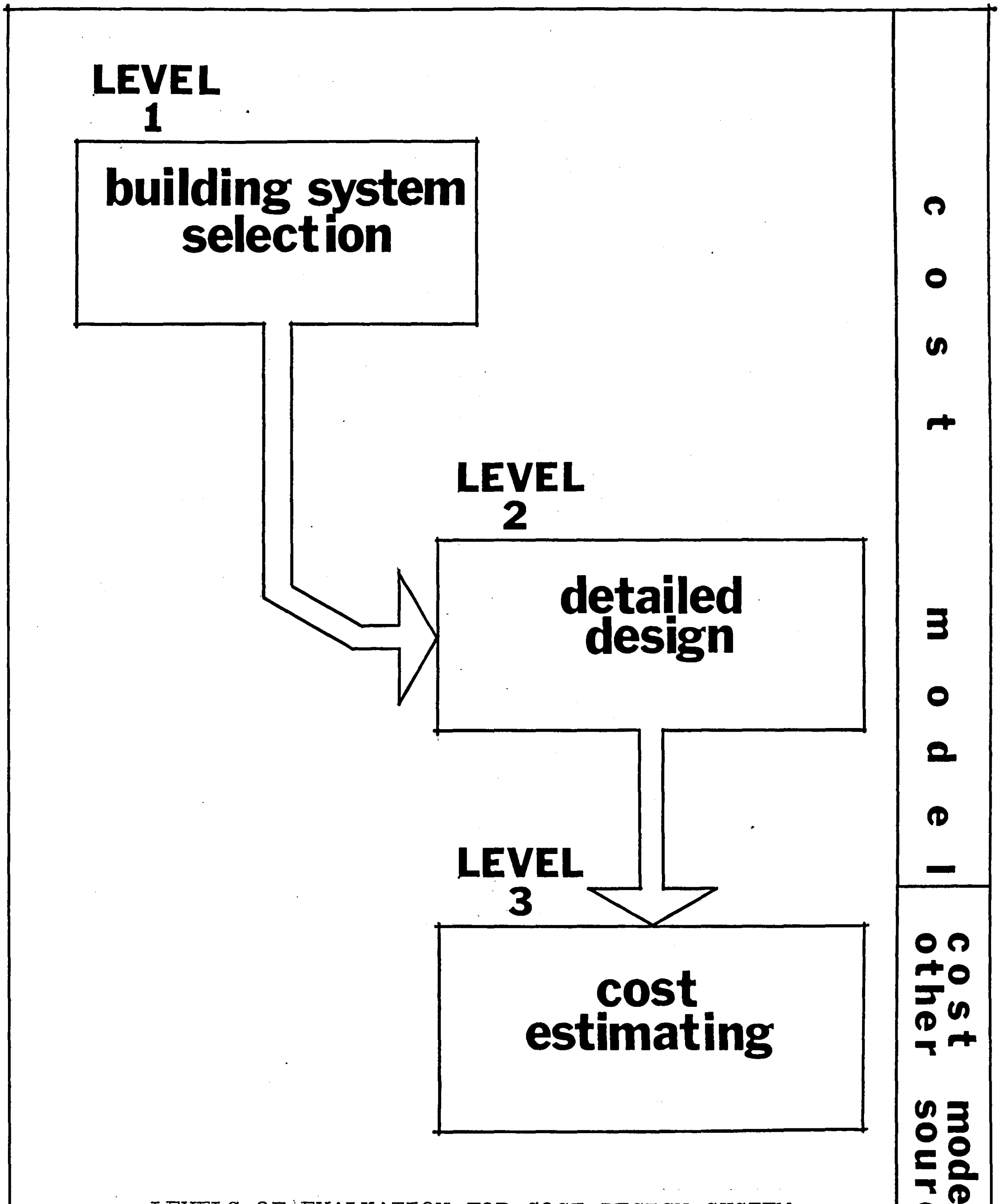
direct use in the design phase of the building. Cost components relate to the building parts that are part of the designer's process and needs when designing a building.

2) Housing Producer's Cost Accounting System: Designed to enable the housing producer to easily visualize his costs in terms of the construction or production operation of his product. Will enable the builder to have a better cost control.

3) Building Function Cost Accounting System: Designed primarily for the cost estimator. Contains a very detailed hierarchial classification cost breakdown with quantities related strictly to their functional relationships in a building.

The Cost Model is used to provide the essential minimum information for the cost estimating aspect of the study. It is designed primarily for building system comparison and evaluation. For information other than the minimum given in the Cost Model, the user must expand the cost data with data from other sources. However, it should be stressed that the Cost Model and the Cost Design System provides the framework in which the designer, producer, or cost estimator can aggregate costs to be of maximum use to him.

The following are the three developed cost accounting systems and their translated quantities from the Cost Model and cost data from other sources:



LEVELS OF EVALUATION FOR COST DESIGN SYSTEM

1) DESIGNER'S COST ACCOUNTING SYSTEM

SHELL	Structural
	Non-Structural
INTERIOR SPACE-MAKING ELEMENTS	Interior Walls (cost of whole rooms?)
	Bookshelves
	Closets
	Interior Doors
BUILDING EQUIPMENT	Vertical Circulation
	Plumbing System
	HVAC
	Electrical System
	Kitchen Equipment
	Bathroom Equipment
	Refuse Disposal System
	Other Household Equipment
	Other Equipment
FENESTRATION & ORNAMENTATION	Interior Doors
	Windows
	Exterior Trim & Ornamentation
FINISHES	Interior
	Exterior
FURNISHINGS	Bathroom Furnishings
	Kitchen Furnishings
	Furniture
	Carpets & Mats
	Drapery & Curtains
	Other Cabinetwork
	Other Furnishings
TRANSPORTATION	Materials Transporation System
	Component Transportation System
	Box Module Transportation System

This cost breakdown is for direct use in the design phase of the building. Components are meant to relate in terms of the parts that the designer thinks when he is designing a building. From this breakdown the designer can easily and very quickly integrate costs with other aspects of design.

1) Category Translation From Cost Model To Designer's Cost Accounting System

from cost model	designer's cost system	costs from other sources
	EXTERIOR SHELL	
Structural System Exterior Closure Roofing System	a. Structural b. Non-Structural Enclosure	
	INTERIOR SPACE-MAKING ELEMENTS	
interior partitions interior doors interior windows	a. Partitions b. Whole Rooms c. Bathroom Core Units d. Kitchen Core Units e. Closets f. Bookcases	closets bookcases wet units (bathrooms, kitchens) whole rooms other enclosure support units
	BUILDING EQUIPMENT	
Vertical Circulation Plumbing HVAC Electrical Refuse Disposal System	a. Vertical Circulation b. Plumbing c. HVAC d. Electrical e. Refuse Disposal System f. Garbage Disposal System g. Communications System h. Vaccuum System	Communications Systems Central Vaccuum System Garbage Disposal

exterior doors

exterior windows

exterior trim & ornamentation

FENESTRATION & ORNAMENTATION

a. Ornamentation & Trim
b. Windows
c. Exterior Doors

other ornamentation

interior wall finish

interior ceiling finish

finish flooring

interior painting

other int. trim & touchup

exterior painting

FINISHES

a. Interior
b. Exterior

kitchen appliance

kitchen cabinets & counters

utility equipment

bathroom furnishings

FURNISHINGS

a. kitchen appliances
b. kitchen cabinets
c. utility equipment
d. bathroom furnishing
e. carpeting
f. furniture
g. carpets & mats
h. drapery & curtains
i. other cabinetwork
j. other furnishing

furniture

carpets & mats

drapery & curtains

other cabinet work

other furnishings

Delivery → DELIVERY

Lift & Secure → LIFT & SECURE

2) HOUSING PRODUCER'S COST ACCOUNTING SYSTEM

STRUCTURAL	Floor
	Wall
	Ceiling
	Roof
EXTERIOR (excluding Mechanical)	Exterior Wall (including insidewall)
	Exterior Doors & Windows
	Roofing
	Exterior Painting
	Exterior Trim & Ornamentation
INTERIOR (excluding Mechanical)	Partitions
	Interior Doors
	Wall Finish
	Ceiling Finish
	Floor Finish
FURNISHINGS (excluding Mechanical)	Appliances, Furniture, Cabinetwork
	Finished Kitchen
	Finished Bathroom(s)
MECHANICAL	Plumbing
	Electrical
	Heating, Ventilation, Air Conditioning
BUILDING EQUIPMENT (average cost/ dwelling unit)	Elevators
	Stairs & Ramps
	Building Equipment Systems
TRANSPORTATION	Transportation
	Erection (On-Site) - only for box mod.

2) Category Translation From Cost Model To Housing Producer's Cost Accounting System

from cost model	producer's cost system	costs from other sources
	STRUCTURAL	
Structural System	a. Floor b. Wall c. Ceiling d. Roof	
	EXTERIOR	
Exterior Closure Roofing System Exterior Finishes	a. Exterior Wall b. Ext. Doors & Windows c. Roofing d. Exterior Painting e. Ext. Trim & Ornamentation	
	INTERIOR	
Interior Vertical Elements Interior Finishes	a. Partitions b. Int. Doors c. Wall Finish d. Ceiling Finish e. finish flooring	
	FURNISHINGS	
Appliances & Furnishings	a. Appliances b. Furniture c. Cabinetwork d. Finished Kitchen e. Finished Bathroom(s)	Finished Kitchen Finished Bathroom

Plumbing Electrical HVAC	MECHANICAL a. Plumbing b. Electrical c. HVAC
load-bearing staris non-load bearing stairs elevators Refuse Disposal System kitchen appliances kitchen cabinets utility equipment bathroom furnishings	BUILDING EQUIPMENT a. Elevators b. Stairs c. Ramps d. Building Equipment Systems
Delivery	DELIVERY

(3) BUILDING FUNCTION COST ACCOUNTING SYSTEM

STRUCTURAL SYSTEM	Vertical Elements		columns trusses exterior bearing walls interior bearing walls cross-bracing
	Horizontal Elements		spandrel & interior beams floor decks roof decks
NON-STRUCTURAL ENCLOSURE ELEMENTS	Exterior		exterior non-structural wall exterior doors & windows other exterior enclosure elements
	Interior		fixed partitions movable partitions interior door units other interior enclosure elements
FINISHES	Exterior		exterior painting exterior trim & ornamentation
	Interior		wall finishes floor finishes ceiling suspension systems ceiling finishing systems other interior finish
	Special		roofing finishing system stair finish other
BUILDING EQUIPMENT SYSTEMS	Vertical Circulation	Fixed Elements	stairs ramps railings ladders
		Movable Elements	elevators escalators dumbwaiters conveyors other
	Plumbing System	Supply Systems	hot water supply cold water supply water storage equipment fire protection other special subsystems
		Drainage Systems	rainwater drainage system waste, soil, ventilating system
	HVAC	Supply & Outlet Equipment	heating equipment with insulation cooling equipment temperature control system
		Distribution System	piping ducts registers, grilles, & diffusers

BUILDING EQUIPMENT SYSTEMS	Electrical System	Power Supply Equipment	prinary equipment main distribution & panels substations power and lighting distribution special systems emergency power systems communications systems
		Lighting Systems	fittings lamps
	Kitchen Equipment		dishwasher disposal units kitchen cabinets ranges & ovens sinks with fixtures & hardware
	Bathroom Equipment		laundry equipment lavatory and medicine cabinets
	Other Household Equipment		central vaccuum system
	Refuse Disposal System		chutes bin furnace
	Other Equipment		
FURNISHINGS	Bathroom Furnishings		bathtub-shower w/ fixtures lavatory w/ fixtures toilet w/ fixtures
	Furniture		
	Carpets & Mats		
	Drapery & Curtains		
	Other Cabinetwork		
	Other Furnishings		
TRANSPORTATION	Materials System		tranporation handling
	Component System		transportation handling
	Box Module System		tranportation erection

3) Category Translation From Cost Model To Building Function Cost Accounting System

from cost model	**building function cost system**	**costs from other sources**
	STRUCTURAL SYSTEM	
Structural System	a. Vertical Elements b. Horizontal Elements	
	NON-STRUCTURAL ENCLOSURE ELEMENTS	
Exterior Closure Interior Vertical Elements	a. Exterior b. Interior	
	FINISHES	
Exterior Finish Interior Finish Roofing System	a. Exterior b. Interior c. Special	

BUILDING SYSTEMS

Vertical Circulation
Plumbing
HVAC
Electrical
kitchen cabinets
kitchen appliances
utility equipment
Refuse Disposal System

a. Vertical Circulation
b. Plumbing System
c. HVAC
d. Electrical System
e. Kitchen Equipment
f. Bathroom Equipment
g. Other Household Equipment
h. Refuse Disposal System
i. Other Equipment

Communication System
Central Vaccuum System
dishwasher
Garbage Disposal
Other

FURNISHINGS

plumbing hardware
bathroom furnishings
other cabinet-work & enclosures

a. Bathroom Furnishing
b. Furniture
c. Carpets & Mats
d. Drapery & Curtains
e. Other Cabinetwork
f. Other Furnishings

furniture
carpets & mats
drapery & curtains
other furnish-ings

Delivery

TRANSPORTATION

Lift & Secure

LIFT & SECURE

2.5 SYSTEM APPLICATION

The Cost Design System is applicable to many needs. Four category types are listed with associated questions to show it's wide flexibility.

1) Building System Evaluation: gives the user pertinent cost information on certain preliminary design considerations - materials choice, structural type, generic type, construction method.

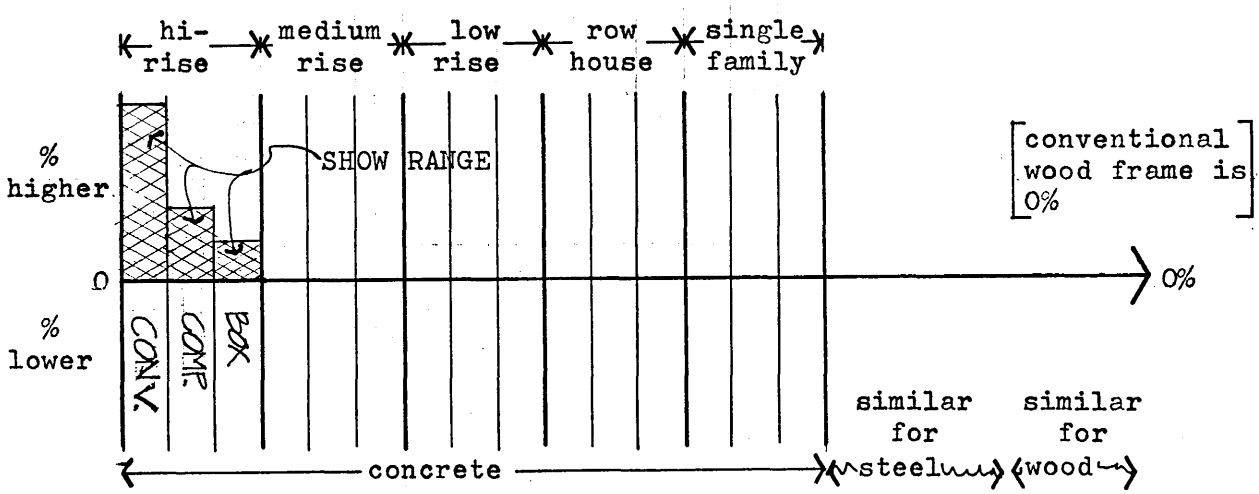
2) Detailed Design: allows the user to begin a detailed design evaluation of the individual building components - floors, finishes, plumbing distribution, plumbing hardware, etc.

3) Production Cost Control: allows the manufacturer and builder to ask critical questions about his own region, or with the whole country or regions of the country. He may assess other materials, structural systems, or generic types for future production.

4) Cost Estimating: Determines what cost accounting categories are needed for cost feasibility.

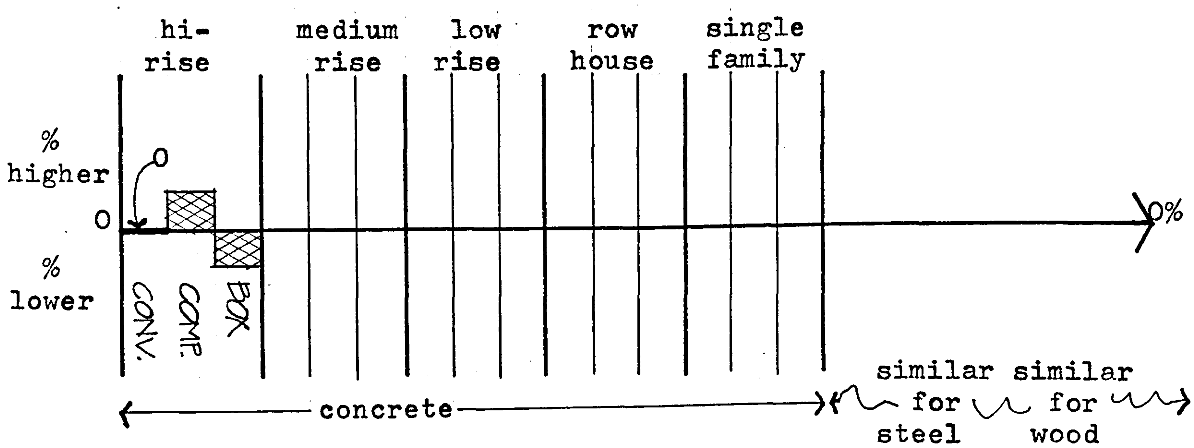
1) <u>BUILDING SYSTEM EVALUATION</u>

a) How do the different types of buildings compare to conventional wood frame construction costs? in percentage savings?(compare similar material types to same conventional type)



To be done by aggregate regions (1-9)

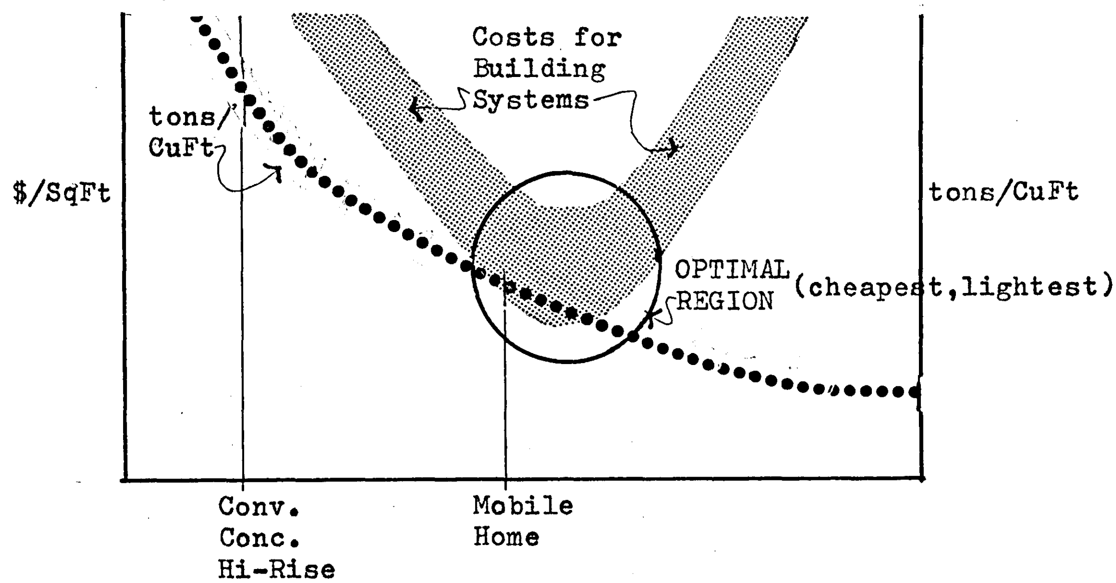
STRUCTURE COST COMPARISON OF VARIOUS BUILDING SYSTEMS TO CONVENTIONAL WOOD CONSTRUCTION



STRUCTURE COST COMPARISON OF SIMILAR MATERIAL TYPES

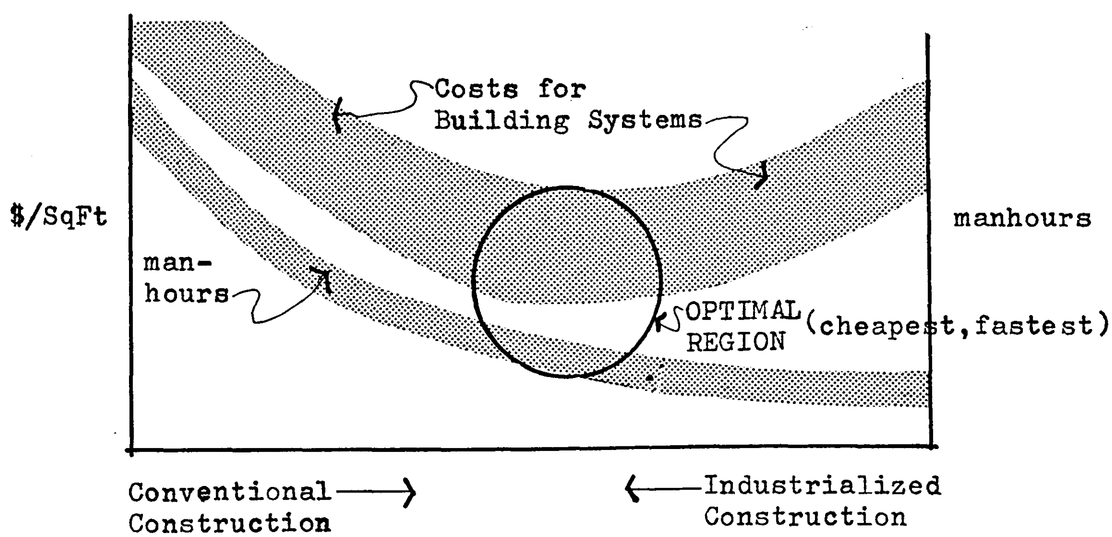
(BASE = SIMILAR CONVENTIONAL TYPE)

b) What is the most efficient and cheapest structural system-materials-generic type?



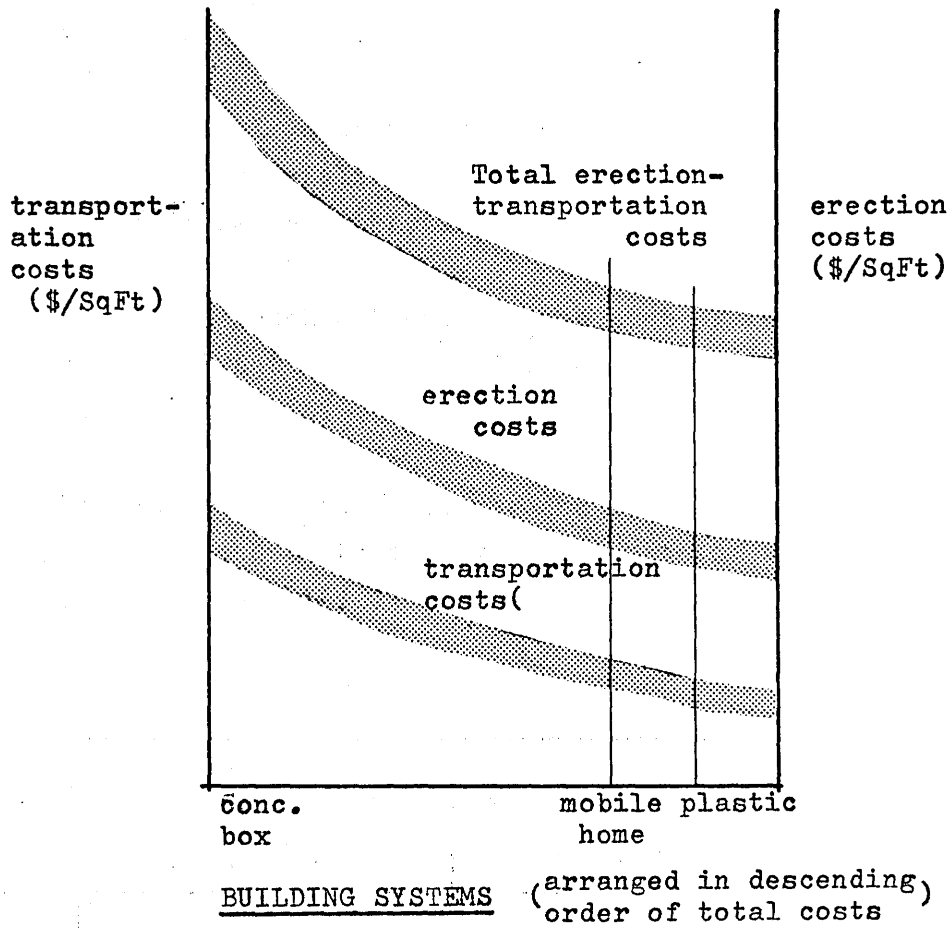
BUILDING SYSTEMS (arranged in descending order of structural efficiency)

c) What is the relationship between manhours and cost for the various building systems?



BUILDING SYSTEMS (arranged indescending order of structural efficiency)

d) What is the transportation-erection cost relationship of the various building types? (assume 100 miles delivery distance)



2) DETAILED DESIGN

a) What are the critical building subsystem components in the structure cost for design concentration?

b) How critical is transportation and erection for each of the industrialized building systems compared to conventional construction?

c) What is a rough estimate of the cost of my designed unit? In what areas should I concentrate to effectively cut costs?

d) What is the detailed comparison of the various industrialized costs for my chosen housing type and design materials?

ITEM	Conventional $	Component $	Box $
Detailed List			

3) PRODUCTION COST CONTROL

Builders (On-Site)

a) In what areas can I industrialize my building process to obtain lower building costs?

b) How many more homes can I build if I do industriaoize my building process? What are the costs?

c) How do my costs compare to the costs of other similar units in my region? Other regions? the U.S. avaerage?

d) What is the unit breakdown of structure costs of other producers of my similar unit? How do my costs compare? with other regions? the U.S. average?

Manufacturers

a) How do my production costs compare with the production costs in my region?

b) How do my production costs compare with the production costs of other types of industrialized units? traditional units? Is my process the optimum process?

c) Where are the critical areas (high cost areas) in my production process? for other producers? What is the whole percentage breakdown of the whole production process?

d) Is there an area (generic type, materials, region, etc.) to expand to where I can easily adapt my production methods and obtain lower production costs? how much?

4) Detailed Cost Estimating

a) What cost estimating categories are needed (designer, builder, manufacturer, building function, etc)?

b) What are the costs for a designer unit? (at different design stages)

c) Compare detailed labor-material costs for industrialization versus conventional.

3.0 A CLASSIFICATION SYSTEM FOR RESIDENTIAL BUILDING SYSTEMS

3.1 Non-Materials Orientation

Because of the high degree of specialization required for tooling, equipment, and labor skill, the traditional producer of housing found himself oriented strictly along the lines of the four basic building materials - wood, steel, concrete and brick. The method of classifying a housing producer consequently evolved along the lines of the major building materials. New developments in research and the need for adaptibility to the factory-assembly process is expected to revolutionize this materials orientation. Materials are no longer expected to be thought of as raw formless products but rather as functional components of a building. A large portion of the traditional building materials are expected to be replaced by synthetic materials. Therefore, any new classification system must account for this expected change. Less emphasis must be placed on the materials and more emphasis should be placed on component functions and building construction.

3.2 Construction Methods

The recent upsurge in the need for housing coupled with the low availability and the high cost of skilled labor has caused builders of housing to rethink the construction process.

Consequently, much effort has been invested to try to industrialize this process. A change in construction methods is taking place - from only a few traditional on-site construction methods to literally hundreds of new and exotic methods on and off-site.

3.3 Classification System

To order the housing industry, the following classification system will be employed:

1) The first divisional hierarchy is type of construction method employed.

Building construction can be either traditional on-site construction or industrialized construction.

Traditional Construction: Construction involving the delivery of raw materials to the site where each piece is cut, shaped, and assembled into a house. A few finished components may be employed, but the majority of the work involves a piece-by-piece assembly.

Industrialized Construction: Construction involving the use of prefabricated elements, components, or modules for building a house. Use of large scale mechanization off-site, standardization of product, improved management and production control, and large quantity purchase and production.

2) The second divisional hierarchy is the generic type used for on-site erection.

Traditional methods may use either stick-built construction or rationalized conventional. Industrialized construction methods may use a componentized construction method or a box construction method.

<u>Stick-Built Construction</u>: The traditional manner of construction where raw materials are delivered to the site and cut, shaped, and assembled piece-by-piece into a house.

<u>Rationalized Conventional Construction</u>: An extension of the traditional on-site technique. Involves large scale on-site construction where repetitive processes and labor specialization are emphasized. Characterized by a well planned operation with minimum delays resulting in a high rate of continuous production and labor production. Methods employed may be: precut wood pieces, no preassembly of components, large tract development of identical homes with parts shipped to site in coordination with the progress of the building

and function-organized work groups going from house to house doing repeated tasks.

<u>Componentized Construction</u>: Housing built from a variety of individual components which may be partially fabricated by the builder or purchased from a manufacturer.

<u>Box Construction</u>: Housing built from a three dimensional space-enclosing unit fabricated at an off-site location. Boxes may be a component, an assembly, or a complete subsystem.

3) The system's third divisional hierarchy will be structural type.

Structural types are broken into three groups: frame, bearing wall, and monolithic shell. Definitions shall be based on the physical structural makeup of the product. In fuzzy areas like stressed skin and stud wall construction the classification type shall vary, depending on the structure's makeup. Thus stud wall construction shall be classified under frame since its structural makeup is closest to a frame. The stressed skin will depend on the type. A stud wall with sheathing acting as the stressed skin element will be classified as frame. On the other hand, a stressed skin with urethane foam in the core will be considered a bearing wall since its physical makeup approximates a bearing wall rather than a frame.

Frame: Structural system which the structural skeleton is enclosed by a non-load bearing material. Only the frame is load bearing, any of the sides, top, or bottom can be omitted without affecting the structure.

Bearing Wall: Structural system in which the structural load is carried by the whole wall. Only minimum openings are allowed since the whole wall is required for the load carrying function.

Monolithic Shell: System in which structural continuity is provided between horizontal and vertical surfaces of the shell. It will act as a box beam if cantilevered. As with the bearing wall system, only minimum openings can be allowed.

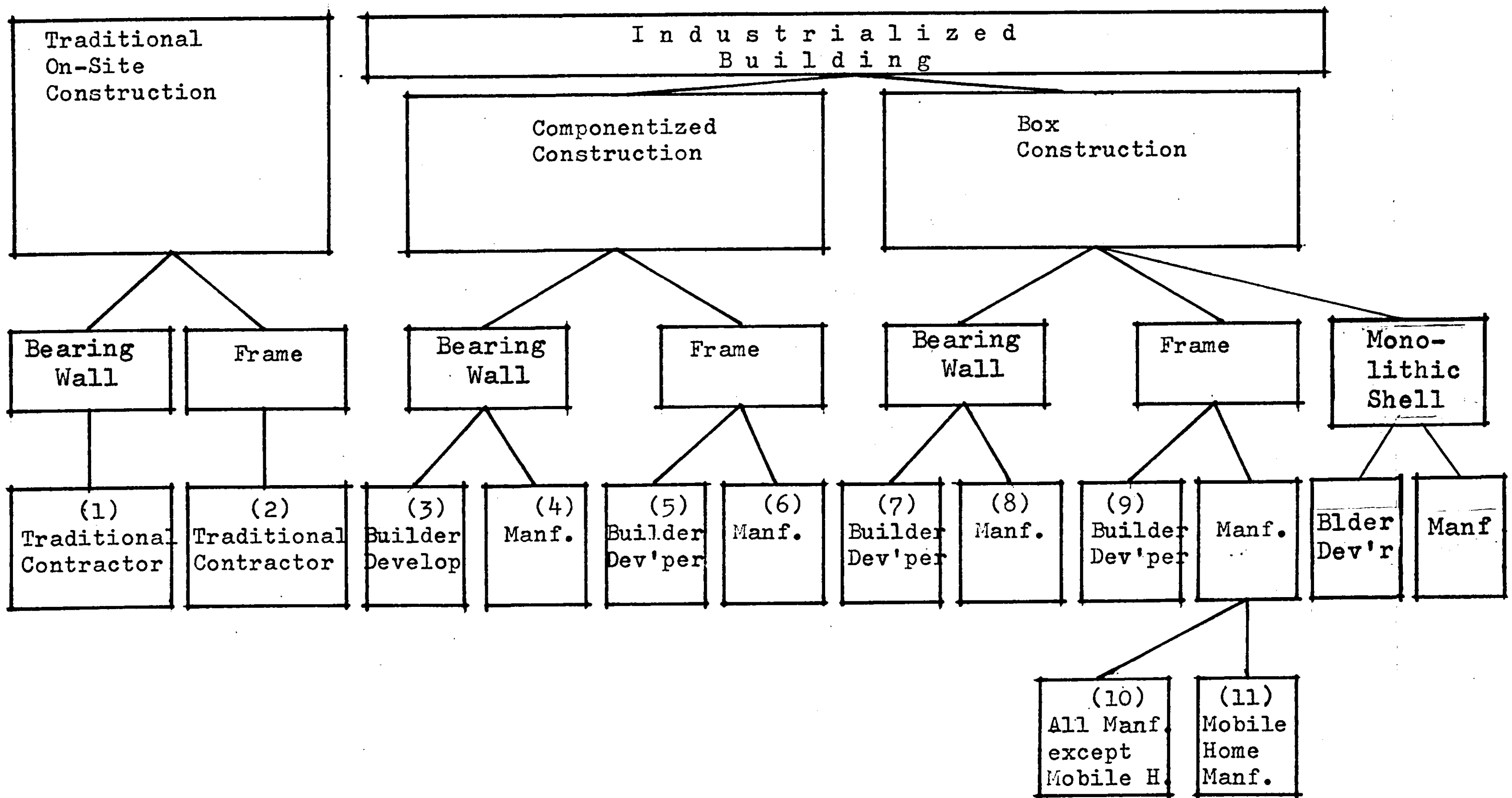
4) The system's fourth division hierarchy will be the type of housing producer.

The housing producer may be either a builder/developer or a manufacturer, or both.

Manufacturer: The producer of the factory-fabricated generic types (building components or boxes).

Builder/Developer: The producer of traditional on-site housing or the on-site assembler and finisher of factory produced components or boxes.

RESIDENTIAL BUILDING SYSTEMS



Construction Type	TRADITIONAL ON-SITE CONSTRUCTION	
Structural Classification	BEARING WALL	FRAME
Structural Type	Poured-in-place Bearing Wall	Wood Frame Steel Frame
Manufacturers		
Builder-Developer	Builders of Conventional Structures	
Stick Builders	Traditional General Contractor of Concrete (poured-in-place) Brick Concrete Block	Traditional General Contractor of Steel, Wood
Rationalized Construction		Merchant Builder Precut-Wood Builder

Type of Contruction	INDUSTRIALIZED BUILDING	
Generic Type	COMPONENTIZED CONSTRUCTION	
Structural Classification	BEARING WALL	FRAME
Structural Type	Bearing Wall Panel System	Space-Frame Post-Beam Post-Truss
Manufacturers	Manufacturers of Components who do their own erecting.	
Builder-Developers	Builders of Components (non-manufacturers)	
Examples	Concrete Panel Manufacturers (Techcrete, San Vel, Balency, Bison, Cebus) Concrete Panel Builder Wood Panel System Builder	Concrete Frame Manufacturer Concrete Frame Builder Steel Frame Builder

Type of Construction	INDUSTRIALIZED BUILDING		
Generic Type	BOX CONSTRUCTION		
Structural Classification	BEARING WALL	FRAME	MONOLITHIC SHELL
Structural Type	Bearing Wall Core Stressed Skin	Stud Frame Stud Stressed Skin Post-Beam Post-Truss	Monolithic Shell
Manufacturers	Manufacturers of Factory-Fabricated Boxes		
Builder-Developers	Builders of Factory-Fabricated Boxes		
Examples	Concrete Hi-Rise Big Box Manufacturers (Dependent on structural continuity between vertical & horizontal surfaces)	Mobile-Home Manufacturers Modular-Home Manufacturers Steel Hi-Rise Manufacturers	Experimental Glass-Spun Tubes

4.0 REGIONAL CLASSIFICATION SYSTEM

Because of the large variances in costs from region to region, the establishment of a regional classification system is necessary. A nine region breakdown will be employed. This breakdown is similar to the system used by the Bureau of Census and the National Association of Home Builders.

NORTHEAST

1. New England
   - Connecticut
   - Maine
   - Massachusetts
   - New Hampshire
   - Rhode Island
   - Vermont

2. Middle Atlantic
   - New Jersey
   - New York
   - Pennsylvania

NORTH CENTRAL

2. East North Central
   - Illinois
   - Indiana
   - Michigan
   - Ohio
   - Wisconsin

4. West North Central
   - Iowa
   - Kansas
   - Minnesota
   - Missouri
   - Nebraska
   - North Dakota
   - South Dakota

SOUTH

5. <u>South Atlantic</u>

Delaware
District of Columbia
Florida
Georgia
Maryland
N. Carolina
S. Carolina
Virginia
W. Virginia

6. <u>East South Central</u>

Alabama
Kentucky
Mississippi
Tennessee

7. <u>West South Central</u>

Arkansas
Louisiana
Oklahoma
Texas

WEST

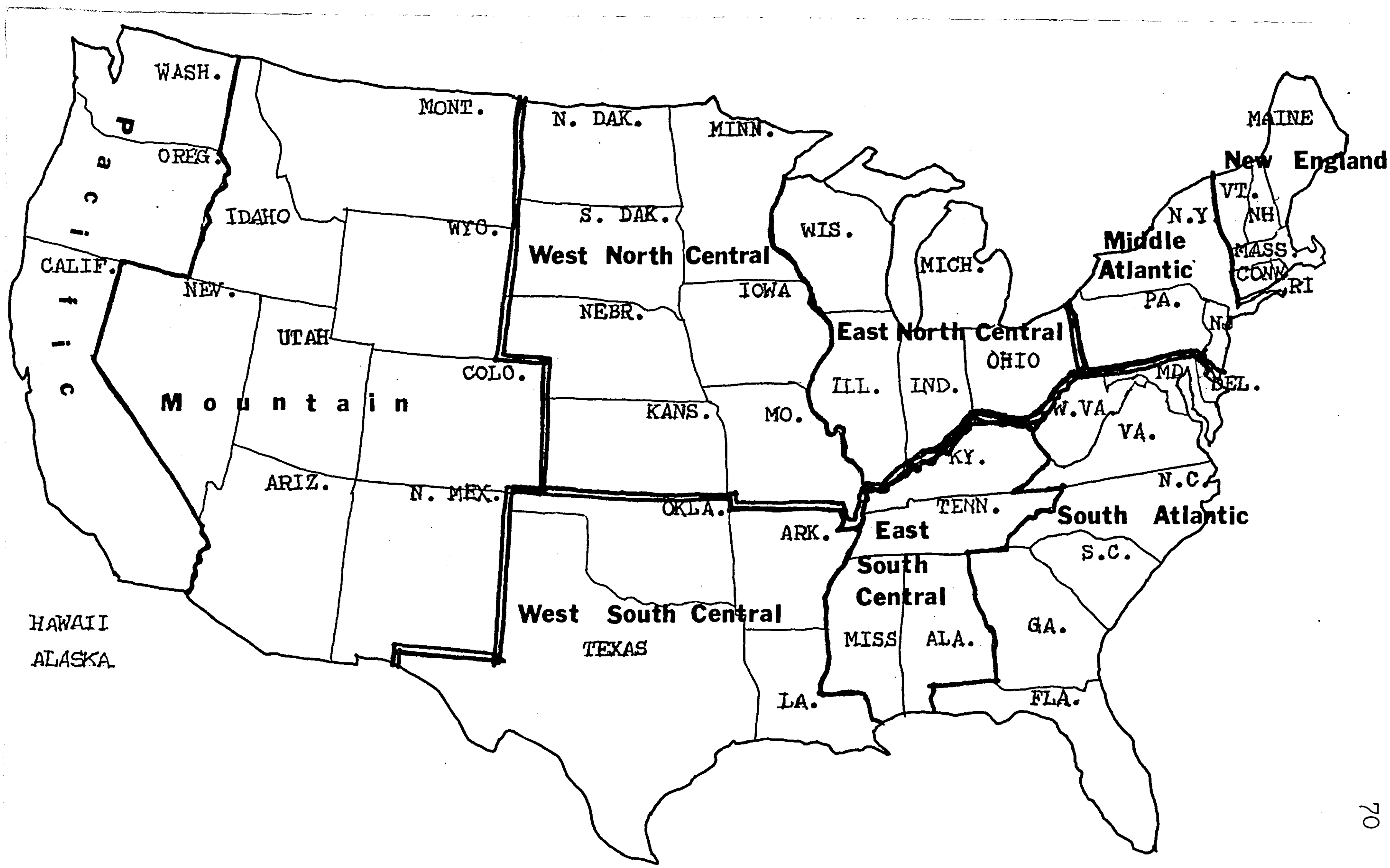
8. <u>Mountain</u>

Arizona
Colorado
Idaho
Montana
Nevada
New Mexico
Utah
Wyoming

9. <u>Pacific</u>

Alaska
California
Hawaii
Oregon
Washington

Puerto Rico will be considered a separate area because of its difference in wage rates, building requirements, geographical conditions, etc.



WASH.
OREG.
CALIF.
Pacific
IDAHO
NEV.
MONT.
WYO.
UTAH
COLO.
ARIZ.
N. MEX.
Mountain
N. DAK.
S. DAK.
NEBR.
KANS.
MINN.
IOWA
MO.
West North Central
OKLA.
ARK.
TEXAS
LA.
West South Central
WIS.
MICH.
ILL.
IND.
OHIO
East North Central
KY.
TENN.
MISS
ALA.
East South Central
W.VA.
VA.
MD
DEL.
N.C.
S.C.
GA.
FLA.
South Atlantic
N.Y
PA.
NJ
Middle Atlantic
MAINE
VT.
NH
MASS.
CONN
RI
New England
HAWAII
ALASKA

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5.0 COST INDEXES

The accuracy of the cost data is a direct function of the cost indexes used in updating costs. Four types of costs indexes are given in this section: General Construction Cost Indexes, Residential Cost Indexes, Labor Hourly Wage Cost Indexes, and Wholesale Price Indexes. For a rough idea of cost trends, it is suggested that the reader use the Residential Cost Indexes to adjust costs to a common base. However, for any type of work that requires greater accuracy, the reader may have to analyze the labor and material indexes of each major building component. In addition, the reader should refer to the analysis of the cost components in Volume III, Section 3.3.

The following cost indexes collected in the February 1972 issue of Construction Review will be used. However, it will be assumed that these indexes will have to be periodically updated:

GENERAL CONSTRUCTION COST INDEXES (1967 = 100)

	American Appraisal Company	Engineering-News Record, Building	Dept. of Commerce Composite Cost Index
1966	95	96.9	96
1967	100	100.0	100
1968	107	107.4	106
1969	116	107.7	114
1970	124	124.4	122
1971	138	140.5	131

RESIDENTIAL COST INDEXES (1967 = 100)

	Boeckh Cost Indexes, Residences	Bureau of the Census, New One Family Houses
1966	94.3	97
1967	100.0	100
1968	107.3	106
1969	116.2	115
1970	122.4	118
1971	132.8	-

Indexes of Union Hourly Wage Rates for Selected Building Trades

Date	All trades	Brick-layers	Carpenters	Elec-tricians	Painters	Plasterers	Plumbers	Building laborers
1954: July 1	58.0	63.6	57.6	59.0	58.5	64.7	58.8	53.7
1955: July 1	60.0	65.3	59.8	60.3	60.9	66.7	60.3	56.1
1956: July 1	62.8	68.3	62.3	63.6	63.4	69.2	62.9	59.3
1957: July 1	66.0	70.9	65.6	66.8	66.7	71.7	66.4	63.0
1958: July 1	69.0	73.3	68.6	70.3	69.1	74.0	69.3	66.1
1959: July 1	72.4	76.5	72.1	72.7	71.8	76.4	72.9	70.5
1960: July 1	75.4	78.8	75.0	76.4	74.9	79.6	75.3	73.8
1961: July 1	78.4	81.8	77.9	79.4	77.7	81.4	78.1	77.4
1962: July 1	81.3	84.3	80.7	83.6	80.6	84.0	81.1	80.0
1963: July 1	84.2	86.7	83.6	86.2	84.3	86.0	84.4	82.9
1964: July 1	87.3	89.3	86.6	89.2	87.3	89.7	87.8	86.4
1965: July 1	90.9	91.8	90.7	91.5	90.9	92.1	91.4	90.5
1966: July 1	94.7	95.0	94.6	94.9	94.6	95.6	94.6	94.5
1967: July 1	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1968: July 1	106.6	106.8	107.0	106.5	106.3	105.1	106.8	106.5
1969: July 1	115.4	115.0	115.8	117.1	115.1	113.3	115.9	114.8
1970: July 1	128.8	127.7	128.9	130.4	126.6	126.0	130.5	129.3
October 1	*130.8							
1971: January 4	*133.2							
April 1	*134.6	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
July 1	*143.8							
October 1	*145.2							

* Estimated. n.a. - Not available. [1967 = 100]

Source: U.S. Department of Labor, Bureau of Labor Statistics.

Indexes of Wholesale Prices of Materials Used in Construction, by Selected Groups and Commodities

Period	All construction materials	Softwood lumber: Douglas fir	Softwood lumber: Southern pine	Softwood lumber: Other	Selected hardwood lumber	Millwork: Group index	Millwork: General millwork	Millwork: Prefab. structural members	Plywood: Group index[1]	Plywood: Softwood
1966	98.8	96.8	100.2	97.5	116.2	98.0	98.7	94.8	104.0	106.1
1967	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1968	105.6	120.3	113.7	123.5	107.7	105.8	105.3	107.8	115.7	129.2
1969	111.9	131.7	126.0	139.0	127.7	117.8	117.6	119.2	122.5	139.2
1970	112.5	108.8	114.5	115.1	116.8	116.0	115.6	118.0	108.5	113.6
1971	119.5	137.6	133.8	145.3	114.4	120.7	121.4	117.5	114.7	127.2

Period	Building paper and board: Group index	Building paper and board: Insulation board	Building paper and board: Hardboard &particle-board	Prepared paint	Selected finished steel products: Structural shapes	Selected finished steel products: Reinforcing bars	Selected finished steel products: Galvanized sheets, carbon	Selected finished steel products: Wire nails, 8d common	Builder's hardware
1966	100.8	98.4	103.4	97.7	99.9	100.8	100.0	101.6	97.0
1967	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1968	100.9	103.0	99.1	104.8	101.8	99.3	102.7	100.1	101.7
1969	105.5	108.8	102.9	109.1	108.1	100.3	105.7	107.8	105.4
1970	101.2	110.8	93.4	112.4	115.3	109.2	109.7	114.7	112.9
1971	103.0	115.1	93.3	115.6	126.8	117.1	114.9	124.7	117.7

Period	Selected Nonferrous Metal Products			Plumbing Fixtures and Brass Fittings			
	Copper water tubing, straight lengths	Building wire, type THW, 12 AWG	Nonmetallic sheathed cable	Group Index[1]	Enameled iron fixtures	Vitreous china fixtures	Brass fittings
1966	104.6	97.5	97.1	98.1	99.4	99.3	97.2
1967	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1968	105.0	98.1	97.1	103.3	102.4	102.9	104.7
1969	115.7	99.3	101.5	107.3	108.5	106.3	108.8
1970	123.1	123.0	131.7	112.5	111.4	108.9	115.8
1971	108.5	97.9	107.3	116.4	114.4	111.8	120.0

Period	Heating Equipment			
	Group index[1]	Steam and hot water	Warm air furnaces and attachments	Water heaters, domestic
1966	99.8	99.5	98.6	101.9
1967	100.0	100.0	100.0	100.0
1968	102.7	103.8	103.2	100.7
1969	105.4	107.4	105.2	103.6
1970	110.6	110.7	111.1	109.6
1971	115.5	116.4	114.5	115.2

Period	Selected fabricated structural metal products: Steel for bldgs	Metal doors sash & trim	Aluminum siding, noninsulated, mft. to distr.	Concrete ingredients: Group index	Sand gravel& crushed stone	Portland cement	Concrete products: Group index	Bldg block	Concrete culvert pipe reinforced	Ready-mixed concrete
1966	97.7	97.7	102.4	98.1	97.8	98.4	97.7	98.8	95.0	98.0
1967	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1968	100.7	103.9	100.3	103.2	103.8	102.5	102.6	104.2	100.3	102.6
1969	104.0	108.5	101.0	106.7	107.8	105.6	106.5	107.9	101.6	107.2
1970	110.6	112.9	104.6	114.6	113.5	115.7	112.2	113.2	103.5	113.6
1971	118.7	118.1	105.2	121.9	119.1	124.6	120.6	118.3	112.0	122.7

Period	Prepared asphalt roofing	Flat glass: Plate	Window glass single B	Other nonmetallic menerals: Group index	Insulation materials	Asbestos cement siding shingles	Selected floor coverings: Asphalt floor tile	Vinyl sheet goods, semi-permanent
1966	102.6	92.9	94.2	98.1	98.9	97.3	97.2	103.8
1967	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1968	104.0	104.1	108.3	104.6	106.4	103.2	106.7	103.5
1969	103.4	109.7	113.9	112.2	115.4	108.2	108.6	97.8
1970	101.8	n.a.	116.1	120.0	123.1	116.4	112.9	97.5
1971	126.5	n.a.	124.8	126.9	131.7	120.7	113.3	102.9

Period	Structural clay products				Gypsum products			
	Group index[1]	Bldg brick	Clay tile	Clay sewer pipe vitrified	Group index	Lath	Wallboard	Plaster base coat
1966	98.2	98.3	97.9	98.6	99.6	100.0	101.2	91.5
1967	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1968	102.6	103.4	102.9	100.0	103.6	102.8	101.3	115.5
1969	106.2	107.8	106.2	101.0	103.6	105.0	99.2	125.2
1970	109.8	112.2	108.7	105.3	100.0	108.0	93.4	128.5
1971	114.2	117.4	112.4	109.4	106.8	118.5	99.7	n.a.

1 Includes items not shown separately.

n.a. - Not available

Source: U.S. Department of Labor, Bureau of Labor Statistics.

APPENDIX

Appendix 1 : Cost Accounting Systems

The cost accounting system used is the key to the effective use of costs in housing design. Therefore, an intensive search was conducted to find which cost accounting systems existed and determine which systems were compatible to the purposes of the study.

Two conditions were observed after studying all the numerous cost accounting systems:

1) Most of the earlier systems (prior to 1967) were materials oriented. However as systems evolved, they became more amd more "building component" or "functionally" oriented.

2) Most systems are good in their breakdowns of the architectural and structural makeup but lack sufficient depth in their breakdowns of the Building Equipment and Mechanical Systems aspect of the classification breakouts.

The following pages in this section is a synopsis of the author's findings.

CLASSIFICATION OF DIFFERENT COST ACCOUNTING SYSTEMS

Name of System Type	Definition	Category Type	Usage	Phase of Building Process Most Applicable	Examples of Cost Accounting Systems or Classification Systems
1) MATERIALS BREAKDOWN	Categories reflective of the substances from which building component or elements are made. (Concrete, Masonry, Metals, Carpentry, Doors, Windows, Glass, Equipment, etc.)	Building Products or Substance	Extensive Use - becoming less popular	Working Drawing Phase	1) Building Construction Cost Data (Robert Means) 1972 2) Construction Pricing & Schedule Manual (Dodge) 1972 3) Building Cost File (McKee, Berger & Mansueto) 1972 4) Uniform System of Cost Accounting (AIA, CSI, AGC) 1966 5) Building Products Register (AIA) 1964 6) SfB/UDC Building Filing Manual - Materials Division (Royal Institute of British Architects - RIBA) 1961
2) CONSTRUCTION PROCESS BREAKDOWN	Categories reflective of the steps or processes involved in the development and construction of a building. (Framing, Rough Plumb Rough Inter. Concret Work Wallboard Insulation Trim, etc)	Construction Operation	Medium Use	Working Drawing Phase Construction Phase	1) Kaiser Commission Report, Technical Studies, Vol II (McGraw-Hill Information System Company) pp. 1-52, 1968 2) SfB/UDC Building Filing Manual - Construction Div. (RIBA) 1961

Name of System Type	Definition	Category Type	Usage	Phase of Building Process Most Applicable	Examples of Cost Accounting Systems or Classification Systems
3) FUNCTIONAL BREAKDOWN	Categories are distinguished from each other by functional use in a building. (External Elements, Structural, Services, Furnishing, Finishes, etc)	Building Component or Elements	Medium Use - becoming more popular	Working Drawing Stage	1) PBS - CMCS User Manual (McKee, Berger, Mansueto) 1972 2) Operation Breakthrough Subsystem (Housing Proposals for Operation Breakthrough - HUD) Dec 1970 3) SfB/UDC Building Filing Manual - Functional Elements (RIBA) 1961
4) TOTAL DEVELOPMENT/ CONSTRUCTION COST BREAKDOWN	Categories are reflective of the financial expenditure & profit of a development or production operation. (Materials, Direct Lab, Indirect ", Selling Expense, General Expense, Overhead, Profit)	Financial Expenditures & Profit	Used on every building project to cal. profit	Completed Project	1) Modular Housing in the Real (Reidelbach) 1970, p. 74 2) Kaiser Commission Report, Dec.1968 pp. 10, 118, 150 3) Douglas Commission Report, Dec.1968 pp. 418-419 4) The Prefabrication of Houses (Kelly) 1951, pp. 346-354

Name of System Type	Definition	Category Type	Usage	Phase of Building Process Most Applicable	Examples of Cost Accounting Systems or Classification Systems
5) HIERARCHIAL BREAKDOWN	Category breakdowns are reflective of the physical parts and makeup of the building (Sitework, Shell, Interior Finish Building Equip., etc.)	Building Component	Used Mostly by the Govenment (FHA Projects)	Design Phase Working Drawing Phase	1) How The Many Costs Of Housing Fit Together (Eaves) 1969 2) Douglas Commission Report, Dec 1968 pp. 424-25,436 3) Developing New Communities, Applications of Technological Innovations (Crane) Dec 1968 pp. 24-25
6) COMBINATION OF ANY FIVE TYPES	Combinations of any of the five categories	Building Component	Wide Use - most used is a combination of Materials & Functional Breakdown	Dependent on Comb.	1) Cost Assessment System (Tishman Research & Goody-Clancy for UDC) 1970 2) Simplified Carpentry Estimating (Wilson, Rogers) 1962

1) COST ASSESSMENT SYSTEM (called Analog)

by Goody-Clancy and Tishman Research Corp. for the Urban Development Corporation (UDC)

Categories of Subsystems:

1. Structure
2. Exterior Closure
3. Windows and Openings
4. Roofing, Insulation, Flashing
5. Carpentry
6. Partitions & Surfaces
7. Miscellaneous Iron & Ornamental Iron
8. Finishes
9. Plumbing
10. Electrical
11. HVAC
12. Other (elevator and completion)

Comments: Subsystem category breakdown based on materials with four bases of building types as analogs 1) 25 story fireproof flat plate concrete frame 2) 7-story fireproof steel frame and bar joist 3) 7-story semi-fireproof bearing wall 4) 2-story wood frame non-fireproof garden apartment

2) UNIFORM SYSTEM FOR CONSTRUCTION SPECIFICATIONS, DATA FILING AND COST ACCOUNTING.

by* Architects Institute of America (AIA), from Title One, Buildings, 1966

Categories of Subsystems:

1. General Requirements
2. Sitework
3. Concrete
4. Masonry
5. Metals
6. Carpentry
7. Moisture Protection
8. Doors & Windows
9. Finishes
10. Specialties
11. Equipment
12. Furnishings
13. Special Construction
14. Conveying System
15. Mechanical
16. Electrical
17. Unit Transportation Factor

Comments: Subsystem category breakdown based on materials rather than components. Similar to Cost-Assessment System.

* also: Associated General Contractors of America, Inc.; Construction Specifications Institute, Inc.; and Council of Mechnanical Specialties Contracting Industries, Inc.

3) PBS - CMCS USER MANUAL: Appendix IV Cost Estimating Procedure
(Public Building Service - Construction Management Control System)

by McKee, Berger, Mansueto, Inc.

Categories of Subsystems:

1. Foundation System
2. Structural System
3. Exterior Wall Construction
4. Roofing System
5. Interior Vertical Elements
6. Finishes
7. Vertical Circulation
8. Plumbing Systems
9. HVAC Systems
10. Electrical Systems
11. Building Equipment Systems
12. Site Construction
13. Construction Related Costs

Comments: Subsystem category breakdown based on building components rather than materials. Category breakdown is more reflective of the construction process and functional role played in building. Cost estimating procedure was devised for commercial and institutional buildings but is still applicable to housing. Proposed system.

4) SUBSYSTEM BREAKDOWN FOR FORT LINCOLN NEW TOWN STUDY
(Developing New Communities, Application of Technological Innovations)

by David A. Crane and Keyes, Lethbridge, & Condon

Categories of Subsystems:

1. Sitework
2. Structure
3. Roofing
4. Vertical Skin
5. Interior Space Division
6. Interior Finishes
7. Casework & Furnishings
8. Plumbing
9. Heating, Ventilation, & Air Conditioning
10. Electrical
11. Conveying (in Structure)

Comments: Subsystem category breakdown based on building components rather than materials.

5) SfB/ UDC BUILDING FILING MANUAL:
(Recommendations for Standard Practice in Precallsification and Filing)

by the Royal Institute of British Architects

Categories of Subsystems (Functional Elements):

1. External Elements
2. Primary Elements
3. Secondary Elements
4. Finishes
5. Services Installations: Sanitations, Heating, Ventilation
6. Services Installations: Electrical and Mechanical
7. General Spaces: Fixtures and Equipment
8. Special Spaces: Fixtures and Equipment

6) Classification System for A Study of Comparative Time and Cost for Building Five Selected Types of Low-Cost Housing
(The Report of The President's Committee on Urban Housing, Technical Studies, Vol. II)

by Marketing Research Department, McGraw-Hill Information Systems Company, McGraw-Hill, Inc.

Categories of Subsystems: (General Breakdown)

Development - Built Single Family Unit

1. Land Purchase
2. On-Site Development
3. Off-Site Development
4. Water and Utility Hook-Up
5. Financing Fees, Marketing, & Miscellaneous Expenses
6. Foundation, Excavation, Footing, Fill, Septic System
7. Framing, Roofing, Wallboards, & Windows
8. Rough Plumbing, Heating, Electrical
9. Rough Interior Work, Interior Finishing, & Appliances
10. Blacktop Driveway and Landscaping

Prefabricated Single-Family Unit

1. Land Purchase
2. On-Site Development
3. Off-Site Development
4. Water & Utility Hook Up
5. Financing Fees, Marketing, & Misc. Expenses
6. Framing, Roofing, & Wallboard
7. Rough Plumbing, Heating, & Electrical
8. Rough Interior Work, and Interior Finishing
9. Freight Charge, Contingency Fee, & Clean Up
10. Foundation, Excavation, Footing, Fill, & Septic System
11. Blacktop Driveway and Landscaping

6) Continued.........

Medium-Rise Apartment Building
(brick-faced curtain wall with reinforced concrete frame with elevators)

1. Contractor, Architects, and Miscellaneous Fees and Expenses
2. Land
3. Demolition
4. Foundation, Excavation, & Fill
5. Structural Frame, Roofing, Masonry, & Windows
6. Plumbing, Heating, and Ventilating, Electrical Work
7. Rough Interior Work, Interior Finishing, and Aplliances
8. Sitework and Landscaping

Comments: Building Component Breakdown rather than material breakdown. Check Detailed Breakdown for further breakdown. General breakdown is too general, it should be broken into two or three smaller categories. There should be correlation between the three building types. (same Subsystem Breakdown for all three types)

7) OPERATION BREAKTHROUGH BUILDING SUBSYSTEMS BREAKDOWN
(from: Housing System Proposals for Operation Breakthrough, Dec. 1970)
by the United States Department of Housing and Urban Development

Categories of Subsystems (Building Subsystems)

1. Structure
2. Exterior Elements
3. Interior Elements
4. Comfort System
5. Plumbing
6. Electrical
7. Furnishings (not including kitchen cabinets,closets)

8) SIMPLIFIED CARPENTRY ESTIMATING
by J. Douglas Wilson, Clell M. Rogers

Categories of Subsystems (Estimating Divisions for Residential Work)

1. Foundation
2. Framing
3. Exterior Finish
4. Interior Finish
5. Hardware

Comments: Building Component Breakdown rather than material breakdown. Breakdown is too simplified and is limited to carpentry only. No mention of "wet" units and other mechanical systems.

9) U.S. FINANCIAL CORP. (comparison of identical 1,290 sq. ft. houses)
from: Modular Housing in the Real, 1970
by J.A. Reidelbach, Jr.

Categories of Subsystems:

1. Construction Cost (Total F.O.B. Price)
2. On-Site Costs
3. Delivery
4. Set up
5. Sales Expenses
6. Construction Finance (lot only)
7. Lot
8. Builder's Overhead
9. Builders Profit

SUB-TOTAL

10. FHA Discount (6 points)

SALE PRICE

10) OFFICE OF THE HOUSING EXPEDITER (data submitted during late 1946 to the first half of 1947)
from: The Prefabrication of Houses. Burnham Kelly, 1951 pp. 346-349

Categories of Subsystems:

Package
- Direct Material
- Direct Labor
- Indirect Labor
- Other Indirect
- Administration
- Sales Expense
- Profit

Erection
- Direct Material
- Direct Labor
- Indirect Labor
- Other Indirect
- Administration
- Sales Expense
- Profit

Total, Package and Erection

11) <u>TVA SECTIONAL HOUSE</u> (1943)

from: <u>The Prefabrication of Houses</u>, Burnham Kelly, 1951 p.353

<u>Categories of Subsystems</u>

Materials
Labor
Plant Burden
Selling Expense
Field Assembly
Advertising
Administration
Social Security & Taxes
Depreciation
Profit

12) <u>AIROH HOUSE</u> (1947)

from: <u>The Prefabrication of Houses</u>, Burnham Kelly, 1951 p.354

<u>Categories of Subsystems</u>

Production
- Materials
- Factory fabrication
- Other Production Costs
- Factory Plant and Equipment

Transport
- Vehicles, Spares, and Repairs
- Haulage

Grading, Utilities, and Foundation
Erection
Contingencies
Overhead Costs

13) FHA HOUSING BREAKDOWN
(from: How The Many Costs of Housing Fit Together)

by Elsie Eaves

Categories of Subsystems

Excavation & Foundations
Frame & Shell
Interior Finish
Mechanical Subcontractors
Elevators
Appliances
Cabinets, Kitchen & Medicine
Job Overhead

14) BUILDING PRODUCTS REGISTER CLASSIFICATION SYSTEM (1964)

by: Architects Institute of America (AIA)

Categories of Subsystems:

1. Structural Systems
2. Curtain Walls
3. Masonry
4. Wood
5. Metals
6. Glass, Plastics
7. Roofing & Siding
8. Masonry & Concrete Treatments & Materials
9. Thermal Insulation
10. Sound Control
11. Lath, Plaster, Gypsum Wallboard
12. Flooring & Wall Covering
13. Panels & Surfaces
14. Paint, Finishes
15. Doors
16. Windows
17. Door & Window Equipment
18. Hardware
19. Skylight, Roof Ventilators, Louvers
20. Store Fronts
21. Partitions & Wirework
22. Vertical & Horizontal Transportation
23. Kitchen Equipment
24. Institution Equipment
25. Education & Recreational Equipment
26. Furnishings & Special Equipment

Comment: Complete material breakdown

15) BUILDING THE AMERICAN CITY (December, 1968)
by the Douglas Commission

Categories of Subsystems:

1. Excavation of Foundations
2. Frame & Shell
3. Interior Finish
4. Mechanical Subcontractor
5. Elevators
6. Appliances
7. Cabinets, Kitchens, & Medicine
8. Job Overhead

Comment: Hierarchial breakdown, mechnaical breakdown is too general.

Appendix 2 : Current Cost Studies

The follosing is a list of current cost studies that the author pursued. The most valuable report that resulted was the study conducted by McKee, Berger, and Mansueto. In this report, numerous square foot costs for various types of dwelling units were collected. It would make a wonderful addition to the data bank but unfortunately the report is a HUD classified report. The author wrote to Mr. Charles B. Altman but received a negative reply. The Stockfisch Report is a good source in providing insight on the reduction of costs for low income housing.

Current CONSTRUCTION COST SYSTEM STUDIES (in progress)

from: Catalog of Federally Funded Housing and Building Research
June, 1970

I.D.#	Title and Objective	Project Monitor	Principal Investigation Performing Organization
8-15 Contract Cancelled	DEPARTMENT HOUSING COST SYSTEM Development of a housing development information system which will used primarily to estimate the cost of housing units & projects (in process)	Israel Rafkin Office of the Deputy Under Secretary H.U.D. 451 7th Street, S.W. Washington, D.C.	DONALD MAC DONALD Computer Applications Inc. 1730 Rhode Island Ave Washington, D.C.
8-10 HUD Report (Classified)	SUBMISSION OF SQUARE FOOT COST DATA ON VARIOUS TYPES OF CONSTRUCTION Current data covering the square foot costs of dwelling construction and equipment for various types of structures, as defined by the housing assistance administration, will be collected. The data will allow more realistic judgements to be made on the reasonableness of proposed development costs. (in process)	Charles B. Altman Housing Production & Mortage Credit FHA Department of Housing and Urban Development 451 7th Street, S.W. Washington, D.C. 20410 HUD # ST H-1002	J.S. Thomas McKee, Berger, Mansuet Inc. 2 Park Avenue New York, N.Y. 10016 Report: Estimated Square Foot Costs for Dwelling Construction & Equipment of Various Building Types

8-20 Stockfisch Report: Available from Clearing-house	REDUCTION IN THE COST OF LOW COST HOUSING (Summary Report of Five Final Report Studies) To examine the possibilities for achieving marked reductions in the cost of urban family housing by introducing major innovations and efficiencies into its design, marketing and production in an organized way. (completed) Report: An Investigation of the Opportunties for Reducing the Cost of Federally Subsidized Housing for Lower Income Families	Dr. Evelyn S. Glatt Low Income Housing Demonstration Office of Research & Technology H.U.D. 451 7th Street, S.W. Washington, D.C. 20410	Jacob A. Stockfisch The Rand Corporation 2100 M Street, N.W. Washington, D.C. 20037
8-21 Internal Report: No theories Developed short reports	BUILDING ECONOMICS Develop economic measures of performance of buildings, and facility complexes of groups of buildings, related to the process of building. Including (1) the investigation of first cost, life cost of building sub-systems and (2) the development of economic units of measure to relate cost of construction experience to economic function usage of buildings. (completed: June, 1969) NBS # 4217 112	Philip O. Chen National Bureau of Standards Building Research Divison Washinton, D.C. 20234	National Bureau of Standards Washington, D.C. 20234

Current CONSTRUCTION COST SYSTEM STUDIES (in progress) ....continued

I.D.#	Title and Objective	Project Monitor	Principal Investigation Performing Organization
8-22 Contract Cancelled	COST ANALYSIS/COST SYNTHESIS SYSTEM FOR CONSTRUCTION CONTROL Develop an automated cost processing technique to analyze construction cost experience, develop descriptors and codes, and develop a cost synthesis systems to permit program managers and designers to make cost estimates as design proceeds NBS # 4217 418 Completed June, 1970	R.W. Blake National Bureau of Standards Building Research Divison Washington, D.C. 20234	G.S. Birrell National Bureau of Standards Washington, D.C. 20234
2-27	OPERATIONS RESEARCH - CONSTRUCTION COSTS Explore, devise, and test methods and techniques of estimating, scheduling and controlling construct-ion operations and improve and document those which effect cost reductions USN # Y-F015-15-06-501 Completed: FY 1967, Report: #AD 652 609, Sept. 66	H.C. Lamb NAVFAC Code 0322 Naval Facilities Command Navy Deptment Washington, D.C. 20390 Letter forwarded to:	J.W. Fondahl Stanford University Department of Civil Engineering Stanford, California Mrs. Joyce Bickerton Rm. 2B66, Bdg. 226 Nationa l Bureau of Standards Washington, D.C. 20234

APPENDIX 3 : QUESTIONNAIRE

MASSACHUSETTS INSTITUTE OF TECHNOLOGY *CAMBRIDGE, MASSACHUSETTS 02139*
Norman Quon   Building E-40

I am preparing a report at M.I.T. which will evaluate and compare building costs from a survey of 600 builders and manufacturers representing the entire housing industry - from on-site residential construction to componentized construction to modular and mobile homes.

The finished report will show the individual builder how his construction costs compare with the costs of the rest of the industry. From the set of comparable costs, a builder could: 1) select the most economic construction methods, materials, housing types, structural systems, transportation and erection methods for specific performance requirements 2) improve the cost control of construction 3) easily and accurately estimate the construction costs of new projects.

The report will be completed in February, 1973 and will be available to you, possibly at the cost of reproduction.

To make the report as useful to you as possible I need your help. I would greatly appreciate it if you would take the time to fill out the enclosed questionnaire, even filling a part will help. All the information you provide will be kept in the strictest confidence and used anonymously in the report.

It would be helpful in interpreting the data from your questionnaire if you could provide me with sales literature of your completed projects.

Thank you very much for your help and cooperation.

Very truly yours,

Norman Quon

NQ:jd
Encl.

NATIONAL ASSOCIATION OF BUILDING MANUFACTURERS
1619 Massachusetts Avenue, Northwest
Washington, D.C. 20036
Telephone: (202) 234-1374

Richard L. Bullock
Executive Vice President

nabm

January 14, 1972

Mr. Norman Quon
Massachusetts Institute
of Technology
School of Architecture
and Planning
Room 7-303
Cambridge, Massachusetts 02139

Dear Mr. Quon:

We wholeheartedly endorse the need for the study on cost comparability you are planning.

I'm not optimistic over your prospects because so very few housing manufacturers seem to be able to break out their costs on the itemized basis you are seeking. However, it is very greatly needed.

I discovered this when I discovered within the past year how many have major problems "cost certifying" to the FHA on projects where an identity of interests exists. Also, it seems there is little agreement on a uniform accounting system, not to mention the problem of charging off plant overhead, amortization etc., against the cost of each unit.

Please keep us posted on your progress. The results could be extremely helpful.

Cordially,

Richard L. Bullock
Executive Vice President

RLB:ldh

cc: Rodney Wright
John Bemis

MOBILE HOMES MANUFACTURERS ASSOCIATION

MHMA

6650 NORTH NORTHWEST HIGHWAY / CHICAGO, ILLINOIS 60631 / (312) 792-3800

February 10, 1972

Mr. Norman Quon
Massachusetts Institute of Technology
School of Architecture and Planning
Room 7-3-3
Cambridge, Massachusetts 02139

Dear Mr. Quon:

Your questionaires would certainly by of value to the mobile home industry. After conferring with some of the MHMA manufacturers, serving on the statistical sub-committee, the following observations were made.

The information would be welcomed but securing a good response would be difficult.

Most manufacturers do not have the necessary manpower to do this type of work. I will make a news announcement that your questionnaire will circulate and encourage members as well as non-members to participate.

MHMA looks forward to receiving your results and analysis.

Best regards.

Very truly yours,

Jerry Bagley
Director, Public Relations

JB:ib

cc: J. M. Martin
H. Omson

WASHINGTON OFFICE: SUITE 922 / 1800 NORTH KENT STREET / ARLINGTON, VIRGINIA 22209 / (703) 525-6550

MOBILE HOMES MANUFACTURERS ASSOCIATION

MAILING ADDRESS: DULLES INTERNATIONAL AIRPORT / P.O. BOX 17404 / WASHINGTON, D.C. 20041 / (703) 471-4700

January 19, 1972

Mr. Norman Quon
Massachusetts Institute of Technology
School of Architecture and Planning
Room 7-303
Cambridge, Massachusetts 02139

Dear Mr. Quon:

Thank you for your letter concerning your project. I am sending your sample questionnaires and your letter to our Chicago office for review by our standards and public relations departments. By copy of this letter I am asking Mr. Henry Omson and Mr. Jerry Bagley to review your project for recommendations regarding MHMA participation.

It appears that you have done an excellent job in preparing the questionnaires. I feel that it would be in order for us to encourage our people to cooperate.

Sincerely,

John M. Martin
President

JMM/jg
cc: Mr. Henry Omson, MHMA/Chicago

LOCATION: 14650 LEE ROAD / CHANTILLY, VIRGINIA

he information you provide will be held in the strictest onfidence and will be reported anonymously in aggregate orm for cost analysis only.

Massachusetts Institu
of Technolo
Attn.: Norman Quon
Building E-40
Cambridge, Mass. 021

QUESTIONNAIRE

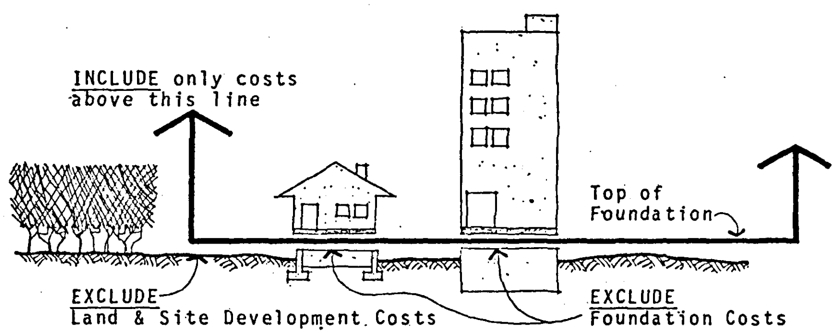
100

ame of Company: ____________________

NSTRUCTIONS

A. SELECT A TYPICAL DWELLING UNIT FROM ONE OF YOUR LATEST JOBS WHICH MOST CLOSELY APPROXIMATES:
   a) Net Floor Area = 1,000 sq.ft.   c) 1 Bathroom
   b) 3 Bedroom Unit   d) No Carport or Garage

B. INCLUDE ONLY THE COSTS ABOVE THE TOP OF THE FOUNDATION LINE



C. BASE ALL YOUR DATA FOR THE REMAINDER OF THE QUESTIONNAIRE ON THE DWELLING UNIT YOU HAVE SELECTED.

WELLING UNIT INFORMATION

ctual Net Floor Area (sq.ft.) ________
eiling Height.............. ________
ctual Number of Bedrooms... ________
ctual Number of Bathrooms.. ________
verage Wall Thickness (in.). ________
ate of Construction........ ________
umber of Stories of Building D.U. Located In.. ________

irect Labor Breakdown for Unit:

	Percent (%)	Average Hourly Wage Rate ($)	Union? Yes	No
Unskilled				
Skilled				

Housing Type (Please check):

Single-Family Detached ☐   Row House Apt. ☐   Walk-Up Apt. ☐

Medium-Rise Apt. ☐   Hi-Rise Apt. ☐

Building Codes Your Unit Conforms To:

Uniform Building Code (ICBO) ☐   BOCA Code (Bldg Off & Code Admin) ☐   Southern Bldg Code ☐   FHA Minimum Property Standards ☐

Other? ____________________

Structural Material(s): ____________

OST INFORMATION

ales Price Breakdown (excluding: Land, Foundation & Site Costs)

	Percent (%)
Materials	
Labor	
Delivery Expense	
Selling Expense	
General & Administrative Expenses	
Overhead & Profit (Before Taxes)	
Financing Expenses	
TOTAL SALES PRICE (above foundation)	100 %

00133

TOTAL SALES PRICE (Above the Foundation): $________

OST OF STRUCTURE BREAKDOWN

NCLUDING: Materials, Labor
XCLUDING: Selling, General, & Administrative Expenses, Overhead & Profit

GENERAL BREAKDOWN Item	Manhours for Each Item	Cost ($) Materials & Labor	DETAILED BREAKDOWN Item	Cost ($) Materials & Labor	Is Item Bought As A Unit? Check (✓) Yes?	No?
STRUCTURAL Load-Bearing			Floor Slab (include: slab on grade)			
			Load Bearing Walls (exclude: interior dry wall or plaster; interior or exterior finishes)			
			Roof Deck			
			Stairs (Load Bearing)			
			Other (list)			
EXTERIOR CLOSURE Non-Load Bearing, exclude: electrical, plumbing, HVAC, & other building equip.			Non-Load Bearing Exterior Walls (exclude: interior dry wall or plaster; interior or exterior finishes)			
			Exterior Door Units			
			Exterior Window Units			
			Exterior Painting			
			Exterior Trim			
ROOFING			include: insulation, vapor barrier, & roofing materials			
INTERIOR VERTICAL ELEMENTS Non-Load Bearing			Partitions (exclude: electrical, plumbing, HVAC, & other building equip.)			
			Interior Doors Units			
INTERIOR FINISHES			Interior Dry Wall or Plastering (for Exterior Walls)			
			Interior Painting			
			Other Wall Finish			
			Ceiling Finish			
			Floor Finish			
VERTICAL CIRCULATION Non-Load Bearing			Stairs Non-Load Bearing			
			Elevators			
			Other (list)			
PLUMBING			Distribution System			
			Fixtures & Hardware			
HVAC			Heating & Cooling Equip.			
			Distribution System			
			Hardware (grilles, etc.)			
ELECTRICAL			Distribution System			
			Fixtures & Hardware			
BUILDING EQUIPMENT			Kitchen Appliances, Cabinets			
			Bathroom Equipment include: bathtub, shower, toilet, sink, & cabinets			
			Other (list)			
FURNISHINGS			Carpeting			
			Furniture			
			Other (list)			
TOTAL						

The information you provide will be held in the strictest confidence and will be reported anonymously in aggregate form for costs analysis only.

Massachusetts Institut
of Technolog
Attn.: Norman Quon
Building E-40
Cambridge, Mass. 0213

QUESTIONNAIRE

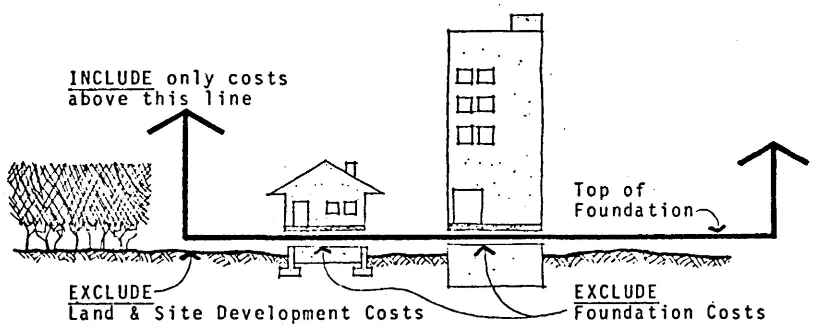
Name of Company: ______________________________

INSTRUCTIONS

A. SELECT A TYPICAL DWELLING UNIT FROM ONE OF YOUR LATEST JOBS WHICH MOST CLOSELY APPROXIMATES:

a) Net Floor Area: 1,000 sq.ft. c) 1 Bathroom
b) 3 Bedroom Unit d) No Carport or Garage

B. INCLUDE ONLY THE COSTS ABOVE THE TOP OF THE FOUNDATION LINE



C. BASE ALL YOUR DATA FOR THE REMAINDER OF THE QUESTIONNAIRE ON THE DWELLING UNIT YOU HAVE SELECTED.

DWELLING UNIT INFORMATION

Actual Net Floor Area(sq.ft.). ________
Ceiling Height.............. ________
Actual Number of Bedrooms... ________
Actual Number of Bathrooms.. ________
Date of Construction........ ________
Number of Stories of Building D.U. Located In... ________

Housing Type (Please check):

Single-Family Detached ☐ Row House Apt. ☐ Walk-Up Apt. ☐
Medium-Rise Apt. ☐ Hi-Rise Apt. ☐

Direct Labor Breakdown for Unit:

	Percent (%)	Average Hourly Wage Rate ($)	Union? Yes	No
Unskilled				
Skilled				

Building Codes Your Unit Conforms To:

Uniform Building Code (ICBO) ☐ BOCA Code (Bldg Off & Code Admin) ☐ Southern Bldg Code ☐ FHA Minimum Property Standards ☐

Other? ______________________

Structural Material(s): ______________

COST INFORMATION

(excluding: Land, Foundation & Site Development Costs)

Percent Breakdown of Sales Price	Percent (%)
Materials	
Labor	
Delivery Expense	
Selling Expense	
General & Administrative Expenses	
Overhead & Profit (Before Taxes)	
Financing Expenses	
TOTAL SALES PRICE(above foundation)	100 %

TOTAL SALES PRICE (Above the Foundation): $________

COST OF STRUCTURE BREAKDOWN

INCLUDING: Materials, Labor
EXCLUDING: Selling, General, & Administrative Expenses, Overhead & Profit

GENERAL BREAKDOWN Item	Manhours for Each Item	Cost ($) Materials & Labor	DETAILED BREAKDOWN Item	Cost ($) Materials & Labor	Is Item Bought As A Unit? Check (✓) Yes?	No?
STRUCTURAL Load-Bearing			Floor Framing & Subfloor			
			Wall Framing (exclude: interior dry wall or plaster; interior or exterior finishes)			
			Ceiling Framing			
			Roof Framing			
			Other Structural (List)			
EXTERIOR CLOSURE Non-Load Bearing exclude: electrical, plumbing, HVAC, & other building equip.			Exterior Wall (exclude: interior dry wall or plaster; interior or exterior finishes)			
			Exterior Door Units			
			Exterior Window Units			
			Exterior Painting			
			Exterior Trim & Ornamnetation			
ROOFING			include: insulation, vapor barrier, & roofing materials			
INTERIOR VERTICAL ELEMENTS Non-Load Bearing			Partitions (exclude: electrical, plumbing, HVAC, & other building equip.)			
			Interior Door Units			
INTERIOR FINISHES			Interior Dry Wall or Plastering (for Exterior Walls)			
			Interior Painting			
			Other Wall Finish			
			Ceiling Finish			
			Floor Finish			
VERTICAL CIRCULATION Non-Load Bearing			Stairs Non-Load Bearing			
			Other (List)			
PLUMBING			Distribution System			
			Fixtures & Hardware			
HVAC			Heating & Cooling Equip.			
			Distribution System			
			Hardware (grilles, etc.)			
ELECTRICAL			Distribution System			
			Fixtures & Hardware			
OTHER EQUIPMENT			Kitchen Appliances, Cabinets			
			Bathroom Equipment (include: bathtub, shower, toilet, sink, & cabinets)			
			Other Equip. (List)			
FURNISHINGS			Carpeting			
			Furniture			
			Other Furnishings			
TOTAL						

he information you provide will be held in the strictest
onfidence and will be reported anonymously in aggregate
rom for cost analysis only.

Massachusetts Institu
of Technolo
Attn.: Norman Quon
Building E-40
Cambridge, Mass. 021

QUESTIONNAIRE

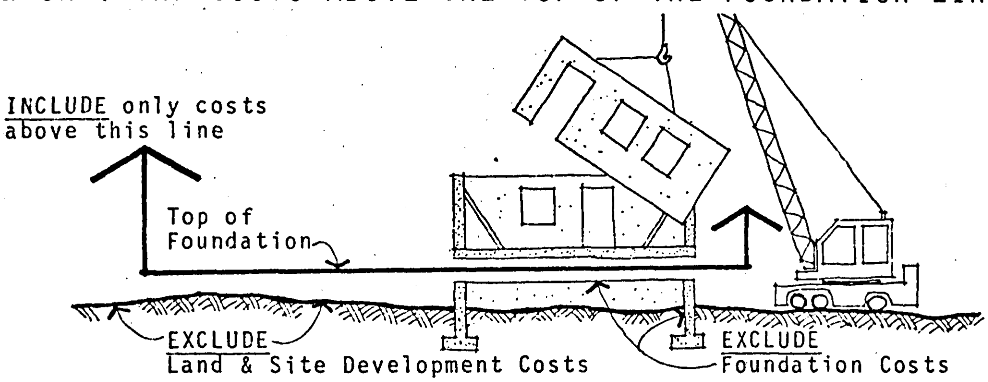
ompany Name: ____________
actory Size (sq.ft.)......... ________

Assume one shift/day,
Current Production Rate (dwelling units/day) ________
Plant Design Capacity (dwelling units/day).. ________

NSTRUCTIONS

A. SELECT A TYPICAL MODEL FROM YOU PRODUCT LINE, WHICH APPROXIMATES:
a) Net Floor Area: 1,000 sq.ft. c) 1 Bathroom
b) 3 Bedroom Unit d) No Carport or Garage

B. INCLUDE ONLY THE COSTS ABOVE THE TOP OF THE FOUNDATION LINE



C. BASE ALL YOUR DATA FOR THE REMAINDER OF THE QUESTIONNAIRE ON THE DWELLING UNIT YOU HAVE SELECTED.

WELLING UNIT INFORMATION

ctual Net Floor Area (sq.ft.) ________
eiling Height............. ________
ctual Number of Bedrooms... ________
ctual Number of Bathrooms.. ________
eight of Model (tons)......... ________
ax Stories Possible
Structurally....... ________
all Panel Sizes ________

Housing Types Possible (Please check):

Single-Family Detached ☐ Row House Apt. ☐ Walk-Up Apt. ☐
Medium-Rise Apt. ☐ Hi-Rise Apt. ☐

ff-Site Labor for Chosen Model:

	Percent (%)	Average Hourly Wage Rate ($)	Union? Yes	No
Unskilled				
Skilled				

Building Codes Your Model Conforms To:

Uniform Building Code (ICBO) ☐ BOCA Code (Bldg Off & Code Admin) ☐ Southern Bldg Code ☐ FHA Minimum Property Standards ☐

Other? ____________

OST INFORMATION

.B. Factory Price Breakdown	Percent (%)
terials	
bor	
livery Expenses (fixed or unfixed)	
lling Expenses	
neral & Administrative Expenses	
erhead & Profit	
her Expenses (List)	
TAL F.O.B. FACTORY PRICE	100 %

Sales Price Breakdown		Percent (%)
F.O.B. Factory Price		
Delivery Expenses		
Lift & Secure	Materials	
	Labor	
On-Site Finishing	Materials	
	Labor	
Selling Expenses		
General & Administrative Expenses		
Financing Expenses		
Overhead & Profit (Before Taxes)		
TOTAL SALES PRICE (above foundation)		100 %

TAL F.O.B. FACTORY PRICE: $________

TOTAL SALES PRICE (Above the Foundation) $________

OST OF STRUCTURE BREAKDOWN

NCLUDING: Materials, Labor, Delivery, Lift & Secure
XCLUDING: Selling, General, & Adminstrative Expenses, Overhead & Profit

GENERAL BREAKDOWN Item	Manhours for Each Item	Cost ($) Materials & Labor	DETAILED BREAKDOWN Item	Factory Costs ($) Materials & Labor	On-Site Costs ($) Materials & Labor
TRUCTURAL			Floor Slab (include: slab on grade)		
			Load Bearing Walls (exclude: interior dry wall or plaster; interior or exterior finishes)		
			Roof Deck		
oad Bearing			Stairs (Load-Bearing)		
			Other (list)		
XTERIOR LOSURE			Non-Load Bearing Exterior Walls (exclude: interior dry wall or plaster; interior or exterior finishes)		
on-Load Bearing			Exterior Door Units		
xclude: electrical, lumbing, HVAC, & ther building equip.			Exterior Window Units		
			Exterior Painting		
			Exterior Trim		
OOFING			include: insulation, vapor barrier, roofing materials		
NTERIOR ERTICAL LEMENTS on-Load Bearing			Partitions (exclude: electrical, plumbing, HVAC, & other building equip.)		
			Interior Door Units		
NTERIOR INISHES			Interior Dry Wall or Plastering (for Exterior Walls)		
			Interior Painting		
			Other Wall Finish		
			Ceiling Finish		
			Floor Finish		
ERTICAL IRCULATION on-Load Bearing			Stairs Non-Load Bearing		
			Elevators		
			Other (list)		
LUMBING			Distribution System		
			Fixtures & Hardware		
VAC			Heating & Cooling Equip.		
			Distribution System		
			Hardware (grilles, etc.)		
LECTRICAL			Distribution System		
			Fixtures & Hardware		
UILDING QUIPMENT			Kitchen Appliances, Cabinets		
			Bathroom Equipment (include: bathtub, shower, toilet, sink, & cabinets)		
			Other (list)		
URNISHINGS			Carpeting		
			Furniture		
			Other (list)		
ELIVERY se 100 miles elivery distance					
IFT & ECURE					
OTAL					

Any sales literature, photographs, or technical drawings of your models and your production process would be greatl appreciated.

he information you provide will be held in the strictest
onfidence and will be reported anonymously in aggregate
orm for cost analysis only.

Massachusetts Institut
of Technolog
Attn.: Norman Quon
Building E-40
Cambridge, Mass. 0213

QUESTIONNAIRE

ompany Name: ____________

actory Size (sq.ft.).........____________

Assume one shift/day,

Current Production Rate (dwelling units/day) ____________

Plant Design Capacity (dwelling units/day)..____________

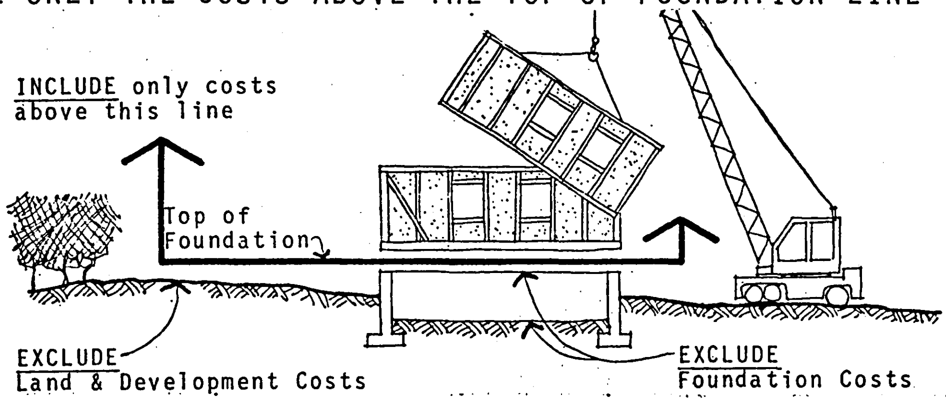
NSTRUCTIONS

A. SELECT A TYPICAL MODEL FROM YOUR PRODUCT LINE, WHICH APPROXIMATES:

a) Net Floor Area: 1,000 sq.ft. c) 1 Bathroom

b) 3 Bedroom Unit d) No Carport or Garage

B. INCLUDE ONLY THE COSTS ABOVE THE TOP OF FOUNDATION LINE



C. BASE ALL YOUR DATA FOR THE REMAINDER OF THE QUESTIONNAIRE ON THE MODEL YOU HAVE SELECTED.

ODEL INFORMATION

ctual Net Floor Area (sq.ft.)____________

eiling Height.............____________

ctual Number of Bedrooms...____________

ctual Number of Bathrooms..____________

eight of Model (tons).........____________

ax. Stories Possible If Stacked....____________

ff-Site Labor for Chosen Model:

	Percent (%)	Average Hourly Wage Rate ($)	Union? Yes	No
Unskilled				
Skilled				

Housing Types Possible (Please Check):

Single-Family Detached ☐ Row House Apt. ☐ Walk-Up Apt. ☐

Medium-Rise Apt. ☐ Hi-Rise Apt. ☐

Building Codes Your Model Conforms To:

Uniform Building Code (ICBO) ☐ BOCA Code (Bldg Off & Code Admin) ☐ Southern Bldg Code ☐ FHA Minimum Property Standards ☐

Other? ____________

OST INFORMATION

B. Factory Price Breakdown	Percent (%)
erials	
bor	
ivery Expenses (fixed or unfixed)	
ling Expenses	
eral & Administrative Expenses	
rhead & Profit	
er Expenses (List)	
AL F.O.B. FACTORY PRICE	100 %

Sales Price Breakdown		Percent (%)
F.O.B. Factory Price		
Delivery Expenses		
Lift & Secure	Materials	
	Labor	
On-Site Finishing	Materials	
	Labor	
Selling Expenses		
General & Administrative Expenses		
Financing Expenses		
Overhead & Profit (Before Taxes)		
TOTAL SALES PRICE (above foundation)		100 %

AL F.O.B. FACTORY PRICE: $____________

TOTAL SALES PRICE (Above the Foundation) $____________

COST OF STRUCTURE BREAKDOWN

INCLUDING: Materials, Labor, Delivery, Lift & Secure
EXCLUDING: Selling, General, & Administrative Expenses, Overhead & Profit

GENERAL BREAKDOWN			DETAILED BREAKDOWN		
Item	Manhours for Each Item	Cost ($) Materials & Labor	Item	Factory Costs ($) Materials & Labor	On-Site Costs ($) Materials & Labor
STRUCTURAL (Framing)			Floor Framing & Subfloor		
			Wall Framing (exclude: interior dry wall or plaster; interior or exterior finishes)		
			Ceiling Framing		
			Roof Framing		
EXTERIOR CLOSURE Non-Load Bearing exclude: electrical, plumbing, HVAC, & other building equip.			Exterior Wall (exclude: interior dry wall or plaster; interior or exterior finishes.)		
			Exterior Door Units		
			Exterior Window Units		
			Exterior Painting		
			Exterior Trim & Ornamentation		
ROOFING			include: insulation, vapor barrier, & roofing materials		
INTERIOR VERTICAL ELEMENTS Non-Load Bearing			Partitions (exclude: electrical, plumbing, HVAC, & other building equip.)		
			Interior Door Units		
INTERIOR FINISHES			Interior Dry Wall or Plastering (for Exterior Walls)		
			Interior Painting		
			Other Wall Finish		
			Ceiling Finish		
			Floor Finish		
VERTICAL CIRCULATION Non-Load Bearing			Stairs		
			Other (List)		
PLUMBING			Distribution System		
			Fixtures & Hardware		
HEATING, VENTILATING, AIR-CONDIT.			Heating & Cooling Equip.		
			Distribution System		
			Hardware(grilles,etc.)		
ELECTRICAL			Distribution System		
			Fixtures & Hardware		
DWELLING UNIT EQUIPMENT			Kitchen Appliances,Cabinets		
			Bathroom Equipment (include: bathtub, shower, toilet, sink, & cabinets)		
			Other Equip. (List)		
FURNISHINGS			Carpeting		
			Furniture		
			Other Furnishing (List)		
DELIVERY use 100 miles delivery distance					
LIFT & SECURE					
TOTAL					

I would greatly appreciate a floor plan of the dwelling unit you have selected.

[The] information you provide will be held in the strictest [c]onfidence and will be reported anonymously in aggregate [f]orm for cost analysis only.

Massachusetts Institute of Technology
Attn.: Norman Quon
Building E-40
Cambridge, Mass. 0213[9]

QUESTIONNAIRE

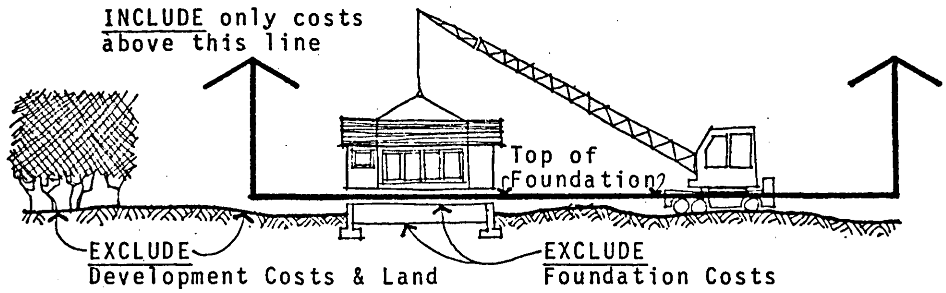
[C]ompany Name: ______

[N]ame of Producer of Factory-Fabricated Box: ______

[I]NSTRUCTIONS

A. SELECT A TYPICAL MODEL FROM YOUR AVAILABLE LINE, WHICH APPROXIMATES:
 a) Net Floor Area: 1,000 sq.ft. c) 1 Bathroom
 b) 3 Bedroom Unit d) No Carport or Garage

B. INCLUDE ONLY THE COSTS ABOVE THE TOP OF THE FOUNDATION LINE



C. BASE ALL YOUR DATA FOR THE REMAINDER OF THE QUESTIONNAIRE ON THE DWELLING UNIT YOU HAVE SELECTED.

[D]WELLING UNIT INFORMATION

[A]ctual Net Floor Area (sq.ft.) ______
[C]eiling Height.............. ______
[A]ctual Number of Bedrooms... ______
[A]ctual Number of Bathrooms.. ______
[W]eight of Model (tons)........ ______
[M]ax. Stories Possible If Stacked.... ______

[O]ff-Site Labor for Chosen Model:

	Percent (%)	Average Hourly Wage Rate ($)	Union? Yes	Union? No
Unskilled				
Skilled				

Housing Types Possible (Please check):

Single-Family Detached ☐ Row House Apt. ☐ Walk-Up Apt. ☐
Medium-Rise Apt. ☐ Hi-Rise Apt. ☐

Building Codes Your Model Conforms To:

Uniform Building Code (ICBO) ☐ BOCA Code (Bldg Off & Code Admin) ☐ Southern Bldg Code ☐ FHA Minimum Property Standards ☐

Other? ______

[C]OST INFORMATION

(excluding: Land, Foundation & Site Development Costs)

[P]ercent Breakdown [o]f Sales Price		Percent (%)
[F].O.B. Factory Price		
[D]elivery Expenses		
Lift & Secure	Materials	
	Labor	
On-Site Finishing	Materials	
	Labor	
[S]elling Expenses		
[G]eneral & Administrative Expenses		
[F]inancing Expenses		
[O]verhead & Profit (Before Taxes)		
[T]OTAL SALES PRICE(above foundation)		100 %

TOTAL SALES PRICE (Above the Foundation): $______

00141

COST OF STRUCTURE BREAKDOWN

INCLUDE: F.O.B. Factory Price, Your Costs for: Delivery,Erection,Materials,Labc
EXCLUDE: Selling, General, & Administrative Expenses, Overhead & Profit

GENERAL BREAKDOWN			DETAILED BREAKDOWN	
Item (On-Site Finishing)	Manhours for Each Item	Cost ($) Materials & Labor	Item (On-Site Finishing)	On-Site Finishing Costs ($) Materials & Labor
STRUCTURAL Load Bearing			Floor Framing & Subfloor	
			Wall Framing (exclude: interior dry wall or plaster; interior or exterior finishes)	
			Ceiling Framing	
			Roof Framing	
			Other (list)	
EXTERIOR CLOSURE Non-Load Bearing exclude: electrical, plumbing, HVAC, & other building equip.			Exterior Wall (exclude: interior dry wall or plaster; interior or exterior finishes)	
			Exterior Door Units	
			Exterior Window Units	
			Exterior Painting	
			Exterior Trim	
ROOFING			include: insulation,vapor barrier, & roofing materials	
INTERIOR VERTICAL ELEMENTS Non-Load Bearing			Partitions (exclude: electrical, plumbing, HVAC, & other building equip.)	
			Interior Door Units	
INTERIOR FINISHES			Interior Dry Wall or Plastering (for Exterior Walls)	
			Interior Painting	
			Other Wall Finish	
			Ceiling Finish	
			Floor Finish	
VERTICAL CIRCULATION Non-Load Bearing			Stairs Non-Load Bearing	
			Other (list)	
PLUMBING			Distribution System	
			Fixtures & Hardware	
HVAC			Heating & Cooling Equip.	
			Distribution System	
			Hardware (grilles,etc.)	
ELECTRICAL			Distribution System	
			Fixtures & Hardware	
OTHER EQUIPMENT			Kitchen Appliances,Cabinets	
			Bathroom Equipment (include: bathtub, shower, toilet, sink, & cabinets)	
			Other (list)	
FURNISHINGS			Carpeting	
			Furniture	
			Other (list)	
F.O.B.PRICE OF MODEL				
DELIVERY use 100 miles delivery distance				
LIFT & SECURE				
TOTAL				

The information you provide will be held in the strictest confidence and will be reported anonymously in aggregate form for cost analysis only.

Massachusetts Institu
of Technolo
Attn.: Norman Quon
Building E-40
Cambridge, Mass. 021

QUESTIONNAIRE

110

Company Name: __________

Factory Size (sq.ft.)......... __________

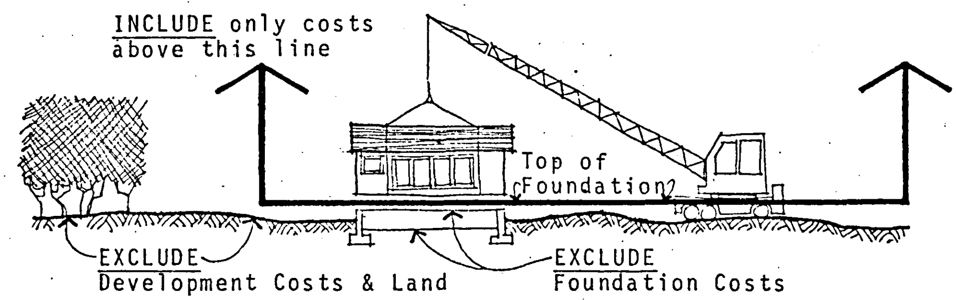
Assume one shift/day,
Current Production Rate (dwelling units/day) __________

Plant Design Capacity (dwelling units/day).. __________

INSTRUCTIONS

A. SELECT A TYPICAL MODEL FROM YOUR PRODUCT LINE, WHICH APPROXIMATES:
a) Net Floor Area: 1,000 sq.ft.
b) 3 Bedroom Unit
c) 1 Bathroom
d) No Carport or Garage

B. INCLUDE ONLY THE COSTS ABOVE THE TOP OF FOUNDATION LINE



C. BASE ALL YOUR DATA FOR THE REMAINDER OF THE QUESTIONNAIRE ON THE MODEL YOU HAVE SELECTED.

MODEL INFORMATION

Actual Net Floor Area (sq.ft.) __________

Ceiling Height.............. __________

Actual Number of Bedrooms... __________

Weight of Model (tons)........ __________

Actual Number of Bathrooms.. __________

Max. Stories Possible If Stacked.... __________

Off-Site Labor for Chosen Model:

	Percent (%)	Average Hourly Wage Rate ($)	Union? Yes	Union? No
Unskilled				
Skilled				

Dimensions of Dwelling Unit __________

Housing Types Possible (Please check):

Single-Family Detached ☐ Row House Apt. ☐ Walk-Up Apt. ☐

Medium-Rise Apt. ☐ Hi-Rise Apt. ☐

Building Codes Your Model Conforms To:

Uniform Building Code (ICBO) ☐ BOCA Code (Bldg Off & Code Admin) ☐ Southern Bldg Code ☐ FHA Minimum Property Standards ☐

Other? __________

Structural Material(s): __________

COST INFORMATION

Percent Breakdown of F.O.B. Factory Price:

	Percent (%)
Material	
Direct Labor	
Indirect Labor	
Delivery Expense (fixed or unfixed)	
Selling Expense	
General & Administrative Expenses	
Overhead & Profit (Before Taxes)	
Other Expenses (List)	
TOTAL F.O.B. FACTORY PRICE	100 %

00143

TOTAL F.O.B. FACTORY PRICE: $ __________

OST OF STRUCTURE BREAKDOWN

NCLUDING: Materials, Direct Labor, Indirect Labor, Delivery, Lift & Secure
XCLUDING: Selling, General, & Administrative Expenses, Overhead & Profit

GENERAL BREAKDOWN			DETAILED BREAKDOWN		
Item	Manhours for Each Item	Cost ($) Materials & Labor	Item	Factory Costs ($) Materials & Labor	On-Site Finishing Costs ($) Materials & Labor
STRUCTURAL (Framing)			Floor Framing & Subfloor		
			Wall Framing (exclude: interior dry wall or plaster; interior or exterior finishes)		
			Ceiling Framing		
			Roof Framing		
EXTERIOR CLOSURE Non-Load Bearing exclude: electrical, plumbing, HVAC, & other building equip.			Exterior Wall (exclude: interior dry wall or plaster; interior or exterior finishes)		
			Exterior Door Units		
			Exterior Window Units		
			Exterior Painting		
			Exterior Trim & Ornamentation		
ROOFING			include: insulation, vapor barrier, & roofing materials		
INTERIOR VERTICAL ELEMENTS Non-Load Bearing			Partitions (exclude: electrical, plumbing, HVAC, & other building equip.)		
			Interior Door Units		
INTERIOR FINISHES			Interior Dry Wall or Plastering (for Exterior Walls)		
			Interior Painting		
			Other Wall Finish		
			Ceiling Finish		
			Floor Finish		
VERTICAL CIRCULATION Non-Load Bearing			Stairs		
			Other (List)		
PLUMBING			Distribution System		
			Fixtures & Hardware		
HEATING, VENTILATING, AIR-CONDIT.			Heating & Cooling Equip.		
			Distribution System		
			Hardware (grilles, diffusers)		
ELECTRICAL			Distribution System		
			Fixtures & Hardware		
DWELLING UNIT EQUIPMENT			Kitchen Appliances, Cabinets		
			Bathroom Equipment (include: bathtub, shower, toilet, sink, & cabinets)		
			Other Equipment (List)		
FURNISHINGS			Carpeting		
			Furniture		
			Other Furnishings (List)		
DELIVERY use 100 miles delivery distance					
LIFT & SECURE					
TOTAL					

I would greatly appreciate a floor plan of the dwelling unit you have selected.

Massachusetts Institut
of Technolog
Attn.: Norman Quon
Building E-40
Cambridge, Mass. 0213

he information you provide will be held in the strictest onfidence and will be reported anonymously in aggregate rom for cost analysis only.

QUESTIONNAIRE

ompany Name: ______________

actory Size (sq.ft.)......... ______________

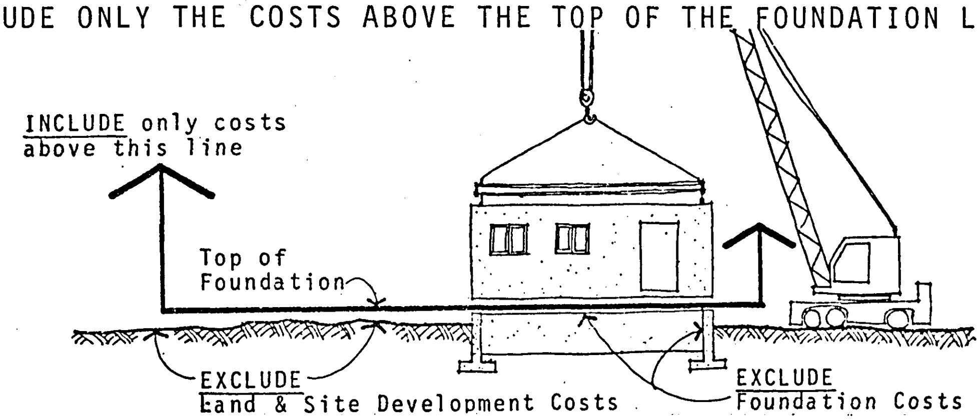
Assume one shift/day,
Current Production Rate (dwelling units/day) ______________

Plant Design Capacity (dwelling units/day).. ______________

NSTRUCTIONS

A. SELECT A TYPICAL MODEL FROM YOUR PRODUCT LINE, WHICH APPROXIMATES:
   a) Net Floor Area: 1,000 sq.ft.   c) 1 Bathroom
   b) 3 Bedroom Unit   d) No Carport or Garage

B. INCLUDE ONLY THE COSTS ABOVE THE TOP OF THE FOUNDATION LINE



C. BASE ALL YOUR DATA FOR THE REMAINDER OF THE QUESTIONNAIRE ON THE DWELLING UNIT YOU HAVE SELECTED.

WELLING UNIT INFORMATION

ctual Net Floor Area (sq.ft.) ______________

eiling Height............. ______________

ctual Number of Bedrooms... ______________

ctual Number of Bathrooms.. ______________

eight of Model (tons)........ ______________

ax. Stories Possible If Stacked.... ______________

all Thickness (in.)......... ______________

ff-Site Labor for Chosen Model:

	Percent (%)	Average Hourly Wage Rate ($)	Union? Yes	No
Unskilled				
Skilled				

Housing Types Possible (Please check):

Single-Family Detached ☐   Row House Apt. ☐   Walk-Up Apt. ☐

Medium-Rise Apt. ☐   Hi-Rise Apt. ☐

Building Codes Your Model Conforms To:

Uniform Building Code (ICBO) ☐   BOCA Code (Bldg Off & Code Admin) ☐   Southern Bldg Code ☐   FHA Minimum Property Standards ☐

Other? ______________

OST INFORMATION

ercent Breakdown of F.O.B. Factory Price:

	Percent (%)
Materials	
Direct Labor	
Indirect Labor	
Delivery Expense (fixed or unfixed)	
Selling Expense	
General & Administrative Expenses	
Overhead & Profit (Before Taxes)	
Other Expenses (List)	
TOTAL F.O.B. FACTORY PRICE	100 %

00145

F.O.B. FACTORY PRICE OF CHOSEN MODEL $______________

OST OF STRUCTURE BREAKDOWN

NCLUDING: Materials, Direct Labor, Indirect Labor, Delivery, Lift & Secure
XCLUDING: Selling, General, & Administrative Expenses, Overhead & Profit

GENERAL BREAKDOWN Item	Manhours for Each Item	Cost ($) Materials & Labor	DETAILED BREAKDOWN Item	Factory Costs ($) Materials & Labor	On-Site Finishing Costs ($) Materials & Labor
TRUCTURAL			Floor Slab (include: slab on grade)		
			Load-Bearing Walls (exclude: interior dry wall or plaster; interior or exterior finishes)		
			Roof Deck		
			Stairs (Load-Bearing)		
Load Bearing			Other (list)		
EXTERIOR CLOSURE Non-Load Bearing xclude: electrical, lumbing, HVAC, & ther building equip.			Non-Load Bearing Exterior Wall (exclude: interior dry wall or plaster; interior or exterior finishes)		
			Exterior Door Units		
			Exterior Window Units		
			Exterior Painting		
			Exterior Trim		
ROOFING			include: insulation, vapor barrier, & roofing materials		
INTERIOR VERTICAL ELEMENTS Non-Load Bearing			Partitions (exclude: electrical, plumbing, HVAC, & other building equip.)		
			Interior Door Units		
INTERIOR FINISHES			Interior Dry Wall or Plastering (for Exterior Walls)		
			Interior Painting		
			Other Wall Finish		
			Ceiling Finish		
			Floor Finish		
VERTICAL CIRCULATION Non-Load Bearing			Stairs (Non-Load Bearing)		
			Elevators		
			Other (list)		
PLUMBING			Distribution System		
			Fixtures & Hardware		
HVAC			Heating & Cooling Equip.		
			Distribution System		
			Hardware (grilles, etc.)		
ELECTRICAL			Distribution System		
			Fixtures & Hardware		
BUILDING EQUIPMENT			Kitchen Appliances, Cabinets		
			Bathroom Equipment (include: bathtub, shower, toilet, sink, & cabinets)		
			Other Equipment (list)		
FURNISHINGS			Carpeting		
			Furniture		
			Other Furnishings (list)		
DELIVERY se 100 miles delivery distance					
LIFT & SECURE					
TOTAL					

Any sales literature, photographs, or technical drawings of your models and your production process would be greatly appreciated.

e information you provide will be held in the strictest
nfidence and will be reported anonymously in aggregate
rm for cost analysis only.

Massachusetts Institut
of Technolog
Attn.: Norman Quon
Building E-40
Cambridge, Mass. 0213

QUESTIONNAIRE

mpany Name: ____________

ctory Size(sq.ft.).......... ____________

Assume one shift/day,

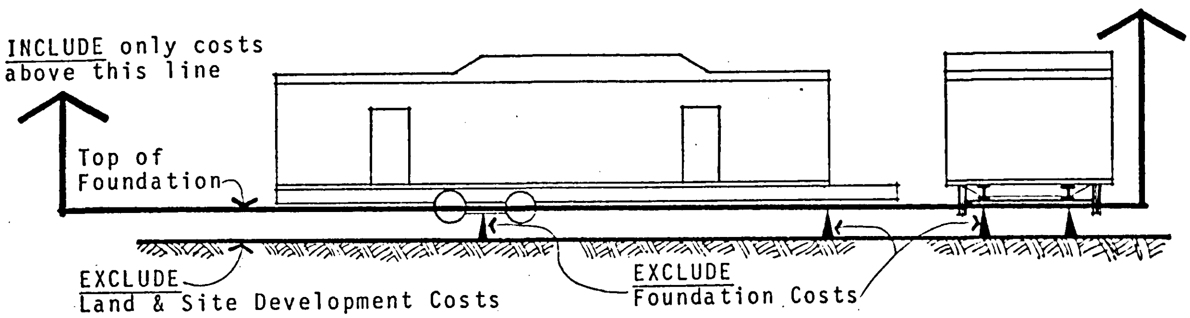
Current Production Rate(dwelling units/day) ____________

Plant Design Capacity(dwelling units/day) .. ____________

NSTRUCTIONS

A. SELECT A TYPICAL MODEL FROM YOUR PRODUCT LINE, WHICH APPROXIMATES:
- a) Net Floor Area: 1,000 sq.ft.
- b) 3 Bedroom Unit
- c) 1 Bathroom
- d) No Carport or Garage

B. INCLUDE ONLY THE COSTS ABOVE THE TOP OF THE FOUNDATION LINE



C. BASE ALL YOUR DATA FOR THE REMAINDER OF THE QUESTIONNAIRE ON THE DWELLING UNIT YOU HAVE SELECTED.

WELLING UNIT INFORMATION

tual Net Floor Area(sq.ft.). ____________

iling Height............. ____________

tual Number of Bedrooms... ____________

tual Number of Bathrooms.. ____________

ight of Model (tons)........ ____________

x. Stories Possible If Stacked.... ____________

Housing Types Possible (Please check):

Single-Family Detached ☐ Row House Apt. ☐ Walk-Up Apt. ☐

Medium-Rise Apt. ☐ Hi-Rise Apt. ☐

f-Site Labor for Chosen Model:

	Percent (%)	Average Hourly Wage Rate ($)	Union? Yes	Union? No
Unskilled				
Skilled				

Building Codes Your Model Conforms To:

Uniform Building Code (ICBO) ☐ BOCA Code (Bldg Off & Code Admin) ☐ Southern Bldg Code ☐ FHA Minimum Property Standards ☐

Other? ____________

COST INFORMATION

ercent Breakdown of
.O.B. Factory Price

	Percent (%)
Materials	
Direct Labor	
Indirect Labor	
Delivery Expense	
Selling Expense	
General & Administrative Expenses	
Overhead & Profit (Before Taxes)	
Other Expenses (List)	
TOTAL F.O.B. FACTORY PRICE	100%

00147

F.O.B. FACTORY PRICE OF CHOSEN MODEL $____________

COST OF STRUCTURE BREAKDOWN

INCLUDING: Materials, Direct Labor, Indirect Labor, Delivery, Lift & Secure
EXCLUDING: Selling, General, & Administrative Expenses, Overhead & Profit

GENERAL BREAKDOWN			DETAILED BREAKDOWN	
Item	Manhours for Each Item	Cost ($) Materials & Labor	Item	Cost ($) Materials & Labor
STRUCTURAL (Framing)			Floor Framing & Subfloor	
			Wall Framing (exclude: interior dry wall or plaster; interior or exterior finishes)	
			Ceiling Framing	
			Roof Framing	
EXTERIOR CLOSURE Non-Load Bearing exclude: electrical, plumbing, HVAC, & other building equip.			Exterior Wall (exclude: interior dry wall or plaster; interior or exterior finishes)	
			Exterior Door Units	
			Exterior Window Units	
			Exterior Painting	
			Exterior Trim & Ornamentation	
ROOFING			include: insulation, vapor barrier, & roofing materials	
INTERIOR VERTICAL ELEMENTS Non-Load Bearing			Partitions (exclude: electrical, plumbing, HVAC, & other building equip.)	
			Interior Door Units	
INTERIOR FINISHES			Interior Dry Wall or Plastering (for Exterior Walls)	
			Interior Painting	
			Other Wall Finish	
			Ceiling Finish	
			Floor Finish	
VERTICAL CIRCULATION Non-Load Bearing			Stairs	
			Other (List)	
PLUMBING			Distribution System	
			Fixtures & Hardware	
HEATING, VENTILATING, AIR-CONDIT.			Heating & Cooling Equip.	
			Distribution System	
			Hardware (grilles, diffusers)	
ELECTRICAL			Distribution System	
			Fixtures & Hardware	
DWELLING UNIT EQUIPMENT			Kitchen Appliances, Cabinets	
			Bathroom Equipment (include: bathtub, shower, toilet, sink, & cabinets)	
			Other Equipment (List)	
FURNISHINGS			Carpeting	
			Furniture	
			Other Furnishings (List)	
DELIVERY use 100 miles delivery distance				
LIFT & SECURE				
TOTAL				

Any sales literature, photographs, or technical drawings of your models and your production process would be great appreciated.

APPENDIX 4 : COST MODEL

Profile: ________ Classification: ____________________

I. SOURCE

1.	Name	
2.		
3.		
4.		

II. BACKGROUND INFORMATION

REGION

1.	Name	
2.	Region #	
3.	Metropolitan or Rural Area	

COST

4.	Total Sales Price (with Land)	$ Total	
5.		$/SqFt	
6.		$/CuFt	
7.	Construction Cost	$ Total	
8.	(includes/excludes) foundation & excavation costs	$/SqFt	
9.		$/CuFt	
10.	Structure Cost	$ Total	
11.	(includes/excludes) foundation & excavation costs	$/SqFt	
12.		$/CuFt	
13.	Construction Date		
14.	Current Cost Index		
15.	Project Cost Index		
16.	Revised Sales Price (with land)	$ Total	
17.		$/SqFt	
18.		$/CuFt	
19.	Revised Construction Cost	$ Total	
20.		$/SqFt	
21.		$/CuFt	

Profile #_____

22.	Revised Structure Cost	$ Total	
23.		$/SqFt	
24.		$/CuFt	

PHYSICAL CHARACTERISTICS OF DWELLING UNITS

25.	Generic Type	
26.	Housing type	
27.	Structural Material	
28.	Structural Type	

29.	Story Height	

30.	Net Floor Area	
31.	Ceiling Height	
32.	Total Volume of Dwelling Unit (CuFt)	
33.	Number of Bedrooms	
34.	Number of Bathrooms	
35.	Carport?	
36.	Garage?	

37.	Wall Thickness	
38.	Panel Sizes	

39.	Total Weight of Dwelling Unit (Tons)	
40.	Pounds/cubic feet	

LABOR CHARACTERISITCS

41.	Unskilled	Percentage	
42.	Workers	Average Wage Rate	
43.		Union?	
44.	Skilled	Percentage	
45.	Workers	Average Wage Rate	
46.		Union?	

Profile #____

VOLUME OF BUSINESS

47.	Dwelling Units/Year	

FACTORY

48.	Factory Size	
49.	Production Rate	
50.	Plant Design Capacity	

POSSIBLE HOUSING TYPES

51.	Housing Type # 1	
52.	Housing Type # 2	
53.	Housing Type # 3	
54.	Housing Type # 4	
55.	Housing Type # 5	

BUILDING CODES CONFORMING TO

56.	Building Code # 1	
57.	Building Code # 2	
58.	Building Code # 3	
59.	Building Code # 4	
60.	Building Code # 5	
61.	Building Code # 6	

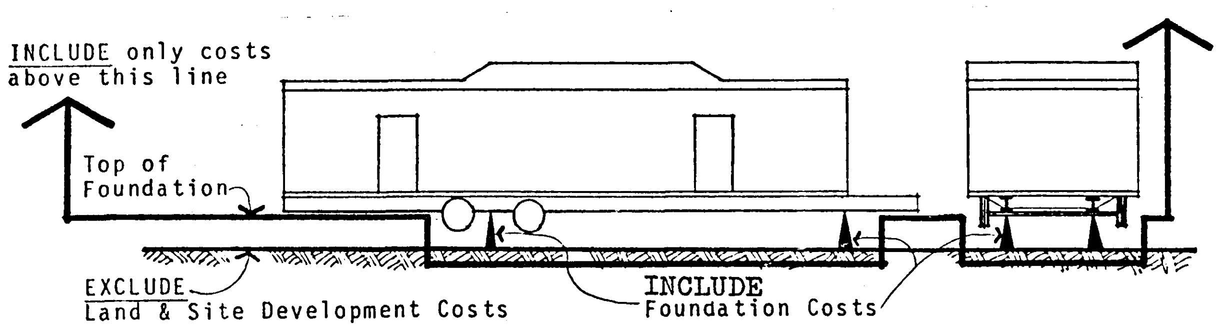
Profile #____ INDUSTRIALIZED

IV. CONSTRUCTION COST "A"

DEALER-DEVELOPER'S COST

1.	Structure Cost "A"	Foundation & Excavation	Material			
2.			Equip.			
3.			Labor			
4.		F.O.B. Factory Price				
5.		Lift & Secure	Material			
6.			Equip.			
7.			Labor			
8.		On-Site Finishing	Material			
9.			Equip.			
10.			Labor			
11.	Selling Expenses					
12.	General & Administrative Expenses					
13.	Financing Expenses[1]					
14.	Overhead & Profit	Overhead				
15.		Profit				

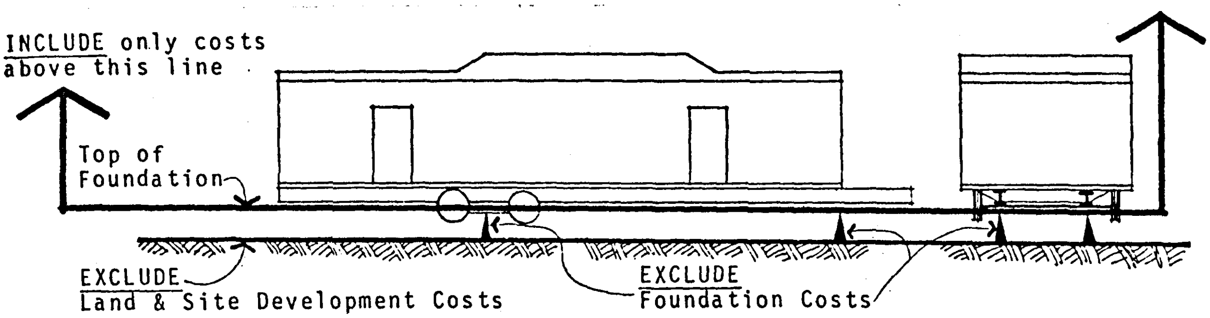
[1] (includes / excludes) Mortgage Points



Profile #____

IV. CONSTRUCTION COST "B" (exclude foundation & excavation)

MOBILE HOME



F.O.B. FACTORY PRICE

1.	Structure Cost "B"	Materials			
2.		Equipment			
3.		Labor			
4.	Delivery Expenses (miles)				
5.	Selling Expenses				
6.	General & Administrative Expenses				
7.	Overhead & Profit	Overhead			
8.		Profit			
9.	Other				

DEALER'S SELLING PRICE

1.	F.O.B. Factory Price				
2.	Delivery Expenses (miles)				
3.	Lift & Secure	Materials			
4.		Equipment			
5.		Labor			
6.	On-Site Finishing	Materials			
7.		Equipment			
8.		Labor			
9.	Selling Expense				
10.	General & Administrative Expenses				
11.	Financing Expenses [1]				
12.	Overhead & Profit	Overhead			
13.		Profit			

[1] (includes / excludes) Mortgage Points

Profile #____

INDUSTRIALIZED

IV. MOBILE HOME PARK DEVELOPMENT COST (includes land)

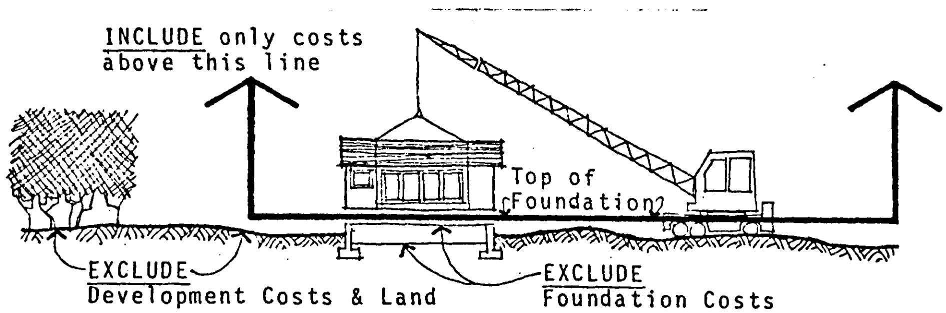
1.	Development Cost	Land Acquisition				
2.		Site Prep. & Finish'g				
3.		Development Fees				
4.		Foundation & Excavation	Material			
5.			Equip.			
6.			Labor			
7.						
8.	Structure Finishing Costs	Lift & Secure	Material			
9.			Equip.			
10.			Labor			
11.		On-Site Finishing	Material			
12.			Equip.			
13.			Labor			
14.	Selling Expenses					
15.	General & Administrative Expenses					
16.	Financing Expenses[1]					
17.	Overhead & Profit	Overhead				
18.		Profit				

[1] (includes / excludes) Mortgage Points

Profile #____

BOX/FRAME

IV. CONSTRUCTION COST "B"
(exclude foundation & excavation)



F.O.B. FACTORY PRICE

1.	Structure Cost "B"	Materials			
2.		Equipment			
3.		Labor			
4.	Delivery Expenses (miles)				
5.	Selling Expenses				
6.	General & Administrative Expenses				
7.	Overhead & Profit	Overhead			
8.		Profit			
9.	Other				

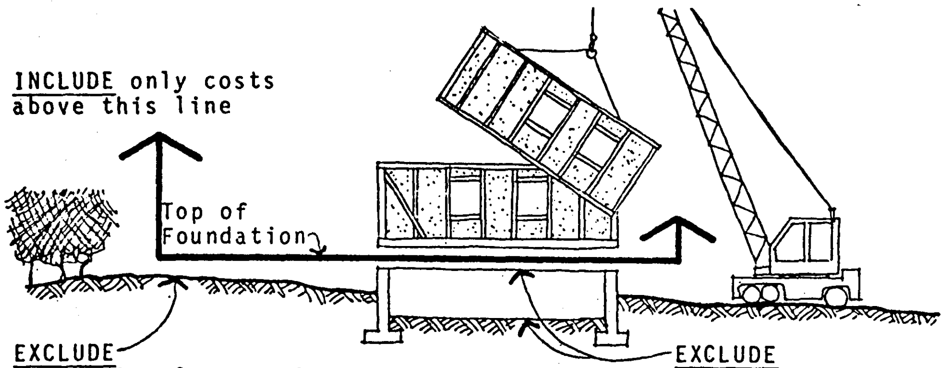
ON-SITE CONSTRUCTION COSTS

1.	F.O.B. Factory Price				
2.	Delivery Expenses (miles)				
3.	Lift & Secure	Materials			
4.		Equipment			
5.		Labor			
6.	On-Site Finishing	Materials			
7.		Equipment			
8.		Labor			
9.	Selling Expense				
10.	General & Administrative Expenses				
11.	Financing Expenses[1]				
12.	Overhead & Profit	Overhead			
13.		Profit			

[1] (includes / excludes) Mortgage Points

Profile #____

IV CONSTRUCTION COST "B" COMPONENT/FRAME
(exclude foundation & excavation)



F.O.B. FACTORY PRICE

1.	Structure Cost "B"	Materials			
2.		Equipment			
3.		Labor			
4.	Delivery Expenses (miles)				
5.	Selling Expenses				
6.	General & Administrative Expenses				
7.	Overhead & Profit	Overhead			
8.		Profit			
9.	Other				

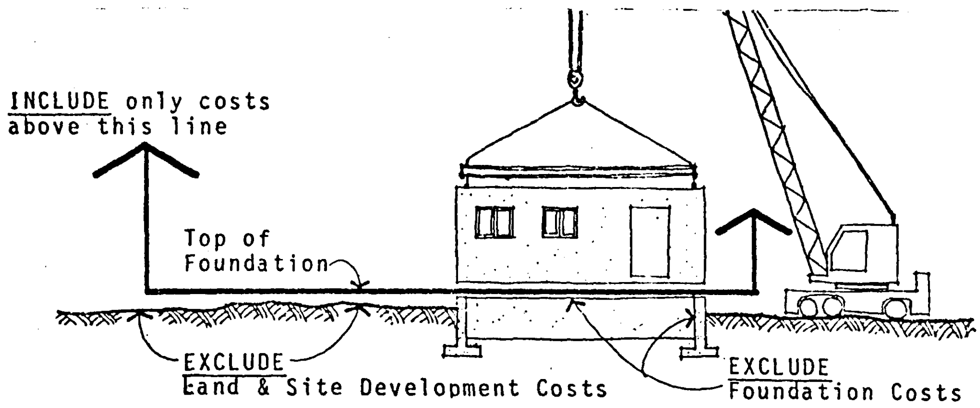
ON-SITE CONSTRUCTION COSTS

1.	F.O.B. Factory Price				
2.	Delivery Expenses (miles)				
3.	Lift & Secure	Materials			
4.		Equipment			
5.		Labor			
6.	On-Site Finishing	Materials			
7.		Equipment			
8.		Labor			
9.	Selling Expenses				
10.	Gneral & Administrative Expenses				
11.	Financing Expenses [1]				
12.	Overhead & Profit	Overhead			
13.		Profit			
	[1] (includes / excludes) Mortgage Points				

Profile #____

IV. CONSTRUCTION COST "B" (exclude foundation & excavation)

BOX/BEARING WALL



	F.O.B. FACTORY PRICE				
1.	Structure Cost "B"	Materials			
2.		Equipment			
3.		Labor			
4.	Delivery Expenses (miles)				
5.	Selling Expenses				
6.	General & Administrative Expenses				
7.	Overhead & Profit	Overhead			
8.		Profit			
9.	Other				

	ON-SITE CONSTRUCTION COSTS				
1.	F.O.B. Factory Price				
2.	Delivery Expenses (miles)				
3.	Lift & Secure	Materials			
4.		Equipment			
5.		Labor			
6.	On-Site Finishing	Materials			
7.		Equipment			
8.		Labor			
9.	Selling Expenses				
10.	General & Administrative Expenses				
11.	Financing Expenses[1]				
12.	Overhead & Profit	Overhead			
13.		Profit			

1 (includes / excludes) Mortgage Points

Profile #______ Cost/SqFt________

V. GENERAL STRUCTURE COST "B" Area:____________
(excludes foundation & excavation)

SHELL	Structural System			
	Exterior Closure			
	Roofing System			
	Interior Vertical*			
FINISHES	Exterior Finishes			
	Interior Finishes			
MECHANICAL	Vertical Circulation [2]			
	Plumbing			
	HVAC			
	Electrical			
	Refuse Dispo'l System			
APPLIANCES & FURNISHINGS	Appliances & Furnishings [1]			
DELIVERY	Delivery [3]			
LIFT & SECURE	Lift & Secure			

[1] (includes / excludes) kitchen, bathroom, utility appliances & furnishings

[2] (includes / excludes) Stairs, elevators

[3] miles delivery distance

*Non-load bearing only

Profile #____ Cost/SqFt:________

Area:________

VI. DETAILED STRUCTURE COST "A"
(includes foundation & excavation)

FOUNDATION	Excavation & Fill				
	Septic System				
	Footing or Piling				
	Foundation				
STRUCTURAL SYSTEM (load-bearing)	Columns				
	Walls	Exterior			
		Interior			
	Stairs				
	Ceiling				
	Roof				
	Floors				
EXTERIOR CLOSURE (non-load bearing)	Exterior Walls				
	Exterior Doors				
	Exterior Windows				
ROOFING SYSTEM	Roofing System				
INTERIOR VERTICAL ELEMENTS	Partitions (non-load)				
	Interior Door				
	Interior Windows				
EXTERIOR FINISHES	Exterior Painting				
	Exterior Trim & Ornm't.				
INTERIOR FINISHES	Wall Finish	Dry Wall			
		Plaster[1]			
		Tile ceramic			
		Tile other			
	Ceiling Finish	Plaster[1]			
		Suspended Clg.			
	Finish Flooring	Wood Flooring			
		Tile ceramic			
		Tile other			
		Carpeting[2]			
	Interior Painting				
	Other Int. Trim & Touchup				

[1] (includes / excludes) lath, furring, stucco

[2] (includes / excludes) carpeting (include only if no other floor finish)

Profile #____

VERTICAL CIRCULATION	Stairs**			
	Elevators			
PLUMBING	Distribution System			
	Fixtures & Hardware			
HVAC	Heating Equipment			
	Cooling Equipment			
	Fans, Ventilating Equipment			
	Distribution System			
	Hardware & Fixtures			
ELECTRICAL	Distribution System			
	Fixtures & Hardware			
REFUSE DISPOSAL SYST.	Bins & Equipment			
	Distribution System			
APPLIANCES & FURNISHINGS***	Kitchen Appliances			
	Kitchen cabinets & counters			
	Utility Equipment[1]			
	Bathroom Furnishings			
	Other cabinets & enclosures			
DELIVERY (miles)				
LIFT & SECURE				

**Non-load bearing only

***No furninture will be included

Note: Only the items listed above will be used for comparison.

1 (includes / excludes) Clothes washer, dryer, utility sink

Profile #_____

Cost/SqFt_________

Area:_____________

V. GENERAL STRUCTURE COST "A"
(includes foundation & excavation)

FOUNDATION	Foundation[1]			
SHELL	Structural System			
	Exterior Closure			
	Roofing System			
	Interior Vertical*			
FINISHES	Exterior Finishes			
	Interior Finishes			
MECHANICAL	Vertical Circulation[3]			
	Plumbing			
	HVAC			
	Electrical			
	Refuse Disposal System			
APPLIANCES & FURNISHINGS	Appliances & Furnishings[2]			
DELIVERY	Delivery[4]			
LIFT & SECURE	Lift & Secure			

1(includes/excludes) foundation, footing, piling, excavation, fill, septic system

2(includes/excludes) kitchen, bathroom, utility appliances & furnishings

3(includes/excludes) Stairs, elevators

4 miles delivery distance

*Non-load bearing only

Profile #_____ Cost/SqFt:________

Area:__________

VI. DETAILED STRUCTURE COST "B"
(excludes foundation & excavation)

STRUCUTRAL SYSTEM (load-bearing)	Columns				
	Walls	Exterior			
		Interior			
	Stairs				
	Ceiling				
	Roof				
	Floors				
EXTERIOR CLOSURE (non-load bearing)	Exterior Walls				
	Exterior Doors				
	Exterior Windows				
ROOFING SYSTEM	Roofing System				
INTERIOR VERTICAL ELEMENTS	Partitions (non-load)				
	Interior Doors				
	Interior Windows				
EXTERIOR FINISH	Exterior Painting				
	Exterior Trim & Ornamentation				
INTERIOR FINISHES	Wall Finish	Dry Wall			
		Plaster[1]			
		Tile ceramic			
		Tile other			
	Ceiling Finish	Plaster[1]			
		Suspended Clg.			
	Finish Flooring	Wood Flooring			
		Tile ceramic			
		Tile other			
		Carpeting[2]			
	Interior Painting				
	Other Int. Trim & Touchup				

[1] (includes / excludes) lath, furring, stucco

[2] (includes / excludes) carpeting (include only is no other floor finish)

Profile #_____

VERTICAL CIRCULATION	Stairs**			
	Elevators			
PLUMBING	Distribtuion System			
	Fixtures & Hardware			
HVAC	Heating Equipment			
	Cooling Equipment			
	Fans, Ventilating Equipment			
	Distribution System			
	Hardware & Fixtures			
ELECTRICAL	Distribution System			
	Fixtures & Hardware			
REFUSE DISPOSAL SYSTEM	Bins & Equipment			
	Distribution System			
APPLIANCES & FURNISHINGS***	Kitchen Appliances			
	Kitchen cabinets & counters			
	Utility Equipment[1]			
	Bathroom Furnishings			
	Other Cabinets & enclosures			
DELIVERY (miles)				
LIFT & SECURE				

**Non-load bearing only

***No Furniture will be included

Note: Only the items listed above will be used for comparison.

[1] (includes / excludes) Clothes washer, dryer, utility sink

VOLUME III:

DESIGNER 'S WORKBOOK

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1.0 AN OVERVIEW OF HOUSING

1.1 The Need For Housing

It is undeniable that there exists a need for housing in the United States. By 1967, these needs had become so critical that two Presidential Commissions were appointed to evaluate the problem and come up with specific recommendations. The National Commission in Urban Problems, headed by Paul H. Douglas, was established on January 12, 1967, and charged to: 1) ". . . work with the Department of Housing and Urban Development and conduct a penetrating review of zoning, housing, and building codes, taxation, and development standards. These processes have not kept pace with the times. Stunting growth and opportunity, they are springboards from which many of the ills of urban life flow."[1]; 2) ". . . recommend the solutions, particularly those ways in which the Federal Government, private industry, and local communities can be marshalled to increase the supply of low-cost decent housing."[2] On June 2, 1967, the Committee on Urban Housing, headed by Edgar F. Kaiser, was established and charged to ". . . find a way to harness the productive power of America - which has proven it can master space and create unmatched abundance in the market place - to the most pressing unfilled need of our society. That need is to provide the basic necessities of a decent home and healthy surroundings for every American family now imprisoned in the squalor of the slums."[3]

"Housing needs" is both an ambiguous and an overused term. To determine its significance it must first be explicitly defined. Both Presidential Commissions chose to define "housing needs" as the necessity to build additional units in order to: 1) replace occupied housing that is substandard (dilapidated or lacking essential plumbing facilities); 2) replace occupied housing that is crowded (having more than one person per room[4]); 3) the need to require some vacancies to allow freedom of choice.[5]

1.1.1 Douglas Commission's Assessment

The Douglas Commission expressed a grave concern over the need for adequate housing in the United States; ". . . those most likely to live in substandard housing are the poor nonwhite who have big families and are renters. But they are not alone. A third of our affluent nation cannot afford adequate, non-subsidized housing today, despite great gains in the housing stock."[6] The Commission further found that there were in 1968, ". . . at the very least, 11 million substandard and overcrowded dwelling units (6.9 million substandard, 3.9 crowded units in standard units). This is 16 percent of the total housing inventory."[7] Although there does exist a housing need in the entire nation, the Commission felt that this issue tended to mask the critical aspect of the problem, that of the slum dweller; "In cities where the general average for substandard overcrowded units is only 10 percent, 40 percent of the housing in slum areas may be deficient."[8] Many misconceptions obscure the real problem of supplying decent housing; "undeniably the trickly-down theory does work for part of the population, but it falls short of supplying enough housing for low-income families principally because: 1) the availability of the lowest cost housing is not always where the poor can get it, and because 2) so much of the cheapest available housing is substandard, that is lacking indoor plumbing and hot water, badly deteriorated, or overcrowded."[9] To solve the minimum housing needs by 1980, the Douglas Commission strongly recommended that 2 to 2½ million new housing units be built a year, of which 500,000 a year would be specially reserved for people in the lower income brackets.

1.1.2 The Kaiser Commission's Assessment

Upon receiving its charge on June 2, 1967, the Kaiser Commission found that reliable information for assessing the housing need was extremely difficult to obtain. Therefore, they commissioned TEMPO (General Electric Center for Advanced Studies) to make an in-depth computerized study of current and future U.S. housing construction and subsidy requirements. TEMPO estimated in 1968, that there were about 60 million housing units and 60 million households. Of these 60 million housing units: 1) 6.7 million occupied units were substandard (4 million lacking indoor plumbing and 2.7 million in dilapidated condition); 2) 6.1 million units (both standard and substandard) were overcrowded with more than one person per room; 3) of the 6 million vacant units, only about 2 million were in standard condition and available for occupancy (this was the nations lowest available vacancy rate since 1958).[10]

The Douglas Commission's recommendations and findings were reinforced by the findings of the Kaiser Commission. Estimates suggested a growing shortage of decent housing in the U.S. To provide enough standard housing by 1978 for the entire population, the following requirements were set: "1) Build 13.4 million units for new young families during the decade ahead, 2) Replace or rehabilitate 8.7 million units that will deteriorate into substandard conditions, 3) Replace 3 million standard units that will be either accidently destroyed or purposefully demolished for non-residential reuses, 4) Build 1.6 million units to allow for enough vacancies for our increasingly mobile population."[11]

Along with the growing shortage of housing for the entire population in the U.S., the Kaiser Commission found that a decent home is still unaffordable to many of the nation's lower income families. In 1968, the following conditions were estimated: "1) About 7.8 million American families - one in every eight - cannot now afford to pay the market price for standard housing that would cost no more than 20 percent of their incomes (average ratio of housing costs to gross income for the total population is 15%); 2) About half of these 7.8 million families are surviving on less than $3,000 a year - Federal poverty level."[12] Projections to 1978 - assuming no marked changes in current economic trends, in national policies, or in priorities among Federal programs - showed a slight decline to 7.5 million families (1 in every 10) still unable to afford standard housing. In 1968, 56% lived in urban areas with 50,000 or more population. But by 1978, 60% of all families requiring housing assistance are expected to be urban dwellers.[13]

1.1.3 1970 Census of Housing

The 1970 Census of Housing counts confirm most of the housing estimates used by the two Presidential Commissions in 1968. The actual total housing inventory in 1970 was 68.7 billion units.[14] The predicted total housing figures for 1970, employed by the Douglas Commission, was 69.5 Million. The Kaiser Commission used 66 million housing units for 1968. Adding two million new starts for 1969 and part of 1970 to the 1968 total, the total housing estimate for 1970 resulted in 68 million. Thus, both Presidential Commissions predicted fairly accurate totals for the 1970 housing inventory.

From the total inventory of 68,679,030 housing units, 1,022,464 were used as seasonal and migratory units, bringing the number of available units for year round use to 67,656,566. Of these units, only 63,449,747 were actually occupied, leaving a total of 4,206,819 (6.1% of the total inventory) year round units vacant.[15]

The first housing need, as defined by the Douglas Commission, was to build additional housing units to replace occupied substandard housing. Substandard housing consists of: 1) dilapidated (as classified by the census); and 2) lacking essential plumbing facilities. Unfortunately, figures on the physical condition of the building (sound, deteriorating, and dilapidated) are not available. The only figure that can be confirmed is the lack of essential plumbing facilities. A total of 4,672, 345 housing units lacked essential plumbing facilities in 1970. The Kaiser Commission, estimating in 1968 that 4 million occupied units lacked indoor plumbing, was very close. The Douglas Commission does not give a breakdown of those units lacking essential plumbing facilities and those which are dilapidated. However, if the Kaiser Commission figure of 2.7 million dilapidated units is assumed correct, then it is found that the Douglas Commission estimate of 4.2 million units lacking essential plumbing is even closer than the Kaiser Commission estimate.

The second housing need consisted of building additional units to replace occupied housing that was over crowded (having more than one person per room). In order to avoid double counting (once for those lacking plumbing facilities and once for overcrowding), only crowded households in standard units were counted in the total housing needs. There existed an actual total of 5,210,874 units that were crowded. The Kaiser Commission's estimate was slightly higher (6.1 million standard and substandard). Of this estimate, 4,464,367 units were standard but crowded. The Douglas Commission's estimate was slightly lower (3.9 million) than the actual count.

The serious concern of both Presidential Commissions over the need for low-income housing was confirmed by the 1970 Census of Housing. It found that 36.8% of all Negro-occupied housing lacked plumbing facilities, were overcrowded, or both.[16] The problem was further increased when the 1970 Census of Housing found that housing units inside the SMSA[17] increased from 1960 to 1970 by 27.2%. The central city also increased in housing units by 15.1%.[18]

1.1.4 Recent Predictions

The Institute of the Future conducted a study for the Owens Corning Fiberglas Corporation during the second half of 1969 and the early months of 1970, to predict the 1985 prospects for residential housing. The base information for the study came from an interdisciplinary panel of experts using the Delphi prediction technique. Each panel member was sent a written questionnaire. This questionnaire was systematically elicited, processed, and returned to the experts for further deliberation. In this manner, substantive forcasts were obtained and concensus was promoted among the experts. The reader is referred to the appendix for a list of panel members.

The Institute of the Future's study concurred with two of the Douglas Commission's definitions of housing need: 1) replacement of substandard units; and 2) maintenance of a reasonable minimum vacancy rate. The existence of crowded units was not considered representative of a need for additional units. It was argued that "reduction of crowded units does not necessarily require additional housing units but only larger units,[19] because when a new (larger) unit is provided for the crowded household, a standard unit is vacated, with that standard unit becoming available in the inventory. If a crowded unit were the result of a doubled-up family, then this would be considered a need.

The Institute further broke down housing needs to consist of: 1) the total backlog of housing needs; and 2) housing desires. It considered housing desires to be "pertinent to marketing studies of the nature of the housing units which are likely to be most saleable to the demand for second homes, and to any scaling-up of the general quality of housing, rather than to the total housing demand per se."[20] Thus, it mainly concerned itself with the backlog of housing needs.

The backlog of needs defined by the Institute of the Future consisted of: 1) replacement of standard units; 2) provision of additional units for nonprimary families and individuals; and 3) satisfaction of necessary quantity of vacancies.[21]

Figures 1.1 to 1.4 are presented for the reader's review of the Institute's analysis. The final results of the needs can be found on figure 1.4. These needs have been estimated to remain at 10 million units from 1973 until 1985. They are slightly less than those projected by either the Kaiser Commission or the Douglas Commission.

Next, single-family homes, multifamily units, and mobile homes were studied. The annual rate of increase in total inventory as a fraction of both new starts and mobile homes added that year was graphed. The downward trend of this graph (figure 1.5) indicates an increasing abandonment rate. The ratio is expected to reach 45 percent by 1985.

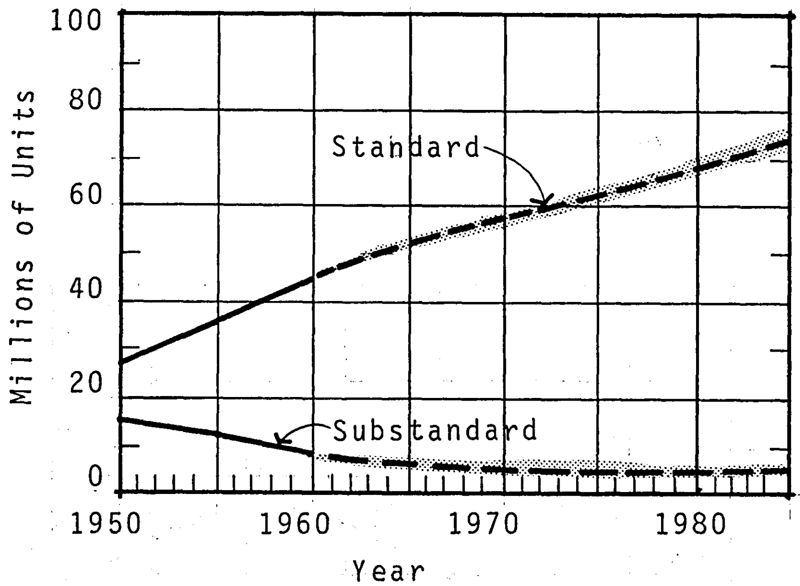


Figure 1.1 - QUALITY OF OCCUPIED HOUSING

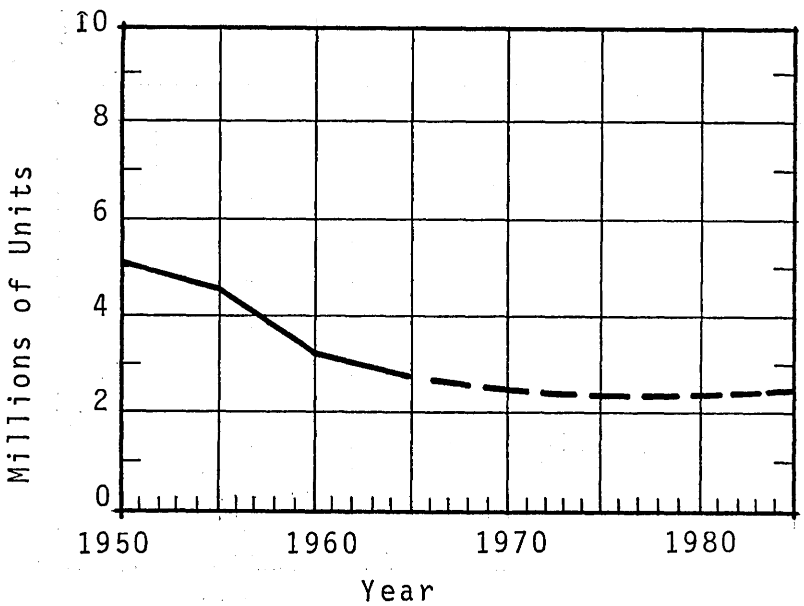


Figure 1.2 - HOUSING UNIT NEEDS FOR NONPRIMARY FAMILIES & INDIVIDUALS

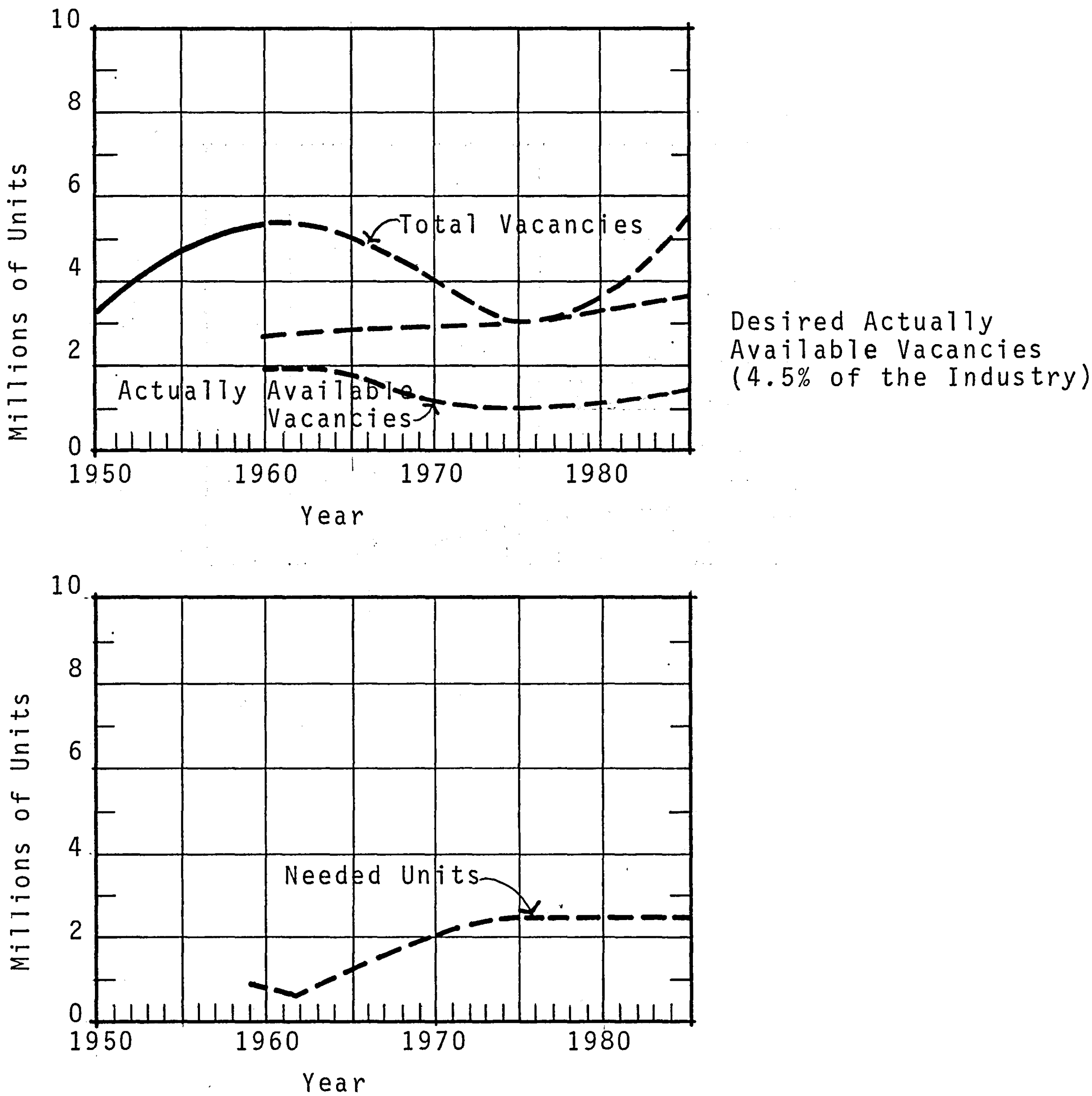


Figure 1.3 - VACANT HOUSING UNIT NEEDS

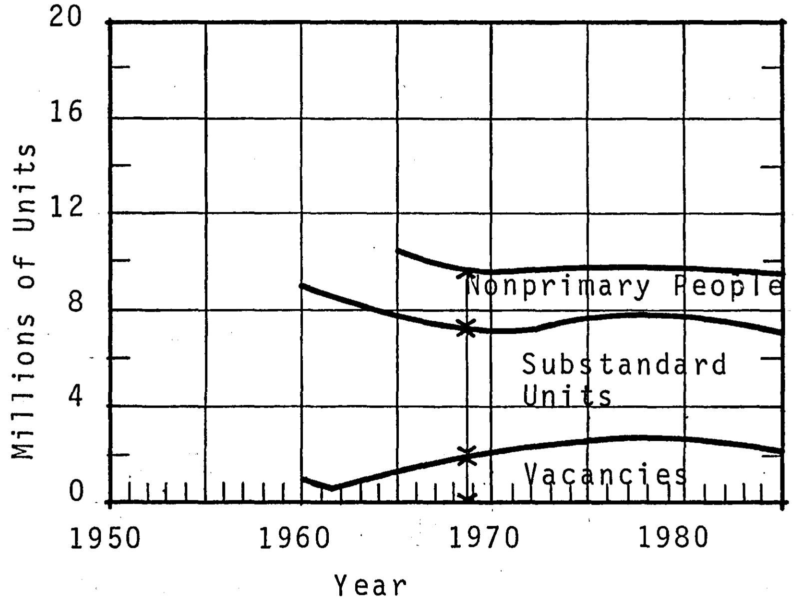


Figure 1.4 - TOTAL HOUSING NEEDS BACKLOG

Thus, by 1985, for every new unit produced, there will be a net addition of .45 unit to the existing housing stock. Housing production is expected to experience an abrupt change in rate. A look at figure 1.5 shows that this rate will double by 1985, to 2.85 million units per year. The Kaiser Commission's goal of 26 million units, by 1978, is not expected to be reached. The total number of new starts between 1968 and 1978 is forcasted at 17 million. Even with mobile homes, this total is only expected to reach 21 million units.

There exists a great need for housing - both now and in the future. Recent studies (Douglas Commission Study, Kaiser Commission Study, Institute of The Future Study) show this need will remain until 1985. Though the housing production is expected to double by 1985, the housing needs will still be considerable. As a result of the need to provide housing for low-income groups, the panel of experts from the Institute of The Future predicts that, "The cost of housing responsive to severally accepted minimum levels of space and facilities will exceed that affordable by many who are in need of such units. This is likely to result in: 1) a lowering of the minimum levels of acceptability; 2) greater housing subsidies."[22]

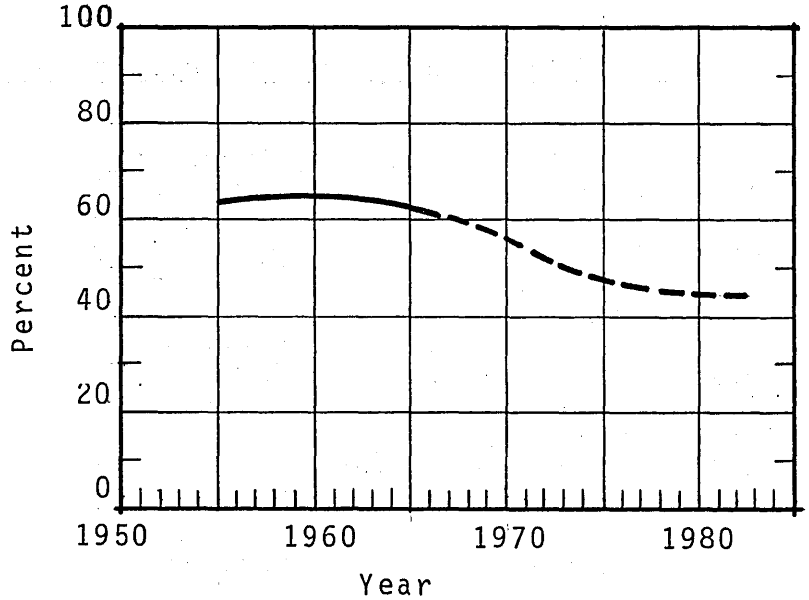


Figure 1.5 - INVENTORY CHANGES PER NEW HOUSING START INCLUDING NEW MOBILE HOMES

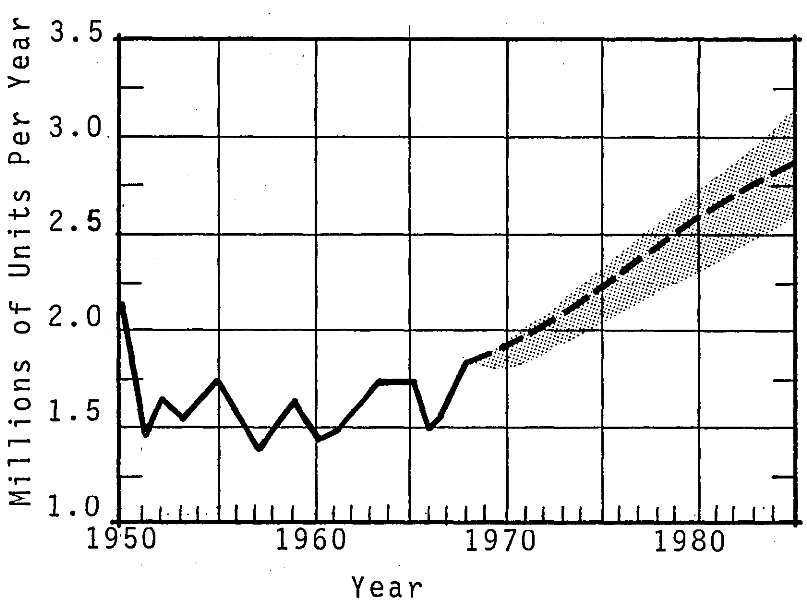


Figure 1.6 - NEW HOUSING STARTS (NONFARM) AND MOBILE HOME PRODUCTION

1.2 The Participants And The Housing Process

> Management responsibility in the housing industry is divided among many poorly coordinated elements. In addition to various types of builders, the industry is made up of material manufacturers and suppliers, general contractors, subcontractors, labor unions, several types of investors, realtors, various classes of mortgage lenders, subdividers, and land developers, and many Federal, state, and local government agencies. There is little effective communication among these groups or between them and the consumer of the product.[23]

The housing development process in the United States is emersed in a vast network of intricate parts - interrelated participants, laws and regulations, activities, standards, needs and requirements, functions and numerous other factors, both public and private. All the control and management of this process focuses on one primary individual - the developer. The multitude of participants involved in the development of housing is endless, as can be seen from figure 1.7. It soon becomes obvious, after studying the process, that there exist too many factors clouding the picture: 1) the uniqueness of each project - taking place in a specific plot of land, in a specific locality, with factors very localized; 2) the business of building; 3) the profession of design - architects and engineers; 4) the system of finance - both construction and mortgage financing; 5) the local union regulations and by-laws; 6) the code of community standards; and 7) the variety of people involved -

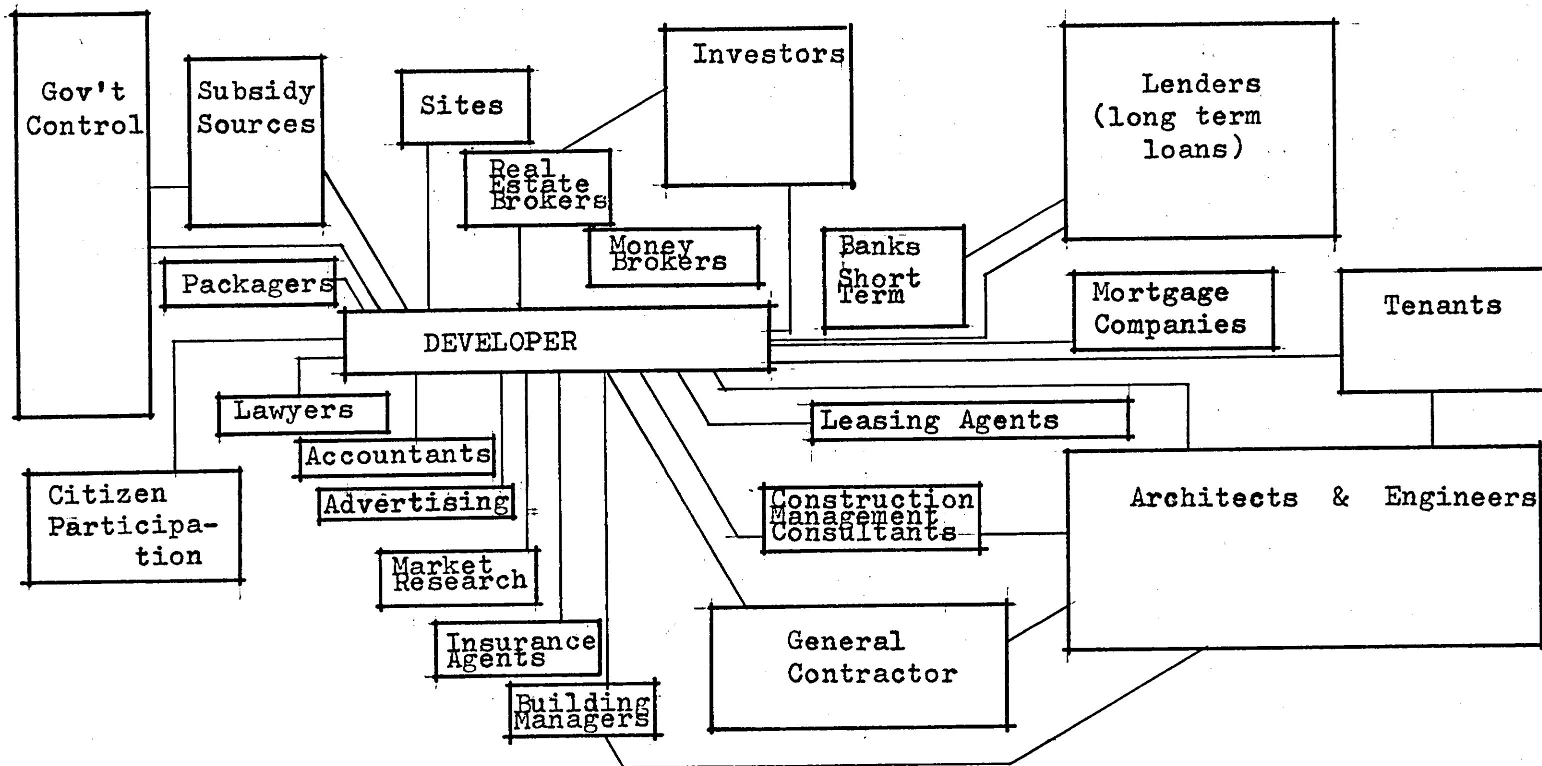


Figure 1.7

Source; Antony Herrey, Class Notes for Course 1.599, Real Estate Dynamics, M.I.T.

from the materials dealer to local building inspectors to the state and local zoning officials to the FHA inspector to the town banker to the work crews of the tiny subcontractor and the general contractor to the newly formed ecology group or citizen participation committee to the lawyer, accountants, real-estate broker, insurance agents, advertising executives, marketing research groups, to the designer.

The boundaries of involvement of all these individual participants is extremely ill-defined. As expressed in the Kaiser report, "Many building and contracting firms are involved not only in housing but in other kinds of light construction. Lenders and real estate brokers who service this industry do much of their business in other areas. Producers and distributors of materials tend to serve the entire construction market rather than specializing in residential construction. Craftsmen and laborers may be building houses one week, but working on missile silos the next. Significantly, the Bureau of the Census does not consider home building to be an industry at all. For example, the Census counts contractors as part of the construction industry, and merchant home builders are part of the real estate industry."[24] Even the main periodicals of the industry do not restrict themselves to housing alone, but also include light construction. Professional Builder calls itself "The Business Magazine of Housing and Light Construction". House and Home calls itself "McGraw-Hill's Marketing and Management Publication of Housing and Light Construction".

The housing process is divided into five phases: 1) Preparation Phase; 2) Production Phase; 3) Distribution Phase; 4) Consumption Phase; and 5) Redistribution Phase. To understand and evaluate this complicated process, the simplified diagram (Figure 1.8) ordering the housing process and its major components is presented. Table 1.1 is then presented to relate, in a time scale, the five phases of the housing process with a detailed account of their related activities. The participants involved in each housing phase in the housing process are next introduced in Table 1.2. It is hoped by this quick presentation that the reader can gain an appreciation of the complexities involved in the housing process.

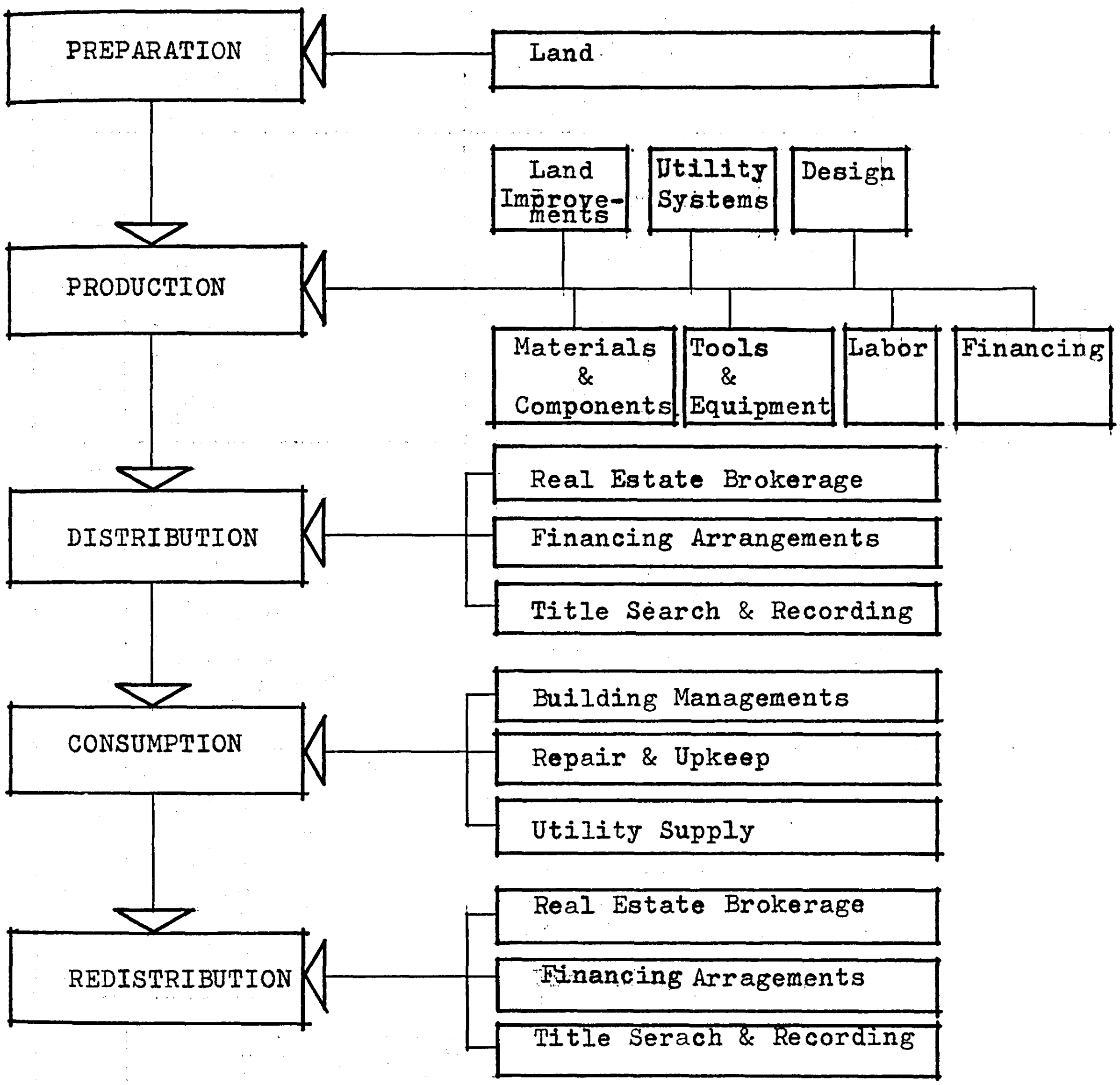


Figure 1.8 - THE HOUSING PROCESS

Source: Kaiser, Edgar F., et. al., A Decent Home, The Report Of The President's Commission On Urban Housing (Washington,D.C.: U.S. Government Printing Office,1969) p. 193
Modified by the Author

Time (approx)	Indefinite	3 months		6 months	60 years (varies)	60 years (varies)
Function	PREPARATION PHASE	PRODUCTION PHASE		DISTRIBUTION PHASE	CONSUMPTION PHASE	REDISTRIBUTION PHASE
General Activity	Site Identification	Site Preparation	Construction	Completion & Sale of Dwelling	Maintenance & Management	Resales
Specific Activity	Raw Land Speculation and Turnover	Financing Raw Land Purchanse Subdivision Engineering, grading, excavation Utility & transportation system installation	Designing Financing Contracting & Subcontracting Purchase of Factor Inputs	Listing Promotion Negotiation Closing Financing Title Search Deed Recording	Repairs Improvements & Additions	Listing Promotion Negotiation Closing Financing Title Search Deed Recording
Public or Quasi-Public Factors	Transfer Taxes (local) Recording Sys. (local) Subdivision Reg. (local, state)	Zoning (local) Subdivision Regulations (local, state) Utility Stand. Usury Laws (state)	Utility Stand. (state) Building Codes (local) Building Fees (local) Construction Licensing (local, state) Transportation Restrictions Usury Laws (st)	Transfer Taxes (local) Recording Syst. (local) Limits on Lending Areas (state, federal) Usury Laws	Property Taxes Income Taxes Housing Codes Health Codes Utility Stand. Usury Laws (st) Zoning Building Codes (local) Mechanical Codes (local) Transport Restr. (federal)	Transfer Taxes (local) Recording Syst. (local) Limits on Lending Areas (state, federal) Usury Laws
Private Factors	Title Insurance	Insurance Standards	Insurance Standards Monopolistic Practices of Arch. & Desin. Mortgage Lend. Material Supy. Union Rules	Title Insurance Monopolistic practices among realty agents, financers, lawyers Lenders Fees	Insurance Standards Restrictive Work Rules Monopolistic Practices among arch. & designers material supplier Mortage Lenders	Title Insurance Monopolistic practices among realty agents, financers, lawyers Lenders Fees

THE PARTICIPANTS IN THE HOUSING PROCESS (Table 1.2)

Function	PREPARATION PHASE	PRODUCTION PHASE	DISTRIBUTION PHASE	SERVICE PHASE	REDISTRIBUTION PHASE
General Activity	Site Identification	Site Preparat. Construction	Completion & Sale of Dwelling	Maintentance & Management	Resale
Management & Control	Developer	Developer	Developer	Owner Property Management Firms	New Owner
Marketing & Transfer	Land Owners Lawyers Real Estate Brokers Title Companies		Lawyers Real Estate Brokers Title Companies		Lawyers Real Estate Brokers Title Companies
Financial Institutions		Lending Institutions FHA, VA, or Private Mortgage Insurance Company Insurance Companies	Lending Institutions FHA, VA, or Private Mortgage Insurance Company	Lending Institutions Insurance Companies Utility Company Tax Assessors	Lending Institutions FHA, VA, or Private Mortgage Insurance Company
Code Officials	Zoning & Planning Officials	Building Code Officials		Local Bldg Officials Local Zoning Officials	
Housing Production	Architects & Engineer Surveyor Planners & Consultants	Architects & Engineer		Architect & Engineers	

THE PARTICIPANTS IN THE HOUSING PROCESS (Table 2.2)

continued	PREPARATION PHASE	PRODUCTION PHASE	DISTRIBUTION PHASE	SERVICE PHASE	REDISTRIBUTION PHASE
Housing Production		Contractors Subcontractors Craftsmen & Their Unions Material Manf. & Distributors		Contractors Sub-Contractors Repairmen, Craftsmen & Their Unions Material Manf. & Distributor Maintenance Firm & Employees	

Tables 2.1 & Table 2.2

Sources: 1) Burns, Leland S. and Mittelbach, Frank G. "Efficiency in the Housing Industry", Housing and Economics, The American Dilemma (Cambridge, Mass.: The M.I.T. Press) p.125

2) Kaiser, Edgar F., et. al. , A Decent Home, The Report Of The President's Committee On Urban Housing (Washington, D.C. : U.S. Printing Office, 1969) p. 115

3) Reorganized by the Author

1.3 The Architect's Role

After studying the whole housing process in its entirety, one begins to get a perspective of the architect's limited role and sphere of influence.

A close look shows very clearly why an architect's decisions are usually overridden. There exist too many other factors - social interworkings, even political actions of the other participants. The architect often forgets that his role is merely one of many that the developer must consider in reaching decisions. Traditionally, the architect concerned himself primarily with the narrow role of design, leaving economic factors to play a secondary role. However, in the hierarchy of the developer, this importance is reversed, with design playing a secondary role. To emphasize this point, the reader is referred to a recent survey conducted by the NAHB which shows the relative importance builders place on the architect's role in housing. The survey shows that only 7% of all the builders surveyed had a staff architect. Moreover, only 29% of the builders had one on a fee basis.[25] It is evident that if the architect is to have any influence at all on the quality of housing being built in this country he must change his focus. He must enlarge his scope of services and become more aware of the economic criteria affecting his designs. He must be able to combine cost with good design.

The A.I.A. has traditionally maintained that it is unethical to become involved in both design and construction. But to become a useful member of the design team, the architect must expand his services to participate in the complete housing process. To do this, the architect must begin a training in business techniques, systems analysis, and management skills so as to effectively compete with the professional developer.

Industrialization is becoming increasingly important. According to the Kaiser Commission report, ". . . On-site builders are making ever greater use of pre-assembled and prefabricated components. Two major types of housing producers - home manufacturers and mobile home producers - carry out a major portion, if not all, of their assembly operations in factories."[26] Unfortunately, the architect has been trained only in the traditional manner of on-site building construction. He has been taught to work out solutions to problems that occur only once. He is ignorant of the production processes that manufacturers use. It is impractical for the manufacturer to radically change his process because of the high investment in costs of facilities and equipment. Therefore, the architect must adapt himself to the manufacturing process. Much of the cause of the architect's ignorance in the production process has been the fault of the manufacturer who tries to keep his process secret, afraid that the competition will use his methods. With industrialization becoming more common however, methods will become more standardized and information will become more widely circulated. The change from stick-built methods to industrialized methods will be very important to the architect. It will be the first time in history that the architect will be able to influence a mass market.

To cope with the coming change, the architect must restructure his thinking and design process to include the following beneficial results of industrialization:

1) Systematic Design Approach: The design parameters must be explicitly defined and a solution arrived at in a rationalized manner - using a logical selection process.
2) Modular Dimensional Coordination: A standard dimensional format for the entire design (including all building systems - plumbing, electrical, HVAC, etc.) should be followed to increase the interchangeability of parts and obtain the maximum advantages of factory production and cost efficiency.
3) Standardization Of Parts: It is often thought that standardization brings boredom in design; looking at nature and studying Corbusier's Modular Schemes will prove otherwise. Standardization brings cost

efficiency. It is up to the architect's imagination and engenuity to achieve good design.

4) Mass Market Approach: Instead of the traditional method of designing one solution for each individual client, the architect must design for a mass consumer market - accounting for consumer needs and desires.

5) Design For The Industrialized Production-Assembly Process: Such things as concern for efficient processing, time-saving methods, concern for costs where primary importance is placed on transportation and erection methods should be included.

6) Use Of The Modular As A Design Element: Instead of copying the aesthetic of conventional design, the Modular should be treated as a wholely new design element.

Footnotes For Chapter I

1. Douglas, Paul A., et. al. Building the American City, Report of the National Commission on Urban Problems (Washington, D.C.: U.S. Government Printing Office, 1969) p.VIII.

2. Ibid.

3. Kaiser, Edgar F., et. al. A Decent Home, The Report Of The President's Committee On Urban Housing (Washington D.C. : U.S. Government Printing Office, 1969) p.1.

4. A bathroom is not a room but a kitchen is a room.

5. Douglas, Paul H., op. cit., pp.69-70.

6. Ibid., p.9.

7. Ibid., p.9.

8. Ibid., p.10.

9. Ibid., p.11.

10. Kaiser, Edgar F., op. cit., p.8.

11. Ibid., p.8.

12. Ibid., p.7.

13. Ibid., p.7.

14. U.S. Bureau of Census, Census of Housing: 1970, General Housing Characteristics, Final Report HC(1) - A1, United States Summary (Washington, D.C.: U.S. Government Printing Office, Dec. 1971) p.1-6.

15. Ibid., p.1-16.

16. Ibid., p.1-6.

17. Standard Metropolitan Statistical Areas: A group of contiguous counties which contain at least one city of 50,000 inhabitants or more, or "twin cities" with a combined population of at least 50,000.

18. Census of Housing: 1970, op. cit., p.1-6.

19. Enzer, Selwyn, Some Prospects For Residential Housing By 1985, Report R-13 (Middletown, Conn. : Institute of the Future, 1971) p.27.

20. Ibid., p.29.

21. Ibid., p.24.

22. Ibid., p.5.

23. Meyerson, Martin, et. al., Housing, People, and Cities (New York, N.Y.: McGraw-Hill Book Company, 1962) p.99.

24. Kaiser, Edgar F., op. cit., p.114.

25. Sumichrast, Michael and Frankel, Sara A., Profile of the Builder and His Industry (Washington, D.C. : NAHB-NHC, 1970) p.158.

26. Kaiser, Edgar F., op. cit., p.158.

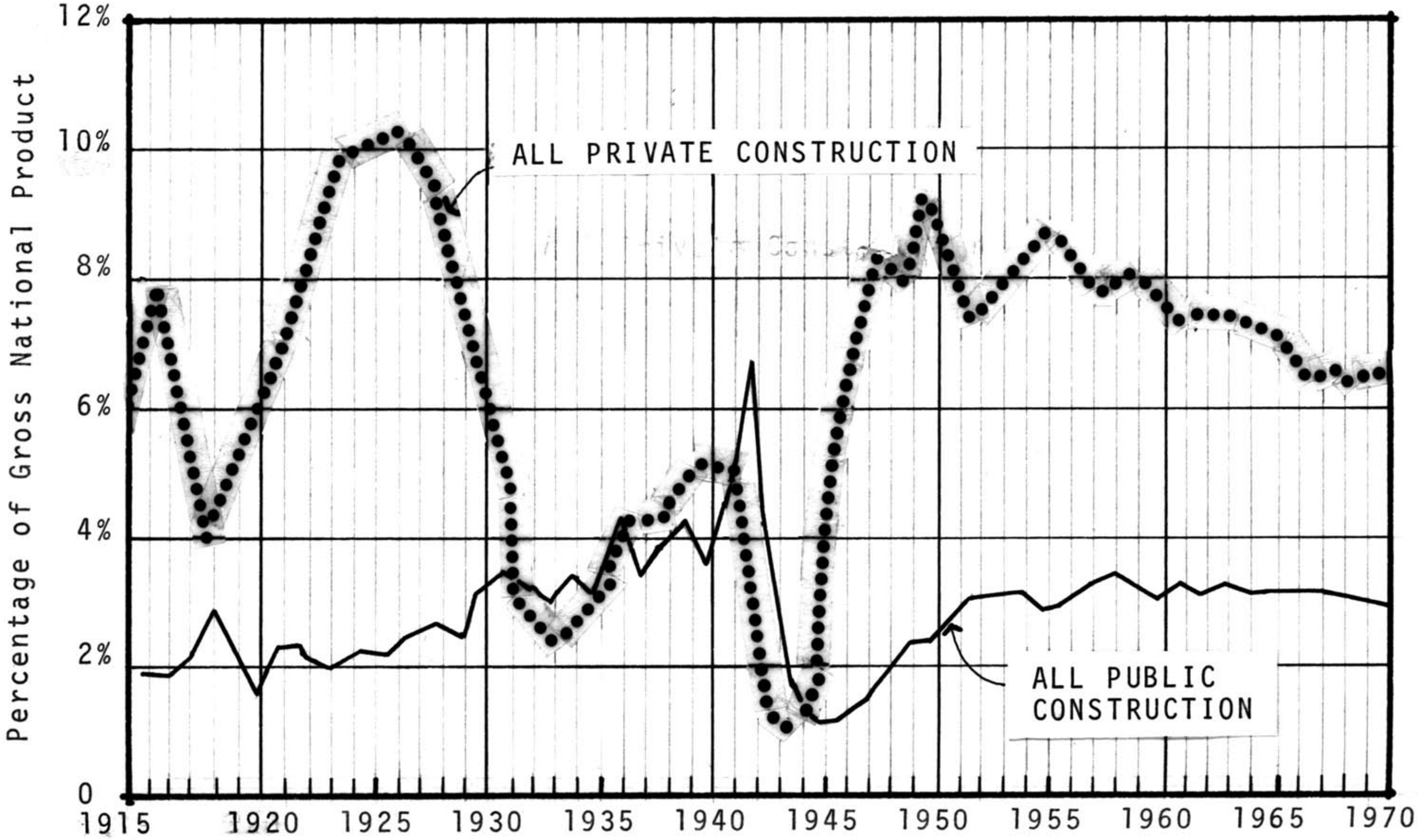
2.0 THE HOUSING INDUSTRY

2.1 A Macroscopic Look At Housing Production In The U.S.

2.1.1 Housing Production, New Construction & GNP

In order to understand the importance of housing production in the U.S., housing construction must be viewed as a part of both total new construction in the U.S. and gross national product. The 1971 projection of total new construction put in place is $108.4 billion, or 10.4% of the gross national product.[1] This is an increase of 15% over 1970, and 16.2% over 1968. As evidenced by figure 2.1, the annual expenditure for total new construction (public and private) has remained fairly constant during peacetime periods, averaging about 10 or 11 percent. Projections for 1972 predict an increase to $117 billion.[2]

Private residential construction amounted to $29.3 billion in 1970.[3] In addition, public residential construction contributed $1.1 billion.[4] On the assumption that eighty percent of the investment in residential construction was used for new housing,[5] it then follows that the total expenditure for housing in 1970 was $24.3 billion. In 1971, private construction for new housing alone accounted for $34.1 billion.[6] Thus, close to a third of total new construction was spent on housing, making it the single



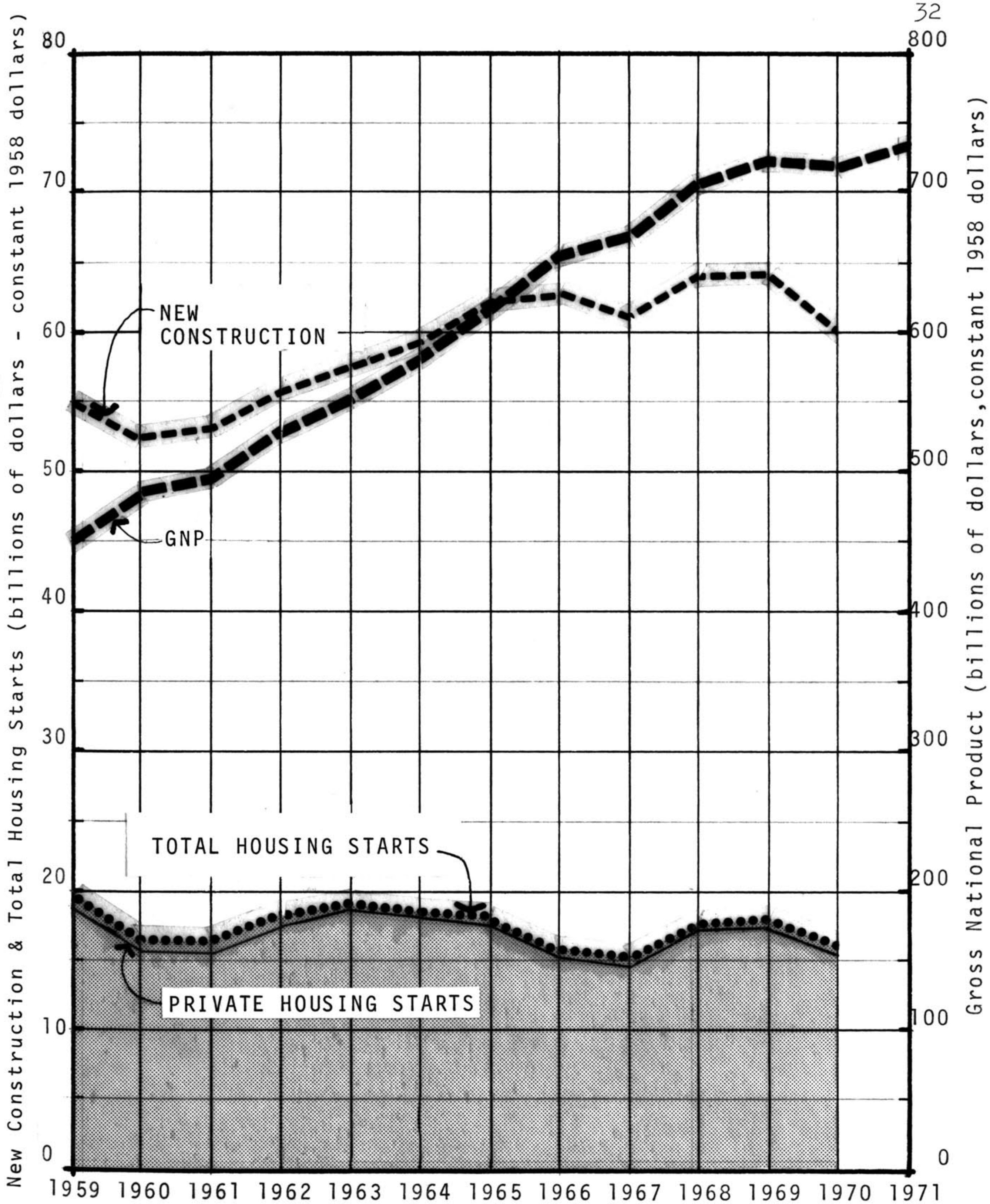
Source: Profile of The Builder & His Industry

Fig. 2.1

most important new construction item.

Private housing makes up the bulk of total housing starts, ranging from 95% to 98%.[7] The dollar output of housing starts remained fairly constant during the years 1959-1970, (figure 2.2), averaging about $17 billion.[8] New construction experienced a growth rate of 3.5% per year between 1960 and 1965.[9] However, since 1965, this output has remained fairly constant, averaging close to $62.5 billion.[10] The gross national product has been experiencing a constant growth rate - from 2.2% per year between 1959-1961, to a high of 4.7% per year from 1961-1969, and to a low of 1.0% per year from 1969-1971.[11] While the production of total housing starts remained constant between 1959-70, the GNP experienced growth. This explains the relative decline of new residential construction as a percentage of GNP between 1959-71, as seen in figure 2.3. Between 1970 and 1971, new residential construction experienced a sharp increase to approximately 4% of the GNP.[12]

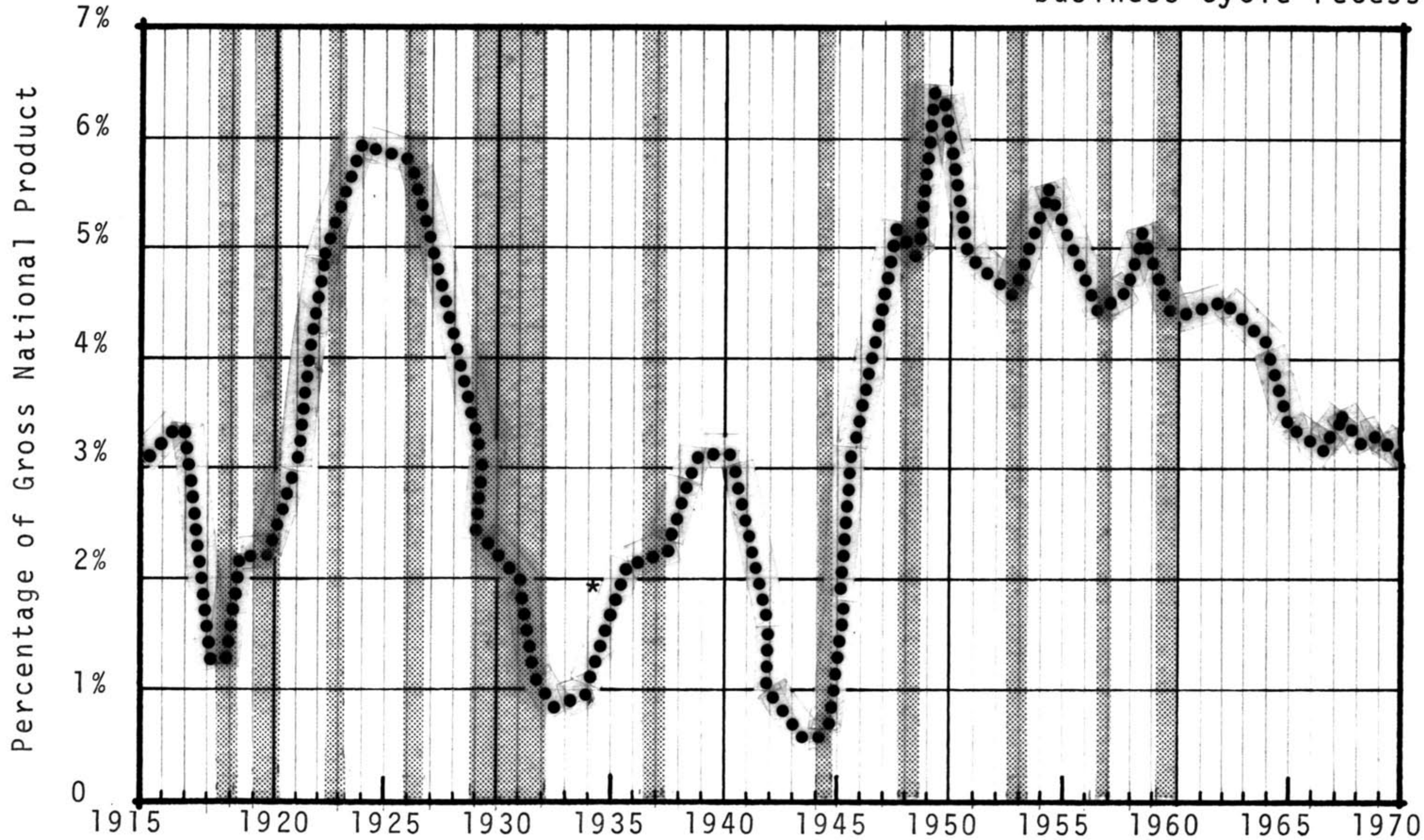
Residential construction is notoriously unstable in character. A look at figure 2.3 illustrates this quite vividly. It is highly susceptible to wide fluctuations in the business cycles, declining periodically with each business recession. Since 1960, housing production, as a percentage of the gross national product, has been declining, largely



Source: Department of Commerce

Fig. 2.2

NEW RESIDENTIAL CONSTRUCTION (Shaded areas represent business cycle recessions)



*1915-1935 private residential only;
1936-1970 private & public

Source: <u>Profile Of The Builder & His Industry</u>

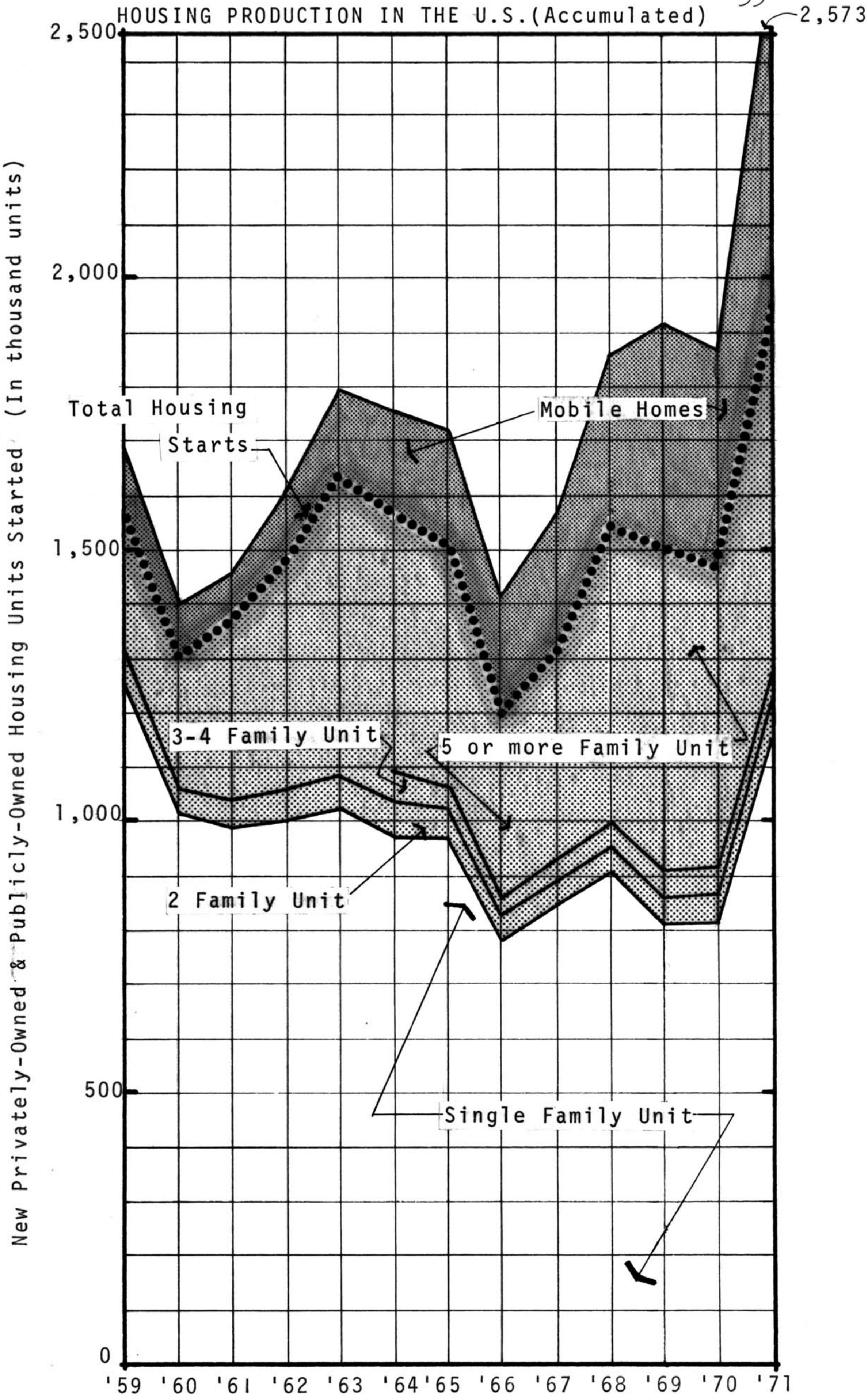
Fig. 2.3

because housing output has tended to oscillate steadily about a constant figure while the GNP has been increasing. From 1969 to 1970, housing production decreased 4%. However, with plenty of available money, control of inflation, and a healthy market demand, the housing sector began a resurgence in the last quarter of 1970. Starting with a low of 1,059,000 units in January 1970, production zoomed to 2,054,000 units in December 1970, and reached 2,517,000 units in December 1971.[13] This is a spectacular increase of 1,458,000 units in two years.

2.1.2 Type of Structure Produced

The single family unit has been steadily losing its dominant position in the housing industry. Figure 2.6 shows that in 1959, 81% of the total housing produced were single family units. Since then, this figure has dropped to a low of 54% in 1969, and 55% in 1970 and 1971. Structures with 5 dwelling units or more have become increasingly important. Starting from a low of 15.7% in 1959 (3 or more units), this figure rose to a high of 39.4% in 1969. It currently accounts for 38.4% of the total production. Structures with 2,3, or 4 family units have a relatively stable production output. However, their total numbers are insignificantly small, amounting to only 3-4% of the total housing production.

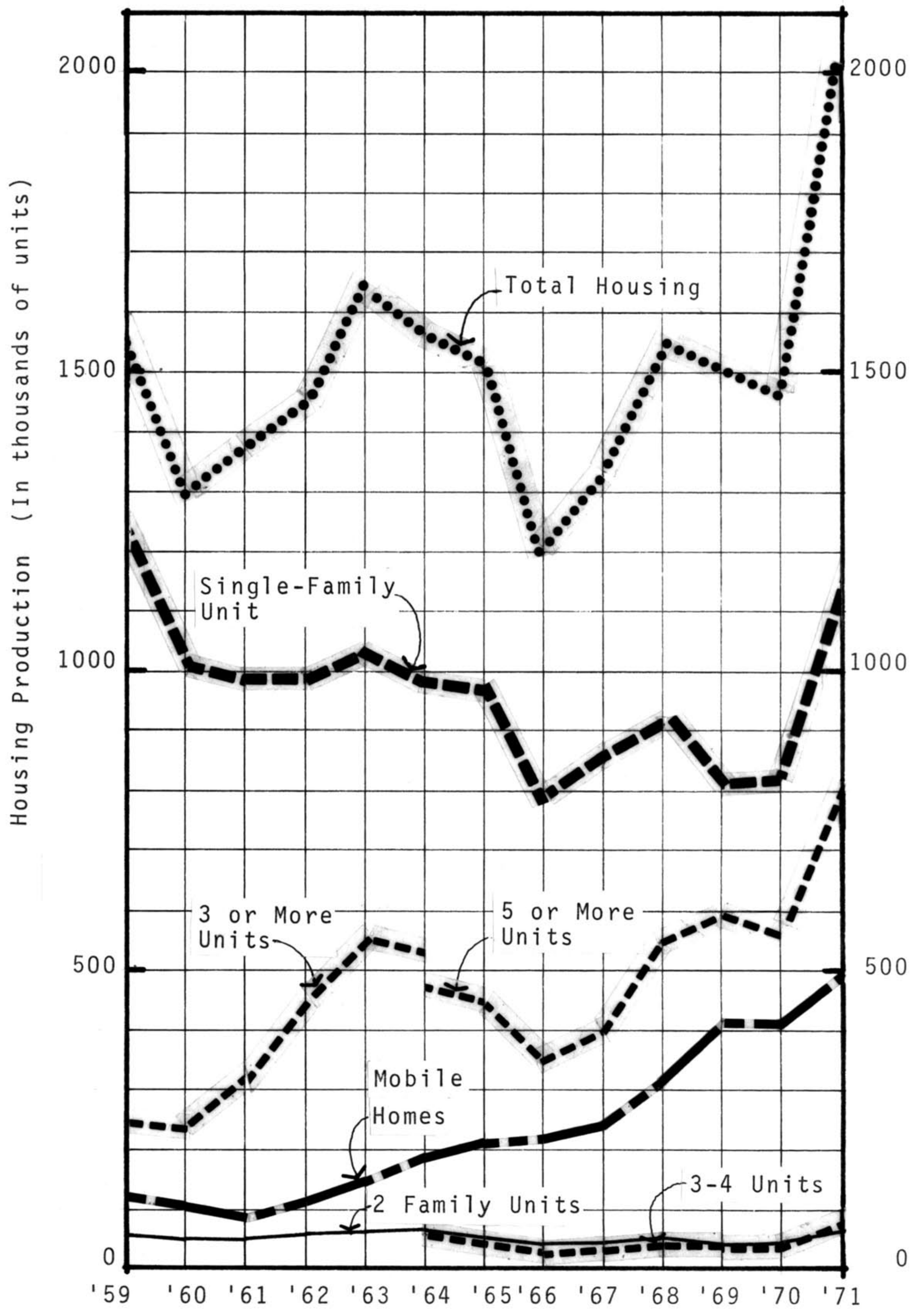
HOUSING PRODUCTION IN THE U.S.(Accumulated)



Source: Dept. of Commerce

Fig. 2.4

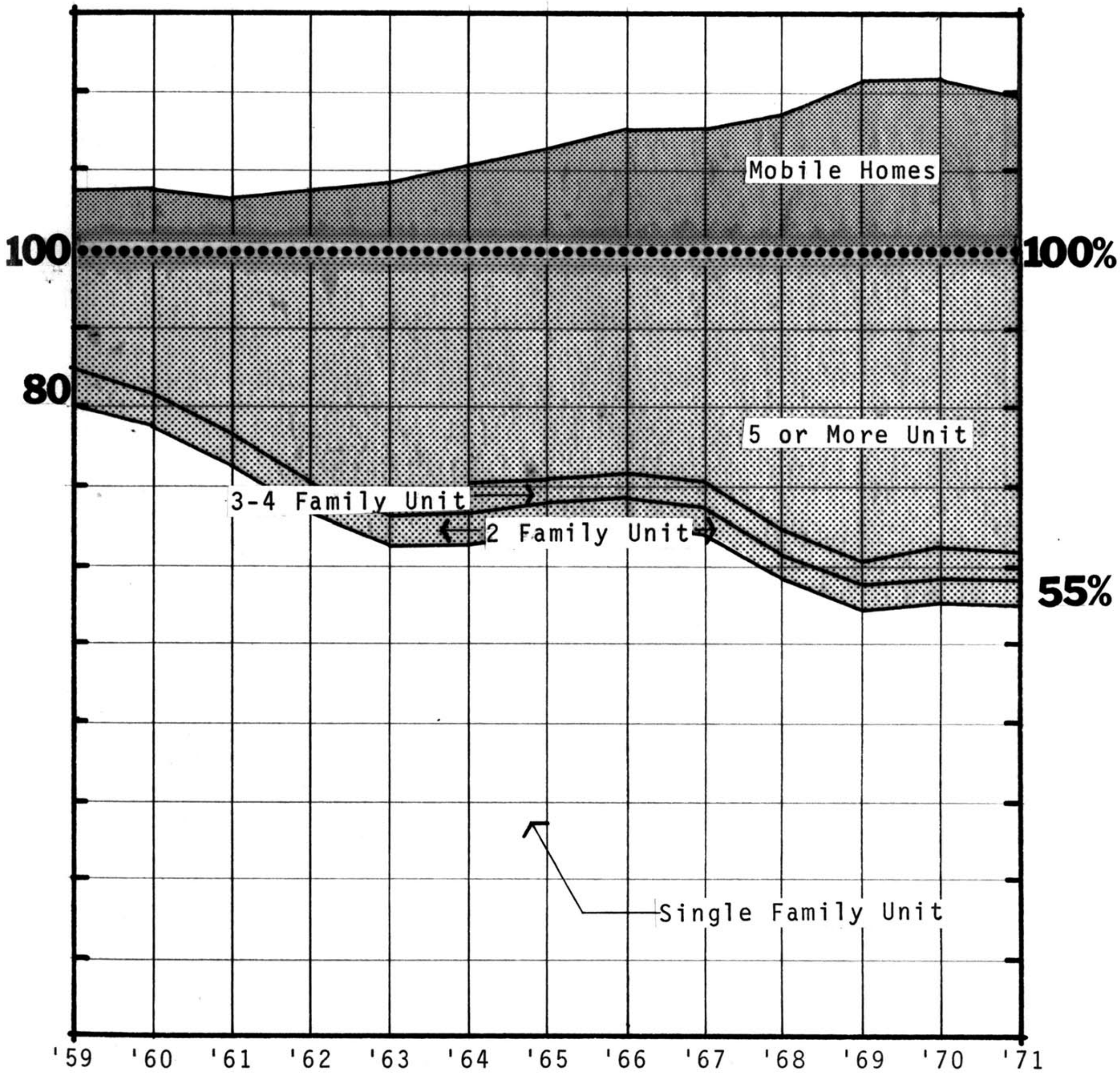
HOUSING PRODUCTION TRENDS OF STRUCTURE TYPES



Source: Dept. of Commerce

Fig. 2.5

PERCENT DISTRIBUTION OF STRUCTURE TYPES



Source: Dept. of Commerce

Fig. 2.6

Mobile homes have become increasingly more important. In 1959, they accounted for only 7.2% of total housing production. Within a 12 year period, this portion rose to 20%. Even more phenomenal than this rapid growth is their production rate which has been relatively immune from the cyclical recessions of conventional housing. This can easily be seen by comparing the steady growth line of mobile home production, illustrated in figure 2.5, with the erratic production of structures having 5 or more units, single-family units or total housing production. The explanation of this phenomena is that mobile homes are not considered realty, thus being subject to a different set of building constraints. They need not conform to the archaic building codes. Instead, the Mobile Home Manufacturers Association has written its own performance standards.[14] Since mobile homes are built entirely in the factory, they gain the maximum advantages of prefabrication and assembly line production. They are built with unskilled labor, thus avoiding the craft labor union problems plaguing all conventional construction. In addition: 1) production is immune from the weather; 2) quality control can be achieved to a high degree; 3) materials can be bought in bulk quantity; and 4) more sophisticated equipment can be employed.

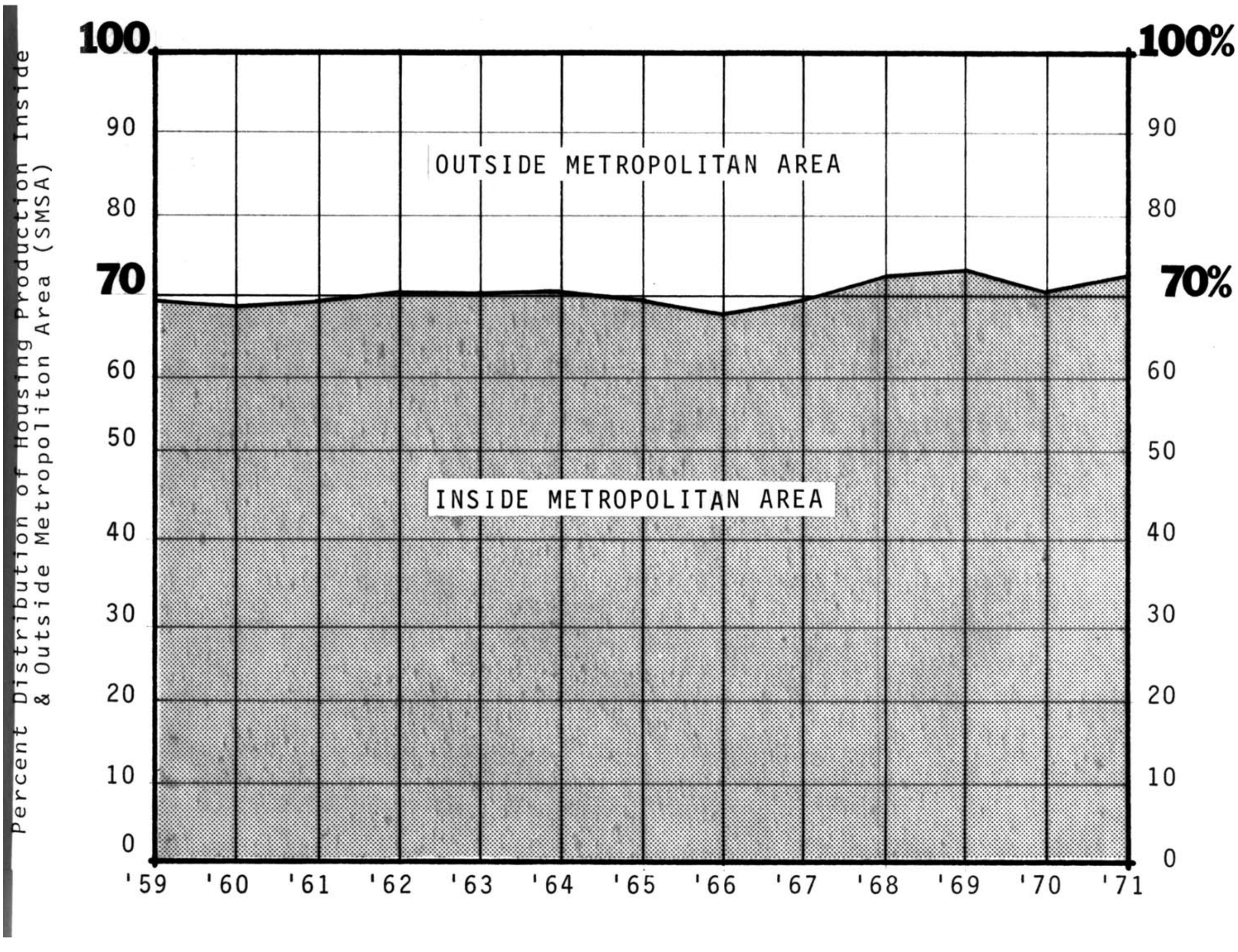
Mobile homes are not included in the Department of Commerce count as housing units since they are not considered realty.

Although designed for only a limited life span,[15] mobile homes do furnish the population with permanent housing.[16] A look at figure 2.6 shows that mobile homes are a significant portion of the total housing production. Twenty percent of the housing production, or 1 out of every 5 housing units produced, is a mobile home. Although the single-family category declined from 80% in 1959, to 55% in 1971, mobile home production rose from 7.5% to 20% of the total housing production. In 1970, mobile home production dropped to 401,190 units.[17] This was a slight drop (2.8%) and only temporary. Starting the last quarter of 1970, mobile home shipments began an upsurge. Shipments reached 491,710 units[18] in 1971 - an increase of 19.2% over 1969 production and 22.6% over 1970 production. The 1971 value is estimated at $3.1 billion.[19] Projections for 1972 expect mobile home production to increase to 500,000 units.[20]

2.1.3 Location of Housing Produced

Seventy percent of the housing produced is located within a metropolitan area (SMSA).[21] An increase in the number of available jobs in the city coupled with a decrease in available jobs outside the city has caused a rise of 2-3% over the last few years. However, viewing the situation over a twelve year period, from 1959-71, very little fluctuation is observed.

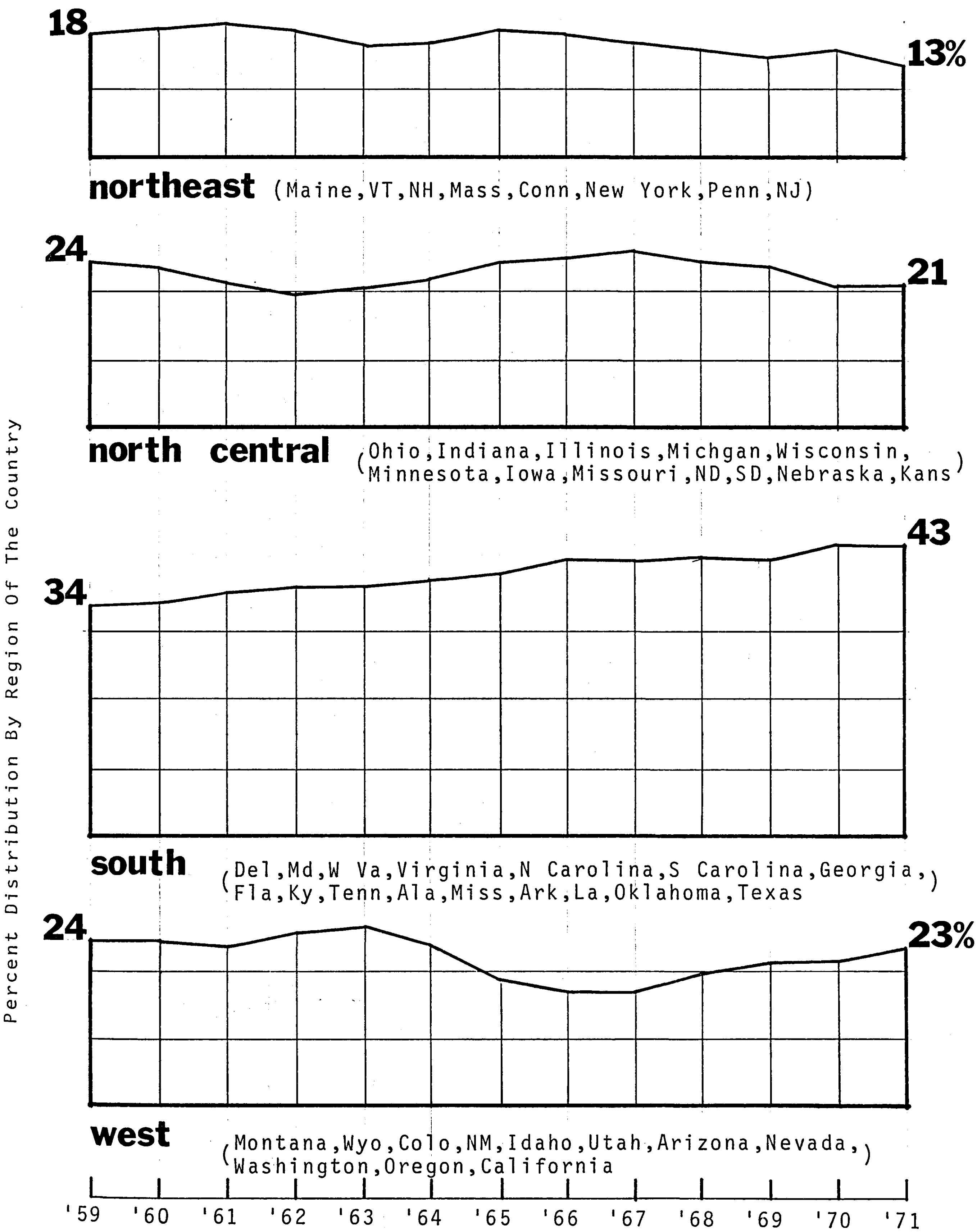
where?



Source: Dept. of Commerce

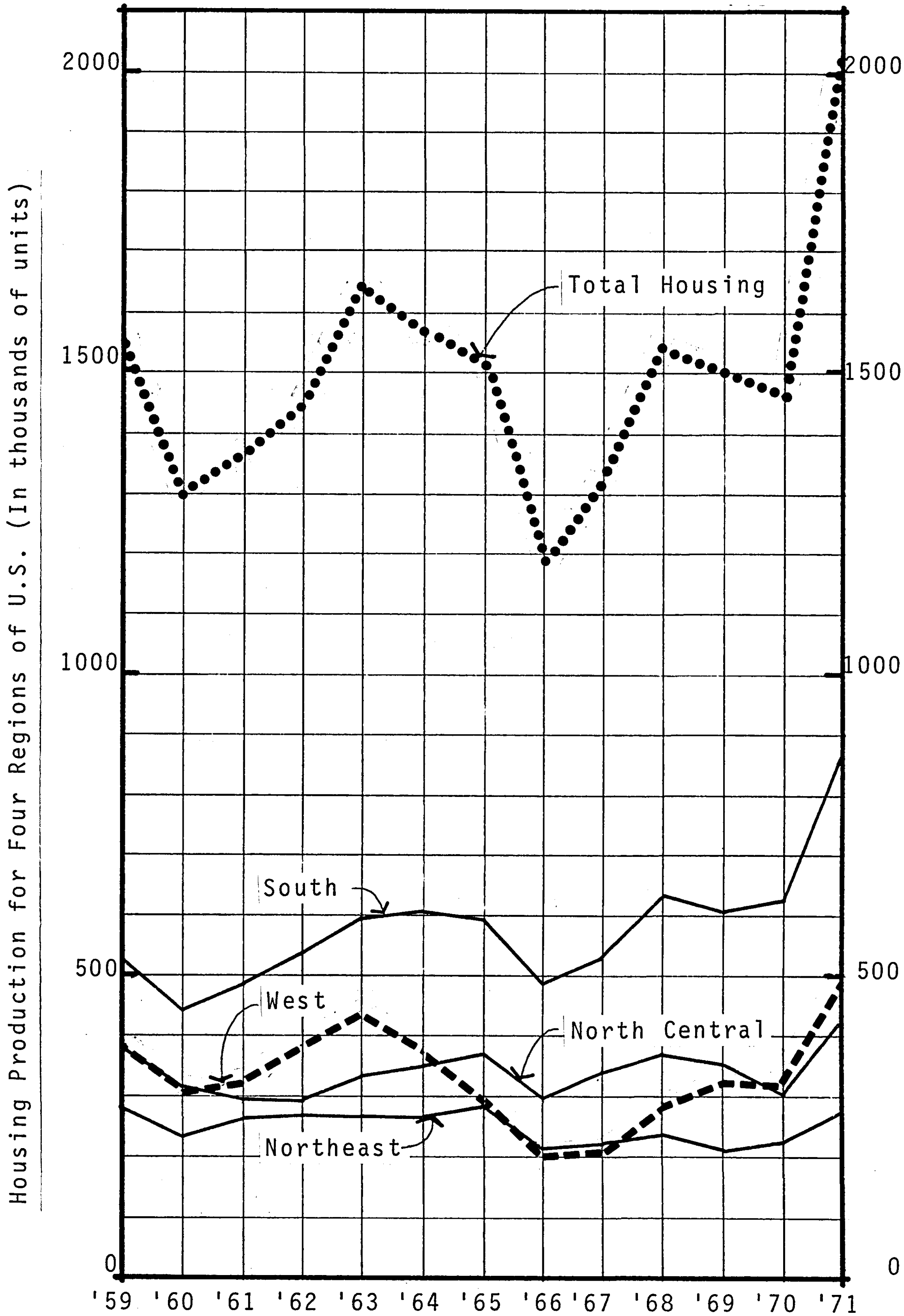
Fig. 2.7

A look at the relative proportions of production distributed throughout the country shows that 43% of the current housing is being produced in the South. Over the twelve year period, 1959-71, the South is the only region of the country that has experienced a net increase in portions of total housing production. This increase has been a steady rise, starting from 34% of the total in 1959, and slowly rising to 43% of the total. This situation can be easily explained by viewing figure 2.9. The South is the only region of the country that has experienced a net growth rate to actual housing production. The production of the rest of the country has fluctuated around a relatively constant production level. Thus, every other sector has experienced a decline in proportion or maintained the same proportion. The Northeast has experienced the direct opposite of the South. Its share of the total has steadily declined from 18% in 1959, to 13% in 1971. The West has experienced the largest fluctuations. By viewing figure 2.9 again, it is noted that housing production in the West is highly unstable. Thus its portion of the total production can be expected to fluctuate highly. Although it received 24% of the housing production in both 1959 and 1971, its share of total production has ranged from a high of 26% in 1963, to a low of 17% in 1966. The North Central's portion has been the most stable, declining 3% (from 24% in 1959, to 21% in 1971). Its fluctuation has been relatively small, ranging



Source: Department of Commerce

Fig. 2.8



Source: Dept. of Commerce

Fig. 2.9

from 20% in 1962, to 26% of the total housing production in 1967.

It should be emphasized that despite an overall rate decline of 4% in actual production of private construction in 1970, the Northeast increased by 6% and the South increased by 4%. The North Central, on the other hand, fell nearly 16%, while the West dropped 4%. Total housing production, from 1970-71, rose a phenomenal 41.7%. The West lead by an increase of 55.2% over its 1970 production. It was followed by the North Central with 45.0%, the South with 40.6%, and finally the Northeast with a 20.8% increase.

Thus, the importance of a breakdown of housing production into local areas has been established. The large variances of production rate changes make a nationwide housing production figure meaningless to the local builder or manufacturer. The need is thus emphasized for a regional breakdown for any valid housing study. Moreover, areas should be subdivided into metropolitan and non-metropolitan areas.

2.1.4 Prospects for the Future

In spite of the recent upsurge of housing in the later part of 1970, housing vacancy rates at the end of 1971 were still low. In fact, vacancy rates dropped from 7.5% for units available for rent in 1965, to 4.9% in 1970, and 5.1% in 1971.[22] The available amount for home-owner units is even more astounding. In 1971, only 0.9% were available for sale.[23] The remaining 99.1% were either occupied or sold and awaiting occupancy.[24] Money for building is increasing; ". . . the flow of funds into mortgage lending institutions in the first 5 months of 1971 came close to equalizing the full year totals achieved in both 1967 and 1968."[25] The demand for additional housing together with the available funds for building should paint a rosey picture for the future of housing.

2.2 The Housing Producers

The housing industry is made up of a large variety of producers. A housing producer may be either a builder or a manufacturer, or both. The product he builds ranges from a complete factory-manufactured mobile home or a modular/sectional home to a precut/prefabricated component home to a custom-designed house constructed entirely on the site. Their operations vary in size from the tiny single-family home builder who builds 1 or 2 units a year to the multi-operational housing corporation like Boise Cascade, which reached $2.6 million in total sales for 1970.[26] The materials the housing producer uses for construction range from the conventional wood, steel, concrete or brick to the more exotic synthetic materials such as plastics, urethane foam, or even paper. The Institute of the Future predicts that eventually these synthetic materials will replace the conventional construction materials because of their adaptability to factory-assembled processes.[27] The Institute further predicts that, "Wood frame construction in one-family homes will decrease to about 50 percent as greater use is made of masonry and plastics for these units."[28]

2.2.1 Structure of the Building Firm

In a survey conducted in 1969, of 8,885 of its members, the NAHB[29] found that the structure of the building firm consisted of: 1) corporation: 45.5%; 2) individual partner:36.9%; 3) partnership: 10.5%; and 4) other types: 6.5%.[30]

The builder of a single family home will probably be a sole proprietorship or a partnership. This is expected because they are the simplist and the cheapest type of organization to run. As the volume of the business grows, a corporation will be formed. Responsibilities will be set up along departmental lines to maximize profit, limit liabilities, increase quality specialization and gain greater management flexibility. The 1969 NAHB survey showed that the primary builder of single-family homes is the small builder who constructs 25 units or less per year. He accounts for 65%[31] of the total single-family units produced by the NAHB.

On the other hand, the large builder dominates the production of multi-family units. Even though small builders of 1-25 units per year amount to 43.4% of all the builders producing multi-family units, their total production was only 4.0% of the total multi-family units produced in 1969. Conversely, builders producing 101 or more units per year make up only 25.8% of the total builders, but accounted for 78.8% of all the multi-family units produced in 1969.[32] The type of multi-family unit built was: 1) Garden Type (1-3 floors): 64%; 2) Townhouse: 23%; 3) Duplex: 23%; 4) Medium Rise (4-8 floors): 5%; and 5) High Rise (9+ floors): 2%.[33]

The NAHB found that only 4.1% of the builders surveyed were a subsidiary of other corporations.[34] Mr. Sumichrast discusses in Profile of the Builder that, "The survey showed a low level of builders indicating they operated as subsidiaries to other corporations. This would support earlier studies on mergers and acquisitions, which indicated some entries of nonbuilding groups into building areas, but these entries have only a nominal impact on the total structure of the construction industry."[35] Both this statement and the 4.1% figure are misleading. The sixties showed an influx of many large corporations entering the home building industry through acquisition of established companies. Many of the parent companies had no direct product or business ties to the housing industries. The attraction was the projected size of the housing market. Table 2.1 gives a detailed listing of the Housing Giants that were subsidiaries of larger corporations. Twenty eight of the top hundred housing firms (measured in total sales) were subsidiaries of larger corporations. Their gross income amounted to slightly less than $2 billion or 8.3%.[36] of the total expenditure for housing in 1970. This percentage is a sizeable margin if one considers that most of these companies have just recently been acquired and the full potential for development has not been realized. Most of the Housing Giants that are subsidiaries of larger corporations rank between 20 and 60. Because of their large financial base, these companies can be expected to gain an even larger foothold, thus having a suvstantial impact on the industry.

In addition to the corperations listed on Table 2.1, many larger corperations have recently entered the housing field: Fruehauf Corporation; Clary Corporation; Avco Corporation; Weil-McLain Corporation; Westinghouse; Wickes, Inc.; Dukor Industries; Florida Gas; Hercules Incorporated; Potlatch Forest, Inc.; Reigel Paper Company; Republic Gypsum Corporation; and Universal Leaf Tobacco.[37] This trend of large corporations entering the housing field is expected to increase. The Institute of the Future predicts that, "Large multi-product-line corporations (or conglomerates) will enter the industrialized housing field. These organizations are expected to augment traditional mortgage financing with corporate participation."[38]

Table 2.1

Housing Giants That Are Subsidiaries of Larger Corporations

(Top 100 Housing Giants) (Ranks in total sales volume)

Corporation	Housing Giant	1970 Volume Sales ($)	Rank in 1970
Boise Cascade Corporation	Boise Cascade Shelter Group 1) BC Bldg. Co. 2) Divco Wayne 3) Kingsberry Homes	$259,300,000	1
ITT	Levitt & Sons, Inc.	$225,000,000	4
American Standard, Inc.	Wm. Lyon Development Co., Inc.	$135,189,800	12
Weyerhaeusen Company	Weyerhaeuser Real Estate Co.	$86,291,000	21
CNA Financial Corporation	The Larwin Group, Inc.	$85,000,000	22
Monogram Industries, Inc.	Ring Brothers Corp.	$71,000,000	27
American Cyanamid Co.	The Ervin Co.	$70,000,000	28
Inland Steel Co.	Inland Steel Urban Development Corp. Scholz Homes, Inc. Jewel Builders	$67,000,000	32
Shelter Resources Corp.	Winston Industries, Inc.	$65,000,000	34
Cerro Corp.	Leadership Housing Systems, Inc.	$63,660,000	36
Monumental Corp.	Monumental Properties, Inc.	$63,250,000	37
Evans Product Co.	Evans Production Co., Home Group	$62,000,000	39

Corporation	Housing Giant	1970 Volume Sales ($)	Rank in 1970
National Gypsum Co.	DMH Corp.	$60,000,000	41
Whittaker Corp .	The Vector Co.,Inc.	$57,700,000	43
Singer Co.	Singer Housing Co. (Besco Group)	$56,100,000	44
Aluminum Co. of America	Alcoa Building Industries	$55,361,000	47
Columbia Broadcasting System	The Klingbeil Co.	$55,230,500	48
National Environment Corp.	W.J. Burke Construction Co., Republic Home Corp., Sproul Homes	$51,926,566	52
International Paper Co.	I.P.C., Realty Corp. (Don L. Bren Co. Spacemakers, Inc. American Central Corp.)	$50,605,602	53
Bethlehem Steel	Multicon Properites Inc.	$49,960,000	55
Olin Corp.	Olin Corp. (Yeonas Co., Morrison Homes, Maryland Housing Corp., Chesapeake Homes	$49,200,000	57
Transamerica Corp.	Transamerica Development Co.	$48,400,000	58
Fuqua Industries	Fuqua Homes, Haft-Gaines Co.	$48,269,591	59
Santa Anita Consolidated Inc.	Robert A. Grant	$37,865,000	74
Gulf Oil Corp.	Gulf Reston, Inc.	$37,794,560	75
Vintage Enterprises, Inc.	Vintage Homes, Inc.	$37,000,000	78

Corporation	Housing Giant	1970 Volume Sales ($)	Rank in 1970
Great Southwest Corp.	Richardson Homes Corp.	$34,965,000	88
U.S. Plywood Champion Papers	Lewers & Cooke, Inc., Development Operations	$32,318,605	98
TOTAL.		$1,953,387,224 or 8.3 % of total housing expenditure for 1970.	

Source: 1. "Annual Report of Housing's Giants" Professional Builder, July 1971 (Chicago, Ill. : Cahners Publishing Co., 1971) p.55,72.

2. Compiled by the author.

2.2.2 Market Aggregation

In 1962, Martin Meyerson, then director of the Joint Center for Urban Studies of M.I.T. and Harvard University, wrote:

> Diffuse location and regulatory structure discourage the heavy capital investment needed to advance organization, technology, and marketing. The industry is wholly lacking in centralized management responsibility. Responsibility is divided among a score of relatively autonomous elements, each serving to protect itself against the fluctuations and insecurities of the business. There is lack of technological research and development on a scale comparable to that of other industries. And finally, the industry does not engage in market research and the development of merchandising techniques of the sort which support the growth of competing industries.[39]

It was estimated in 1970 that there existed 100,000 active builders and contractors in housing and light construction.[40] The large majority of these firms were characterized by their smallness and were localized and fragmented in nature. In 1968, the Kaiser Commission stated, "There is no dominant firm within any category of housing producer, much less in the entire residential construction market.... When compared to the size of the market even these largest producers control only a tiny fraction of output."[41] This trend is expected to change. As discussed in the previous section, large conglomerates and corporations are entering the industry, providing new sources of money. The Institute of the Future predicts that, "New sources of money for housing will be found, probably in the form of equity financing by large corporations, mortgage backed securities, and developer/ builder financing."[42] In addition, "An increased percentage of the mortgage debt will be held by federal agencies, pension funds, corporations, and individuals, with a smaller percentage being held by banks, insurance companies and saving and loan associations."[43] With the coming of industrialization of building systems, the traditional process of building entirely on the site will change. Because of the large investment required, conglomorates and large corporations are expected to gain an increasingly large share of the housing market. The shift to mortgage financing by the large corporations is likely to cause home building to be less susceptible to business fluctuations. This is because the supply of credit will no longer be dependent on private savings in banks and savings and loan institutions. Bringing a large portion of the construction into the factory from the site is likely to stablize production rates since: 1) craft labor union delays will be eliminated; 2) the construction is no longer dependent on the seasonal fluctuations and the weather; 3) labor productivity will be more constant and predictable due to assembly line operations.

Signs of this market aggregation have already been seen in 1970. A look at the annual report for gross business volume of Housing's Giants for 1970 in Professional Builder Magazine shows that 327 firms or less than ½ of 1% of the estimated 100,000 active builders and contractors in housing and light construction accounted for more than 20% of all new housing units (conventional, mobile, & modular) produced in the U.S. Collectively, their gross total amounts to $11 billion or about one half of the total dollar output for housing construction in 1970. The top ten alone account for $1.9 billion or 8.3% of the total housing expenditure for 1970. The top 20 account for 13.2%.[44]

2.2.3 Classification by Primary Operation

There exist numerous types of classification systems for producers of housing. The Kaiser report simplifies the production process to consist of five steps: 1) supply of land; 2) design of structure; 3) construction financing; 4) construction; 5) marketing.[45] It then attempts to categorize producers according to their operations in these five categories. Four basic types of builders are defined, recognizing that many other combinations are possible. These four types include: On-Site Builders: 1) Merchant Builders and 2) General Contractors; and Factory Builders: 3) Home Manufacturers and 4) Mobile Home Manufacturers.[46]

2.2.4 On-Site Builders

The General Contractor

The traditional way of building is to have the owner: 1) hire a contractor for the construction; 2) hire the architect and engineer for the design; and 3) if the unit is not owner-occupied, the owner will do his own marketing. The general contractor builds on the owner's land, according to the owner's specifications and plans. He thus becomes a "servant of the land owner".[47] Most general contractors have only a small nucleus of workers on their staff and subcontract the large portion of the work. In the NAHB survey, 40% of the builders subcontracted from 3/4 to all of the construction work. Only 12% subcontracted up to 1/4 of their construction cost. The trend to subcontract is increasing. In 1959, 31% subcontracted 3/4 to all construction. This figure rose to 38% in 1963, and finally to 40% in 1969.

The Merchant Builder

The merchant builder attempts to unify the whole housing production process under a single operation. He supplies the land, designs the structure, arranges construction financing, controlls the construction, and performs the marketing. This evolution has been important to the housing industry. According to the Kaiser Commission report, "The evolution of the merchant builder has led to a somewhat greater degree of integration in the highly fragmented housing industry."[48] In a study approximating the shares of annual housing starts by type of producer in the U.S. during the middle 1960's, the Kaiser Commission concluded that merchant builders accounted for 41% of total annual production. Of these, 26% were single-family houses and 15% were multi-family houses. General contractors, on the other hand, accounted for only 27% (10% one-family units for private owner, 15% multi-family construction for private owners, 2% for public agencies).[49] Thus, if only by volume alone, the merchant builder emerges as an important factor in the housing industry. The merchant builder first got his start in 1961, when the government allowed him to become a sponsor of 221 (d) (3) (Below Market Interest Subsidy Program) projects. A number of current federal programs are tailored to him - the Turnkey method for public housing and Sec. 235 home ownership program. The critical difference between the merchant builder and the general contractor is that the merchant builder can build housing on his own initiative, while the general contractor must wait for projects to be initiated by others.

2.2.5 Factory Builders

Off-site building is becoming increasingly important. As the scarcity of labor increases and the wages rise, the housing industry will turn more and more toward factory fabrication. The Institute of the Future predicts that, "The availability of an adequate labor supply for future housing construction is believed to depend upon the national economy and involvement in international conflicts. An expanding economy and large international commitments would strongly reduce the availability of labor."[50] "During the next fifteen years (until 1985), earnings of housing construction workers will increase from between $4 and $5 per hour to between $7 and $8 per hour."[51] The Institute of the Future further predicts that the following effects will cause an increase in factory-built housing: 1) Building codes will undergo extensive revision emphasizing standardization mechanisms which permit a greater degree of innovation and use of mass production techniques; 2) Factory-built housing is expected to be approved by a central authority (compared to the U.L.) on the basis of widely accepted standards. Local building officials will be responsible primarily for proper instalation of such assemblies; 3) Industry-wide standards will be adopted which increase the degree of interchangeability among factory-assembled housing components.[52]

Thus, the final result will be: 1) The use of industrialized and pre-engineered building systems will grow and be employed in about 30 percent and 40 percent respectively of all new housing units; 2) Preassembled three dimensional units will be the major form of industrialized housing. This type of factory-assembled unit will be used in about 40% of all multi-family low rise buildings and about 20% of all multi-family high rise and one family-type buildings; 3) Prefabricated building systems based on the use of panels will be the second most widely used form of industrialized housing. These will be used in about 20% of all multi-family high rise and about 10% of all multi-family low rise and one-family-type buildings; 4) Preassembled service cores will be used in about 40% of all new housing units.[53]

The Kaiser Commission determined that in the middle 1960's, home manufacturers accounted for 11% of the total, while mobile homes accounted for 12%.[54] Since then, mobile home production has reached 20% of the total housing production.[55] The newly formed modular housing subsector accounted for 27,000 units in 1970. This production has jumped to 52,160 units in 1971, an increase of 104% over 1970. An estimate from a survey conducted by <u>House and Home Magazine</u> predicts the 1972 total to reach 90,000 units.[56]

The Home Manufacturer

The home manufacturer has replaced the traditional on-site construction process of major building components with an off-site factory assembly process. The major building components are pre-assembled and precut in the factory. They are then distributed as packages through a network of franchised dealers. According to the Kaiser report, "The packages supplied by the home manufacturer usually makes up only between 15% and 30% of the final total cost."[57] The bulk of the home manufacturers use wood mainly because of their single-family home orientation. As the multi-family market increases in quantity, steel and concrete will be used.

The Douglas Commission Report divides the manufactured home business into three basic forms: 1) prefabricated components; 2) sectionalized homes; and 3) manufactured homes. These categories differ primarily in the degree of prefabrication. The difference between the manufactured home and the sectionalized home is slight. In a manufactured home; 1) the walls, floors, and roofs can be constructed as separate items and assembled on the site; or 2) complete rooms and dwelling units may be constructed offsite in the form of modules. The sectionalized home is essentially a manufactured home in which roofs, walls, and floors have been assembled in the plant. Each house section width is limited to 12 feet with some states allowing a maximum of 14 feet. To form the finished dwelling unit, two sections are usually placed on a conventional foundation by a crane, or rolled with wenches and cables from a low-bed truck onto the finished foundation.

The most common form of prefabricated components are: 1) Trusses; 2) Plumbing Trees; 3) Prehung Doors; 4) Molded Fiber Glass Tubs & Enclosurers; 5) Precast Concrete Wall and Floor Panels; and 6) Heat Pumps.[58]

The major obstacle to prefabrication is transportation. None of the home manufacturers markets his products nationwide. Most large manufacturers tend to establish individual plants for each local area of the country. Traditionally, operations have been controlled by the costs of truck transportation. This limit establishes the range to within 300-350 miles of the plants. Currently, however, a number of firms have been investigating the use of other modes of transportation. Stirling Homes shipped 56 modules 1,000 miles on rail from Avon, N.Y. to Corinth, Mississippi.[59] They are now investigating the use of water transportation for shipment of modules. Plans for a new multi-million dollar, 350,000 square foot housing production facility in Gulfport, Mississippi, has been announced. This plant will have a capacity for 100 modules per day and will be located on the inland water way system. Included is an 8500 foot self contained loading dock on which barges carrying woodframe townhouse modules, and steel and concrete highrise modules will be shipped to marketing areas which will extend from coastal states running from Florida to Texas and northward to the central midwest states.[60]

Mobile Homes

The mobile home industry is currently the fastest growing subsector of the total housing industry. Figure 2.6 shows that currently they account for 20% of the total housing production. Three kinds of firms perform the production and marketing functions. The mobile home manufacturer produces the completed unit. It then is sold through local dealers who service and accept tradeins. Finally, the operators of the mobile home parks provide the sites and utility connections for the homes. According to the Kaiser Commission report, the following factors are significant in the sudden rise of output in the mid 60's: "1) production efficiencies achieved through factory assembly; 2) the fact that the units come furnished, and that the cost of furnishing can be included in the financing of the units; 3) freedom of manufacturers from both public and private restrictions in their operations; and 4) the comparatively light property tax burden borne by mobile home occupants."[61]

The history of the mobile home manufacturing business has not been as rosey as might be thought. Several serious obstacles have had to have been overcome. The most important is the shortage of mobile home parks. Many local governments fear mobile home parks, thinking that their presence will cause blight and deterioration to their communities. In addition, since mobile homes are not considered to be realty, they pay no direct real property tax and are thus considered by the local government to be a burden to the community, especially if the parks contain school age children. Thus, many localities flatly prohibit the introduction of mobile homes or zone them into industrial or transitional areas. The fanancing arrangement of a mobile home is high. It is similar to that used for an automobile. The current rate is 25 percent down and a 7 year mortgage. The FHA has extended this to a 12 year mortgage and

10% down for mobile homes over $6,000 and 5% down for those under $6,000.

The reader is referred to section 3.3.3 for an analysis of the cost trends of the mobile home.

2.2.6 Diversification of Primary Operations

The NAHB survey shows a wide diversification of the primary operations for both the single family builder and the multi-family builder: 1) Merchant Builder - 30.4%; 2) Multi-family - 27.4%; 3) Custom Homes - 20.6%; 4) Land Developer - 15.1%; 5) Commercial - 5.5%; 6) Re-hab - 2.3%; and 7) Industrial--1.0%. Mr. Sumichrast claims that the reason for this diversification is ". . . in direct response to the nature of the construction industry. The striking short-term changes in volume, caused by the frequency of changes in money flows into capital investment as well as the interruption of construction production caused by seasonal investment and market demands, forced builders to enter many fields of construction activity rather than commit themselves to one type of operation."[62]

It would be helpful to compare the NAHB activities, whose membership is mostly made up of conventional stick builders, with the activities of the housing giants. According to the Professional Builder survey, the dollar breakdown of

Housing's Giants is: 1) Single-Family - 24.1%; 2) Mobile Homes - 14.2%; 3) Low-Rise Multi For Own Investment - 13.6%; 4) Low-Rise Multi For Sale To Investors - 11.2%; 5) Non-Residential - 7.7%; 6) Town House and Condominium - 6.7%; 7) Rental Income - 5.9%; 8) Land Sales - 4.2%; 9) High-Rise Multi-Family - 2.5%; 10) Prefab (Panelized) Buildings - 2.3%; 11) Modular (3-dimensional units) - 1.8%; and 12) Misc. - 5.8%.

The most noticeable difference between the activities of the NAHB and the Housing's Giants is the tremendous diversity on the part of the Housing Giants - mobile homes, prefabs, modulars, ets. However, the main concentration of the Housing Giants is still on the single-family market and on the low-rise multi-family unit. The custom house category found in the NAHB survey is nonexistent here since housing is dealt with in bulk quantity. The top four producers for 1970 are analyzed below. Their operations are very representative of this dollar breakdown.

1) Boise Cascade Corporation (dollar volume: $259,300,000) Boise Cascade is a multi-operational corporation that has obtained some top name companies through mergers and acquisitions. It is divided into six principal divisions: Residential Communities (formerly BC Bldg. Co.); Mobile Housing (formerly Div. Co. Wayne); Manufactured Housing (formerly

Kingsberry Homes); Urban Housing; and Vacation Housing. Built 1727 homes and townhouses, 696 apartments conventionally built ($65.4 million), 17,359 mobiles ($88.2 million), 771 single and 408 multi-modular units ($17.5 million), 11,179 single and 3,434 multi prefab units ($43.4 million) and developed $14.4 million in industrial parks. [It might be worth noting that the dollar volume does not include $43 million outside of the U.S. and $158 million in sales of recreational land.]

2) Kassuba Development Corporation (dollar volume: $245,000,000) Largest apartment developer. Built 8900 multi-family units ($160 million market value). Holds 39,000 units from which it derived $80 million. Built $5 million worth of motels, shopping centers, and commercial buildings.

3) Skyline Corporation (dollar volume: $230,000,000) Largest producer of mobile homes. Produced 45,000 mobile homes and sectional units plus 15,000 travel trailers. Recently completed a 12,000 square foot research and development building.

4) ITT Levitt and Sons, Inc. (dollar volume: $225,000,000) The country's largest single-family home developer. Constructed 8.379 housing units,

20% of them were apartments and townhouses. Owned by the huge conglomorate, ITT. Convinced that assembly line construction is the key to the big, low-priced market. Has opened a new factory in Battle Creek, Michigan.

These top four housing giants, except for Boise Cascade, are specialists in their field. Their specialties reflect directly each of the top four categories in the dollar breakdown discussed earlier. Boise Cascade, on the other hand, has managed to lump single-family home production, multi-family home production, mobile home production, plus numerous other housing types into a huge diversified conglomorate structure. Its total sales in 1970, if foreign investment and recreational land sales are included, was $460.3 million, almost double that of its nearest competitor.

Footnotes for Chapter II

1. U.S. Council of Economic Advisers, Economic Report of the President, 1972 (Washington, D.C. : U.S. Government Printing Office, 1972) p.240,242,243.

2. Projections By Bureau of Domestic Commerce, U.S. Dept. of Commerce, Construction Review, September 1971 (Wahsington, D.C. : U.S. Government Printing Office, 1971) p.4.

3. Bureau of Domestic Commerce, U.S. Dept. of Commerce, Construction Review, October-November 1971 (Washington D.C.: U.S. Government Printing Office, 1971) p.13.

4. Ibid., p.14.

5. Sumichrast, Michael and Frankel, Sara A., Profile of The Builder and His Industry (Washington, D.C. : NAHB, NAC, 1970) p.5.

6. U.S. Council of Economic Advisers, op. cit., p.242.

7. See figure 2.2.

8. Measured in constant 1958 dollars. See figure 2.2.

9. Based on 1960 & 1965 figures for total new construction, December 1971 figure is seasonally adjusted, calculated by the author.

10. See figure 2.2.

11. Based on 1959, 1961, 1969, 1971 figures for the GNP from Economic Report of the President: 1972, op. cit., p.240. Calculated by the author.

12. U.S. Council of Economic Advisers, op. cit., p.243.

13. Ibid., p.240.

14. Standard for Mobile Homes, USAS A119.9 (Chicago, Ill. : Mobile Home Manufacturers Association, 1971).

15. The normal mobile home is financed on a seven year mortgage with one-fifth down at 12% interest. The FHA has extended the financing to a twelve year mortgage at 8% interest and 10% down for mobile homes over $6,000, and 5% down for those under $6,000.

Source for #15:

Greenwald, Carol S. "Mobile Homes in New England" New England Economic Review, May/June 1970 (Boston, Mass.: Federal Reserve Bank of Boston, 1970) p.4.

HUD-FHA Non-Assisted Program for Mobile Home Parks, Flier put out by HUD-FHA Insuring Office, Assist. Sec. for Housing Production and Mortgage Credit - FHA Commissioner, January 1971.

16. "Though the name implies temporariness, such homes have in fact become permanent residences." Paul Douglas, H., op. cit., p.433.

17. Construction Review, October-November 1971, op. cit., p.13,14,24.

18. Bureau of Domestic Commerce, U.S. Department of Commerce, Construction Review, February 1972 (Washington, D.C. : U.S. Government Printing Office, 1972).

19. Projections by Bureau of Domestic Commerce, U.S. Department of Commerce, Construction Review, September 1971 (Washington, D.C.: U.S. Government Printing Office, 1971) p.4.

20. Construction Review, September 1971 op. cit., p.4.

21. Standard Metropolitan Statistical Area See footnote 17, Chapter I.

22. Bureau of Domestic Commerce, U.S. Department of Commerce, Construction Review, February 1972 (Washington, D.C.: U.S. Government Printing Office, 1972).

23. Ibid.

24. Ibid.

25. Construction Review, September 1971, op. cit., p.4.

26. "Annual Report of Housing's Giants" Professional Builder, July 1971 (Chicago, Ill.: Cahners Publishing Co., 1972) p.56.

27. Enzer, Selwyn, op. cit., p.6.

28. Ibid., p.7.

29. National Association of Home Builders

30. Sumichrast, Michael & Frankel, Sara A. Profile of The

Builder & His Industry (Washington, D.C.: NAHB-NHC, 1970) p.17.

31. Ibid., p.19.

32. Ibid., p.34, Table 3.3.

33. Ibid., p.121.

34. Ibid., p.17.

35. Ibid., p.15.

36. Total collected and calculated by author. Based on $24.2 billion total spent for private housing starts in 1970. Council of Economic Advisers, Economic Report of the President: 1972 (Washington, D.C.: U.S. Government Printing Office, 1972) p.240.

37. Reidelbach, J.a. Jr. Modular Housing In The Real (Annandale, Va.: Mod Co., Inc., 1970) p.51.

38. Enzer, Selwyn, op. cit., p.4.

39. Meyerson, Martin, et. al., Housing, People, and Cities (New York, N.Y.: McGraw-Hill Book Company, 1962).

40. "Annual Report of Housing's Giants, op. cit., p.55.

41. Kaiser, Edgar F., op. cit., p.150.

42. Enzer, Selwyn, op. cit., p.6.

43. Ibid.

44. "Annual Report of Housing's Giants", op. cit., p.55.

45. Kaiser, Edgar F., et. al., op. cit., p.149.

46. Ibid., p.150.

47. Ibid., p.152.

48. Ibid., p.152.

49. Ibid., p.151, Table 3-26.

50. Enzer, Selwyn, op. cit., p.6.

51. Ibid.

52. Ibid., p.5-7.

53. _Ibid._

54. Kaiser, Edgar F., et. al., _op. cit._, p.151, Table 3-20.

55. See figure 2-6.

56. "Second Annual Modular Survey: Profile of a Sub-Industry in Ferment", _House and Home_, March 1972 (New York, N.Y.: McGraw-Hill Publishing Co., 1972) p.72-87.

57. Kaiser, Edgar F., _op. cit._, p.155.

58. Douglas, Paul H., _op. cit._, p.433.

59. _Ibid._, p.433-434.

60. Reidelbach, J.A. Jr., _op. cit._

61. _Professional Builder_, July 1971 (Chicago, Ill. : Cahners Publishing Co., 1971) p.170.

62. Kaiser, Edgar F., _op. cit._, p.157.

63. Sumichrast, Michael, _op. cit._, p.15.

64. "How The Giants Earn Their Dollar", _Professional Builder_, July 1971 (Chicago, Ill. : Cahners Publishing Corp., 1971) p.85.

65. _Ibid._, p.56.

HOUSING COT

3.0 COST STUDY

3.1 PREFACE TO COST STUDY

This cost study was started in the spring, 1971. The initial purpose was to formulate a method for designing a building system using cost criteria as a design basis. The first attempt failed because of the lack of sufficient comparable cost data. It was found that building costs were extremely difficult to obtain. And those that were obtained were usually unreliable and sketchy. However, the conclusions reached in the first attempt proved very helpful in providing a general background for reviewing the existing information on costs and in showing the problems encountered in cost collection. The necessary directions could then be outlined for the second phase. The conclusions showed that: 1) extracting reliable costs from the available information was extremely difficult; 2) most studies went into elaborate detailed descriptions of the building systems but said little or nothing about the associated costs; 3) very few similar cost accounting systems were used; 4) it was impossible to find a set of costs that were similar enough in detail to serve as a base for industry comparison; 5) most costs were not sufficiently detailed to reach any in depth conclusions about the building system; 6) of the detailed cost data that was available, only the conventional construction industry was represented.

Much of the cost data that has been accumulated since that spring has been the result of an intensive search consisting of: 1) writing to different private individuals in the government and industry to obtain current detailed information on cost studies; 2) obtaining various federal and state government subsidized research studies - the United States Department of Housing & Urban Development, the Institute for Defense Analysis, the National Bureau of Standards, the Bureau of Labor Statistics (the U.S. Dept. of Labor), the Urban Development Corporation of the State of New York, the Office of the Lieutenant Governor of the State of Hawaii, the McGraw-Hill Information System's Cost Analysis for the Kaiser Commission; 3) obtaining various surveys and cost reports performed by the National Association of Home Builders; 4) collection information on materials, labor, and equipment found in the numerous cost manuals - Dodge's Construction Pricing and Scheduling Manual, Robert Means' Building Construction Cost Data, McKee, Berger, & Mansueto's Building Cost File, and the Dow Building Cost Calculator & Valuation Guide; 5) collecting information on cost research done at M.I.T. in architecture and civil engineering; 6) examining The Institute of the Future's study on Some Prospects for Residential Housing by 1985 for Owens Corning Fiberglas Company in 1971; 7) field interviewing of cost consultants developing cost systems; 8) field information gathered from the questionnaire of the housing industry;

9) field interviewing of individuals involved in the producing of housing - both industrialized and conventional.

3.2 The Need For A Cost Study

The conclusions reached by the author in the previous section were borne out by other studies conducted during that same period. In a study completed in 1971, The Institute For The Future concluded that:

> The panel[1] exhibited a high degree of concensus in believing that the cost of housing is the foundation of present and future housing issues. As one panelist stated: "Cost is the heart of the whole problem, and comparative cost and value of different products, methods, materials, systems, etc. will be the primary factor on determining what happens in the future." Unfortunately, the basic data with which meaningful housing cost analysis can be made appears to be very fragmented and inconclusive - inconclusive in the sense that it is difficult to identify major contributions to costs and, therefore, to identify means which might result in cost reduction in future units.[2]

In a letter to the author dated January 14, 1972, endorsing the need for this study, Mr. Richard L. Bullock, Executive Vice-President of the National Association of Building Manufacturers summarized existing conditions as follows:

> We wholeheartedly endorse the need for the study on cost comparability you are planning. I'm not optimistic over your prospects because so very few housing manufacturers seem to be able to break out their costs on the itemized basis you are seeking. However, it is greatly needed.
>
> I discovered this when I discovered within the past year how many have major problems "cost certifying" to the FHA on projects where an identity of interest exists. Also, it seems

> there is little agreement on a uniform accounting system, not to mention the problem of charging off plant overhead, amortization, etc., against the cost of each unit.[3]

In a letter to the author received April 16, 1972, from a construction company, regarding the construction cost questionnaire that was sent out to the housing industry, further information regarding the problem is given:

> Regarding your letter of March 27, 1972. I wish to comment as follows:
>
> 1) Construction cost vary not only for types of construction but also in the same types of construction due to many causes.
>
> 2) Cost control is best effected in the design stage, but even then costs will vary from contractor to contractor, site to site, etc.
>
> 3) Each project must always be analyzed separately, always realizing that the exact same conditions have not existed on any other project.
>
> 4) We are interested that you are involved in this survey, however due to the above, we are not able to actually provide you meaningful information for your purpose.[4]

However, in spite of the variable conditions stated above which influence costs, there is still a need to reach a general understanding of the cost components which effect housing - for design, for the production, and for the estimating phases in the housing process. The Douglas Commission, recognizing this problem, summarized the need very well when it stated:

> Substantial difficulties exist in comparing the costs of housing over a period of time or housing of various types or in various locations. Average

> cost figures and average cost relationships tend to be misleading because variations are great and many cost-affecting factors are unpredictable. Labor disputes, bad weather, shipment delays and the like are common. Moreover, there are obvious difficulties in finding a typical dwelling unit on a typical site. Geographic factors may affect the cost of land, materials, and other components. Differences in accounting systems can be substantial. Short term savings in the mortgage market, establishing the price of a mortgage that will prevail over 20 years or more, can be large and erratic. Nevertheless, while it is important to bear these variations in mind, some general understanding of the level and proportion of cost components is essential to public decision making.[5]

3.3 An Introduction To Housing Costs

3.3.1 Development & Construction Costs

As stated earlier, the purpose of this study is to analyze building costs to improve the production efficiency of housing, establish a method using cost criteria as a design basis, and improve the cost estimating process. To achieve these goals, the structure costs must be studied in depth. However, it is important to remember that there exist many other costs to the builder besides the structure costs. Such items include selling expenses, general expenses, administrative expenses and overhead & profit. If a house is industrialized, additional charges are required for lifting and securing, transportation, and factory overhead.

The information on Table 3.1, gathered from collected sources, gives a rough breakdown of the sales price for a conventional single-family unit, row house, walkup, and an elevator apartment unit. Construction costs (materials, on-site wages, and overhead/profit) for single family units represent about 2/3 of the total. For an apartment it accounts for 3/4 of the total. Surprisingly, labor and material costs are not as high as might be expected. Together they account for only 55% of the costs for a single-family home and 60% for an apartment building. A major problem with most new building systems is that they attempt to reduce costs by designing only the building envelope. The Kaiser Commission study determined that the bulk of the construction cost is taken by the utility system (plumbing, heating, ventilating, and electrical) and the interior finishing. The shell or building envelope accounts for only one-sixth of the total initial cost. (The reader is referred to section 3.5 for a more specific breakdown of component costs.) In order to view the construction cost savings in the right perspective, the total savings due to all technological processes in building construction must be assessed. The Institute For The Future states, "However, progress in construction and building technology presently appears to be limited to about a 10- or 15-percent reduction in construction costs and, in proportion to the magnitude of the problem imposed by cost and housing needs, particularly for the low-income consumer, no technological solution appears likely that can

Table 3.1

Rough Breakdown of Sales Price

		One Family House						Row House		Walkups		Elevator Apartment Unit					
		Kaiser Report 1968[1]		NAHB 1968[2]		Five Tract Devel's 1968[3]		1966 HUD		1966 HUD		Kaiser Report 1968[1]		NAHB 1968[2]		HUD Multi-Family Housing[3] 1966	
Land	Acquisition	25		23		17.4		14.0	7.6	15.3	9.6	13		12		9.5	8.3
	Development								6.4		5.7						1.2
Structure	Materials	55	36	56		55.1		67.0		66.6		60	38	60		72.2	
	Labor		19										22				
Overhead & Profit		14		13		14.2		5.4		5.7		15		15		6.9	
Other:		6		8		8.2		10.7		10.9		12		13		11.6	
	Others				1.5										4		
	Financing				6.5		4.0								9		
	Marketing						4.2										
	Mortgage Points																
Sales Price		100%		100%		100%		100%		100%		100%		100%		100%	

Sources: 1. McGraw-Hill Information Systems Company, 1968.

2. NAHB Studies, 1968.

3. Collected HUD Data: Elsie Eaves, How the Many Costs of Housing Fit Together, (Washington, D.C., U.S. Govt. Printing Office, 1969) p.5.

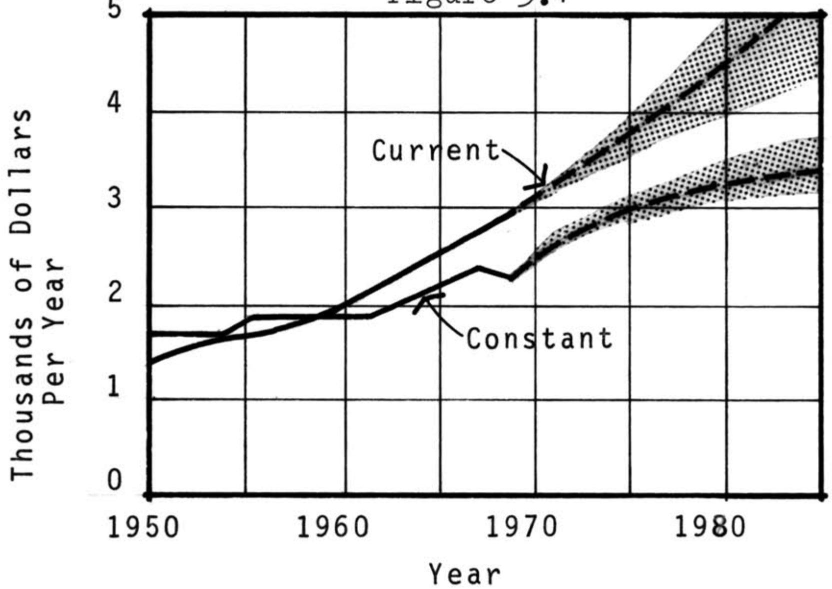
ameliorate the now critical and potentially worsening housing situation. In other words, the critical low-cost housing situation is not technically solvable, but may be eased by a combination of technological and social change in the next fifteen years."[6]

3.3.2 Monthly Occupancy Costs

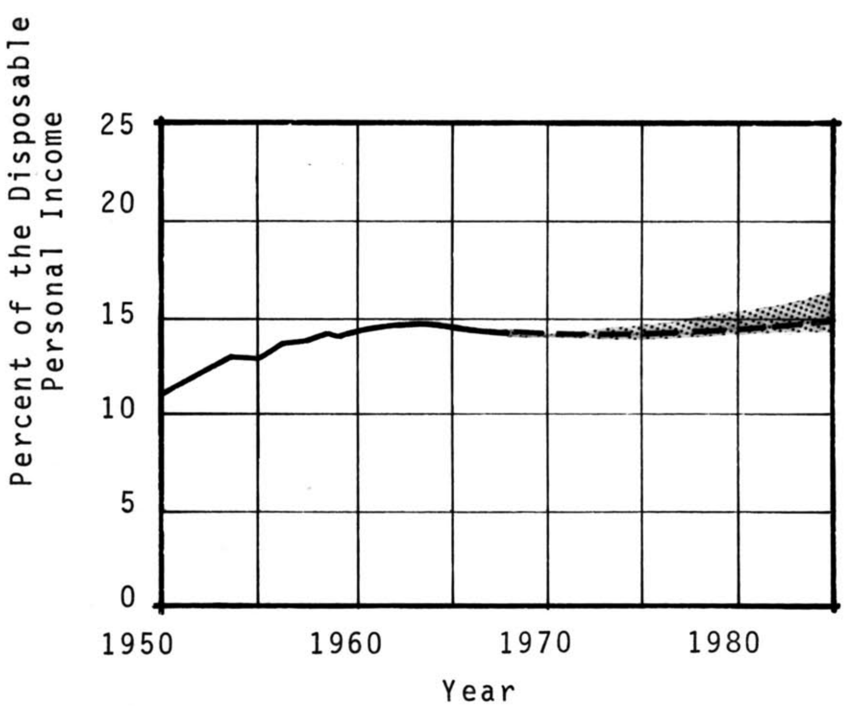
In addition to the construction costs borne by the consumer, there also exist financing charges, closing costs, and moving costs. These are just the initial costs of the house. The occupancy costs (see Table 3.2) to maintain the unit over time must also be included. These costs include: 1) debt retirement; 2) taxes; 3) utilities; 4) insurance; 5) maintenance and repair; 6) rental charges; and 7) other miscellaneous expenses.

To evaluate how the various components of costs actually effect the final user cost, initial costs and monthly time costs must be linked together. Table 3.3 is a sensitivity table developed by The Institute For The Future in which interest rates, land values, construction costs and taxes are related to the monthly cost for a one-family conventional, a one-family pre-fab, a mobile home, a rehab multi-family apartment, and a new multi-family apartment. For each of the cost-contributing sources, the resultant charge in the occupancy cost is shown. For example, each unit (1.00)

Figure 3.1



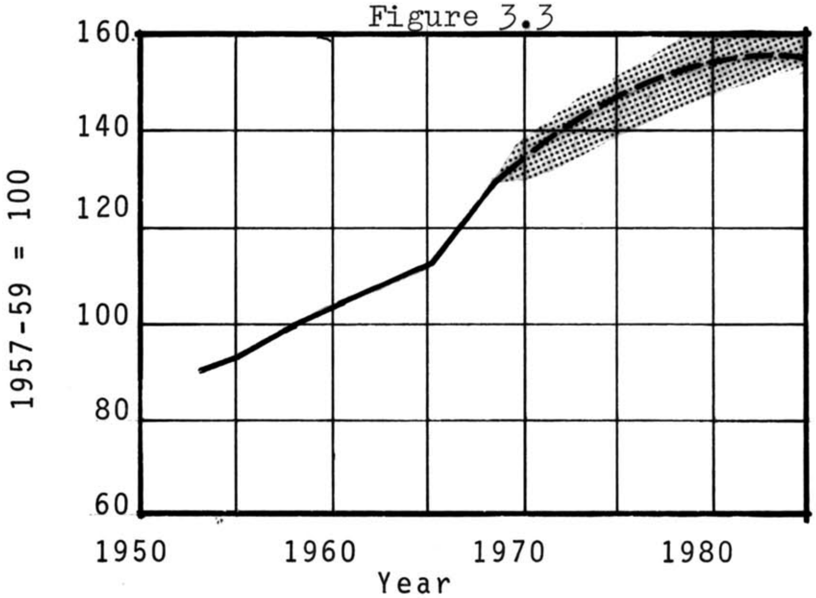
PER CAPITA DISPOSABLE PERSONAL INCOME



PERSONAL CONSUMPTION FOR HOUSING

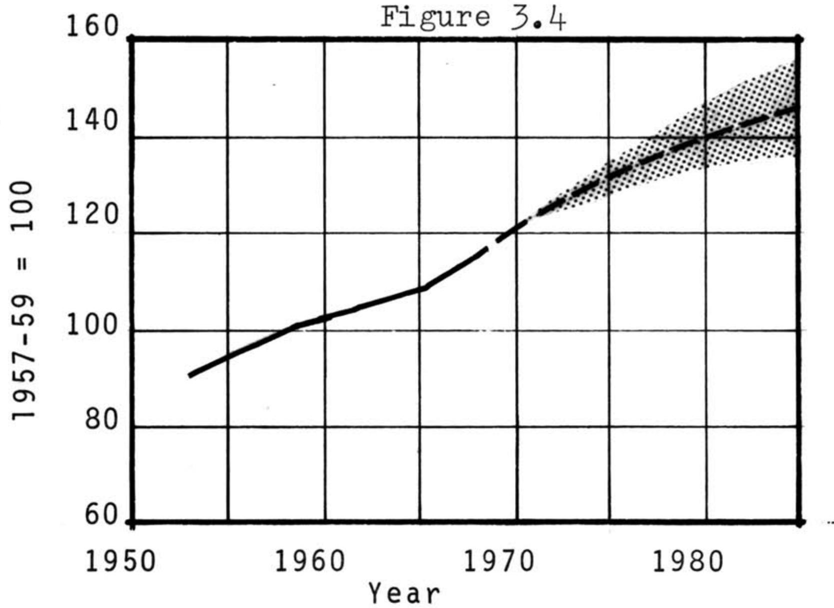
Source: Enzer, Selwyn, op. cit., pp.53, 58

Figure 3.3



CONSUMER PRICE INDEX-HOME OWNERSHIP

Figure 3.4



CONSUMER PRICE INDEX-RENT

Sources: Enzer, Selwyn, op. cit., pp.50,51

Table 3.2

Occupancy Cost Distribution

Characteristics	1-Family Development		1-Family Prefab.		Mobile Home		Rehabilitated Multi-Family		New Multi-Family (Med. - Rise w/ Elev.)	
Cost (Dollars	16,000		15,000		6,000		13,500		20,000	
Mortgage Period (Years)	30		30		7		30		35	
Mortgage Rate (Percent)	6		6		5.5		6		6	
Land (Percent)	9.5		10		14.5*		11.5		9	
Construction (Percent)	69		66		100		73.5		75	
Occupant's Monthly Cost	$	%	$	%	$	%	$	%	$	%
Debt Retirement & Insurance	92	53	84	52	86	55	68	40	102	44
Taxes	45	26	41	25	6	4	24	14	31	14
Utilities	29	16	29	18	18	11	15	9	20	9
Maintenance & Repairs	8	5	8	5	3	2	15	9	14	6
Site Rent	--	--	--	--	44	28	--	--	--	--
Payroll	--	--	--	--	--	--	17	10	--	--
Vacancies	--	--	--	--	--	--	18	11	21	9
Profit & Reserves	--	--	--	--	--	--	12	7	15	7

* No land is actually involved in mobile home costs. This figure represents the percentage value of a typical mobile home court site and is used only to compute sensibilities to recurring costs.

Source: Enzer, Selwyn, <u>Some Prospects for Residential Housing by 1985</u>, (Middletown, Conn.: The Institute For The Future, 1971) p.54.

Table 3.3

Occupancy Cost Sensitivities

	1-Family Conven.	1-Family Pre-Fab	Mobile Home	Rehab. Multi Family	New Multi Family (Med.Rise) Elevator
Interest Rate	.50	.49	.52	.38	.42
Land Value	.08	.08	.04	.06	.05
Construction Cost	.55	.51	.59	.40	.48
Taxes	.26	.25	.12	.14	.14

Source

Enzer, Selwyn, Some Prospects for Residential Housing by 1985, (Middletown, Conn. : The Institute For the Future, 1971) p.54.

change in the cost of land produces a corresponding change of .08 in the occupancy monthly cost of a conventional one-family home. Thus a 10% reduction in the cost of land would produce less than 1% decrease on the monthly occupancy cost paid by the user. It should be immediately pointed out that this sensitivity table was developed merely as a guide and is wholely dependent on the component cost breakdown of both initial construction and development and occupancy costs. Thus, if a different percentage breakdown of cost component resulted, the sensitivity table would change accordingly. This table was based on the study of five selected low-cost housing types that McGraw-Hill Information Systems Company performed for the Kaiser Commission in January, February, and March of 1968.

3.3.3 Trends In Housing Costs

Anyone buying a house today is shocked by the tremendous escalation in prices. The Boeckh building cost index for residences increased 40.6% from 1966 to 1971.[7] Construction cost indexes computed by the Bureau of Census for one family houses shows a 22% increase from 1966 to 1971.[8] A private single-family home cost $20,025 to build by 1971.[9] The construction cost of a multi-family unit was $13,400 in 1971.[10] In 1969, the NAHB's survey determined the medium sales price of a single family home (including land) to be $25,600. This represented a 42% increase over $18,000 for

1964, or an increase of 7% a year. For this same period even the FHA home experienced a 5.8% increase per year. In 1964 it was $15,878, and in 1969, $20,534.[11]

In spite of these increases, both the Kaiser Commission and the NAHB claim that the rapidly rising costs for housing is not a direct reflection of rising housing costs but rather the higher quality product the consumer is receiving. In addition, two other external factors are blamed for the increasing housing prices - higher land prices, and higher financing costs. Table 3.4 shows that the actual housing cost indexes from 1953 to 1965 have experienced only nominal increases. Conversely, Table 3.6, taken from the 1969 Bureau of Census survey, shows a rise in quality. According to the Kaiser Commission, "The widely held view that 'they don't build them like they used to' is usually based on a comparison of the average unit in today's market with the cream of yesterday's market. If one compares quality trends in a given segment of the market (for example, the luxury market) it is clear that, in most respects, they didn't used to build them like they do today."[12] The floor area increased from 1,365 sq. ft. in 1963, to 1,585 sq. ft. in 1969. Garages became more common and increased by 9% over the six year period. However, the main increase occurred in the less measurable areas - more air conditioning, better appliances, and more tasteful design and landscaping. The

Table 3.4

Trends in Cost Indexes for Housing Construction

Index	Percent Change 1963-1967
Census price index for new one-family houses sold	Up 10
Average sales price of new one-family homes	Up 24
Boeckh construction cost index for residences	Up 17
Consumer price index	Up 9

Source

Bureau of the Census.

Table 3.5

Housing Costs[1] 1953-1965

	1953	1965
Total Housing Index	92	108
Rent	90	108
Home Ownership	90	111
Fuel and Utilities	91	107
Household Furnishings and Operation	99	103
All Consumer Items	93	109

1 1958 having a base of 100.

Source

Bureau of Labor Statistics.

Table 3.6

Changes in Single Family Houses -- Characteristics 1963 - 1969

	1963	1969
Price (Median)	$18,000	$25,600
Floor Area (Median)	1,365 sq.ft.	1,585 sq.ft.
Price Per Sq. Ft. (Median)	$13.20	$16.40
Number of Bedrooms (Average)	3.19	3.01
Number of Bathrooms (Average)	1.69	1.89
Type of Foundation		
Basement, full or partial	42%	40%
Slab	36	37
Crawl Space	22	23
	100%	100%
Number of Stories	(1964 Data)	
One	71%	65%
Two or More	17	22
Split Level	12	13
	100%	100%
Type of Parking		
Garage	63%	72%
Single	NA	18%
Double	NA	54
Carport	19	15
None	18	13
	100%	100%
Appliances[1]		
Air Conditioning	19%	39%
Range	79	89
Refrigerator	6	9
Dishwasher	26	51

[1] Data show percent of all sales housing sold with these appliances included in the sales price.

Source: U.S. Department of Commerce, Bureau of Census C25-69-13.

medium square footage of FHA insured single-family homes increased 40% between 1950 and 1965.[13] Cost changes between 1949 and 1969, taken from the 1969 NAHB survey, (found on Table 3.7) indicate an increase in the cost of land, rising from 11% to 24% of the total sales price. Moreover, financing costs accounted for 11% of the total cost in 1969 as compared to only 5% in 1949. Conversely, structural costs decreased 17% in those 20 years. In 1949 it was 69%, and by 1969 it dropped to 52%. The finished floor area increased 51% - from 1,100 sq. ft. to 1,660 sq. ft. Additional changes include the increase in the use of garages from 41% in 1949, to 79% in 1969. In turn, the resulting sales price almost doubled, escalating from $13,500 to $26,000 in 1969.

Outlook

In 1971, the Institute of the Future completed a study predicting housing costs for the year 1985. This study was based on the judgement of an interdisciplinary panel of housing experts (see appendix for the list of housing experts). Their predictions of the average construction cost for one-family, multi-family, and mobile homes through 1985, are presented in graph form in Figures 3.5, 3.6, and 3.7.

The cost of consturction for a single family home is expected to increase linearly until 1975. Afetr 1975, this rate should decline, approaching $26,000 by 1985. This decrease

Table 3.7

Cost Changes 1949-1969

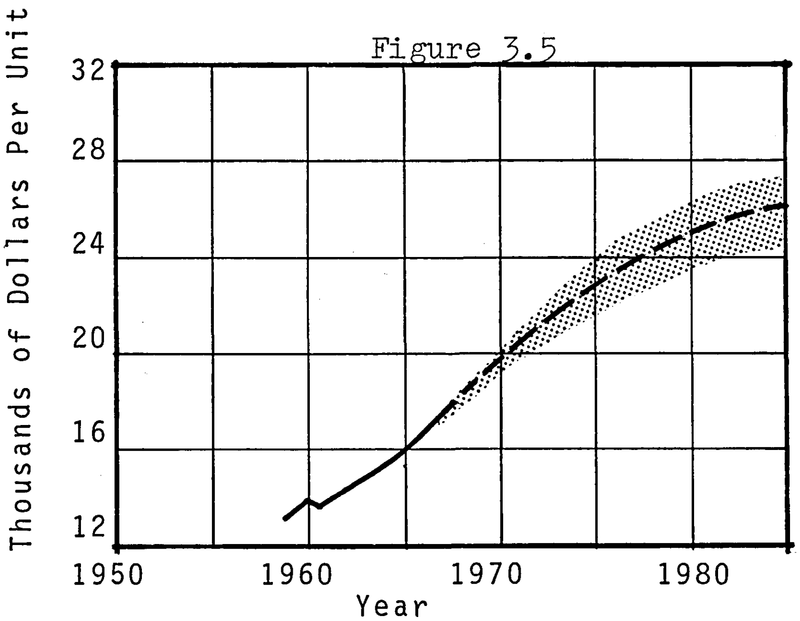
Item	1949 $	1949 %	1969 $	1969 %	Change $	Change %
Land	$ 1,485	11%	$ 6,200	24%	$ 4,715	319%
Overhead and Profit	2,025	15	3,380	13	1,355	67
Financing Cost	675	5	2,860	11	2,185	324
Structure Cost	9,315	69	13,560	52	4.245	45
Sq. Ft. of Finished Floor Area	1,100		1,660		560	50.9
Cost Per Sq. Ft.: of Finished Floor Area	$12.27		$10.20		3.39	27.6
Excluding Land	10.92		11.93		1.01	9.2
Excluding Land & Financial Cost	10.31		10.20		-0.11	-1.1
Sales Price	$13,500		$26,000		$12,500	92.6

Source: The 1949 data from Bureau of Labor Statistics and NAHB Economic News Notes, 1956. Land price derived from BLS and Fha Characteristics of one-family home transactions, Sec. 203, selected years, 18th Annual Report, 1964 HHFA, Table III-35, p.123. Financing cost derived from Saul B. Klaman, The Post War Residential Mortgage Market, Appendix, Table A-4. Sq. ft. of average floor area from BLS & NAHB Economic News Notes, 1956. Overhead and profit based on FHA cost studies average for all insuring offices.

1969 DATA Land data from unpublished 1969 NAHB Survey, Section II, single-family construction, Table 2.2. Overhead and profit based on NAHB Special Cost Survey and the average allowable cost by FHA insuring offices. Financial cost based on current yields as published by HUD, and Federal Home Loan Bank Board. Sq. ft. of livable space from Special NAHB Survey, 1969. The 1969 sales price is taken from the Bureau of the Census Sales Housing, C-25, and the NAHB 1969 Survey.

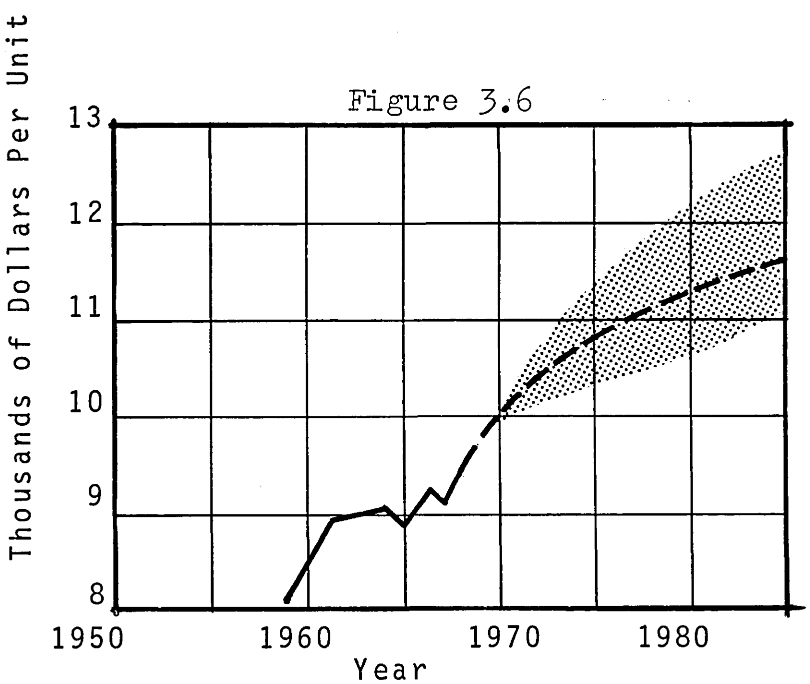
Note: This table does not include changes in the quality, variations in appliances used now as compared to 1949, nor does it include the increase in use of garages from 41% in 1949 to 79% in 1969.

Figure 3.5



<u>AVERAGE CONSTRUCITON COST: PRIVATE</u>
<u>ONE-FAMILY HOMES</u> (NONFARM)

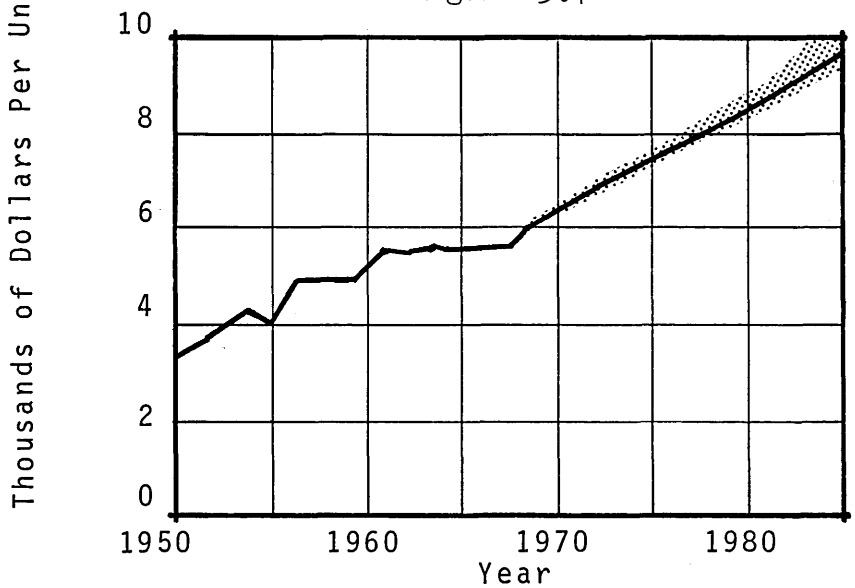
Figure 3.6



<u>AVERAGE CONSTRUCTION COST: PRIVATE</u>
<u>MULTI-FAMILY HOMES (NONFARM)</u>

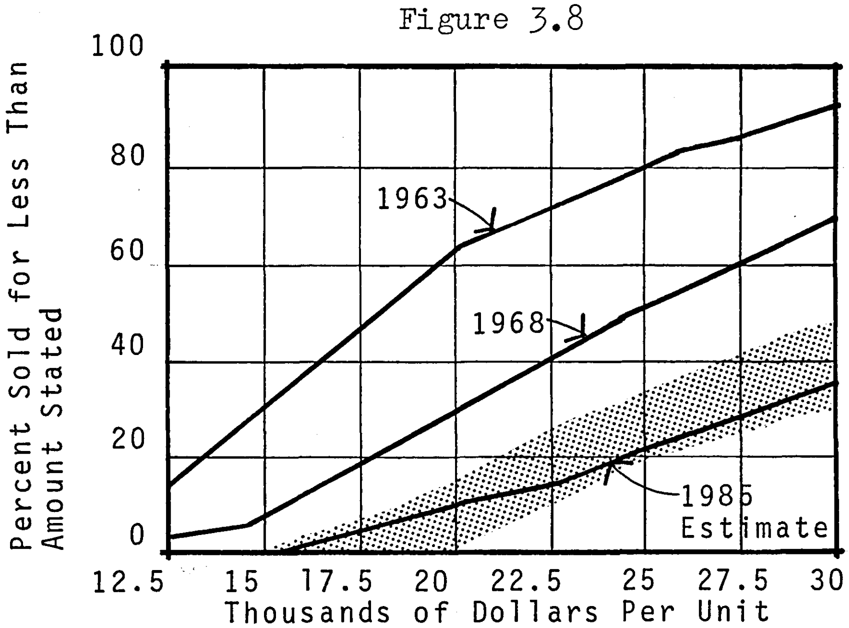
Source: Enzer, Selwyn, <u>op. cit.</u>, pp.42,43

Figure 3.7



AVERAGE UNIT COST: MOBILE HOMES

Figure 3.8



DISTRIBUTION OF NEW ONE-FAMILY HOMES BY SALE PRICE

Source: Enzer, Selwyn, op. cit., pp.44, 45 in rate is expected to result from technological innovations, factory-built sub-assemblies and the greater use of pre-engineered systems and components in general. A high and low estimate is given for each year. A high estimate is expected if: 1) inflation is continued; 2) more prestige housing is built; 3) growth in affluence permits higher prices; 4) industrialization is ineffective in one-family housing; 5) one-family homes are almost all custom built; 6) the scarcity of land forces builders into higher priced units; 7) there is difficulty in financing one-family homes. However, a lower value may result if: 1) wages level off by 1975-1980; 2) materials costs are reduced by 1980 due to technological improvements and building code changes; 3) there is greater use of manufactured assemblies.[14]

Multi-family units are expected to follow the same pattern as shown in the single-family unit graph except that the increase in cost will be faster in the early 1970's. The range of the high and low estimates is greater for multi-families thus showing a higher uncertainty. High estimates occur because of: 1) strengthening of union labor position in multi-family housing construction; 2) continued inflation; 3) increased federal subsidies permitting construction costs to rise; 4) desire for improved performance from housing. The low estimates reflect; 1) industrialized building techniques payoffs after 1975; 2) changes in building codes permitting greater standardization and innovation; 3) public policy promoting zoning changes, thus making greater supplies of land available.[15]

Mobile homes are regarded as the most advanced form of factory built housing. In spite of their present ability to keep cost down, costs are expected to experience a gradual inflationary rise. The higher expectation should result from: 1) continued inflation; 2) more elaborate units; 3) growth of unionism in the mobile home manufacturing industry; 4) compulsory conformance to building codes. Lower expectations of the cost could result from: 1) maximum efficiency of their production technique; 2) qualification for federal housing support.[16]

The distribution of new one-family homes are expected to be offered for less than $16,000. And only 35% of all one-family units are expected to be sold for $30,000 or less.

It becomes obvious after analyzing the housing needs, the industry's current production levels, and the related costs, that the critical problem of providing low-cost housing will not be acheived under the present conditions. Two suggestions are made to alleviate the problem. One is for greater subsidies in the construction, interest rates, welfare payments or combinations of these. The second is to reduce the quality of the dwelling unit. As was pointed out earlier in this section, one of the reasons cited by the Kaiser Commission and the NAHB for the rise in prices was the higher quality of the unit. However, a three-bedroom home need not be 1,585 or 1,660 square feet; "The American Public Health Association states that 450 square feet of space is adequate for a family of four from a health and safety point of view, including psychological as well as physiological factors."[17] FHA Minimum Property Standards require the following standards for the total size of dwelling units: 1) 1-br: 420 sq. ft.; 2) 2-br: 500 sq. ft.; 3) 3-br: 615 sq. ft.; 4) 4-br: 750 sq. ft.[18] Prior to the recent introduction of 14 ft.-wide and double-wide mobile homes, many families were living very adequately in the units averaging between 12' x 50' (600 sq. ft.) and 12' x 65' (780 sq. ft.).[19] Therefore, from the conditions cited, it is suggested that the size of the dwelling unit for low-income families could be cut in half - to only 700 to 800 square feet - and still avoid the psychological effects caused by inadequate space.

3.3.4 Economic Spillover Effects Of Housing

In section 1.2 the housing process was reviewed. Section 2.1.1 then analyzed the significance of housing. This section shall unite the housing process with the significance of housing to show the economic effect that housing has on it's environment.

Within the last twenty years, housing production has accumulated from 3% to 6% of the total United States Gross National Product.[20] The housing production for 1971 alone reached two million units (2,080,000).[21] Thus, by shear bulk, housing construction has become a critical sector in the United States economy. In addition to its direct expenditures for wages, materials, and services, housing construction has a multiplier effect on the national economy. This multiplier effect has been estimated by the NAHB to be "about double the direct dollar expenditure."[22] In 1971, private new housing generated $34.2 billion.[23] In comparison, total public and private housing in 1969 was only $27 billion.[24] NAHB studies show that this smaller housing expenditure had a direct impact which amounted to "$50 billion, or approximately $1 in every $18 or the total amount of gross national product in 1969."[25]

Over one million (1,150,400)[26] new single family houses were built in 1971. The result was a direct expenditure of $22 billion ($22,140,000). Assuming 3,300 manhours of work[27] for each one-family house, the result of these one million newly constructed units was close to 2 million manyears of employment (2,080 manhours per year).

Viewing the same situation differently, the NAHB found that "each new home built provides over 2 manyears of employment, about half off-site and half on-site."[28] Thus, housing construction provided approximately 4 million jobs in 1971.

Site improvements for the single-family home generated an estimated $2,500 per home,[29] or close to $3 billion in 1971.[30]

A little less than one million multi-family units (930,100)[31] were built in 1971, representing a direct expenditure of $12 billion ($12,021,000). This total represents $2.5 billion or a 26% increase from 1969.[32] Figures for on-site improvement of multi-family units are unavailable for 1971. However, the amount spent for on-site improvements of multi-family units approached $1 billion in 1969.[33]

Figure 3.9 on the following page relates the total economic effects that housing construction had on its environment in 1969. The construction activities of each single-family unit alone generated an additional 63% or $11,680 over the construction cost. Over $1,000 per unit is spent each year for such service expenditures as real estate taxes, insurance, heat & utilities, and maintenance & repairs. The total direct expenditure of $25.9 billion for construction in 1969 generated a demand for goods and services of approximately $43 billion. The overall effect that this had on the national economy, as it spread through the various sectors, was conservatively estimated to be $86 billion.

MULTIPLIER EFFECT OF HOUSING CONSTRUCTION
1969

Figure 3.9

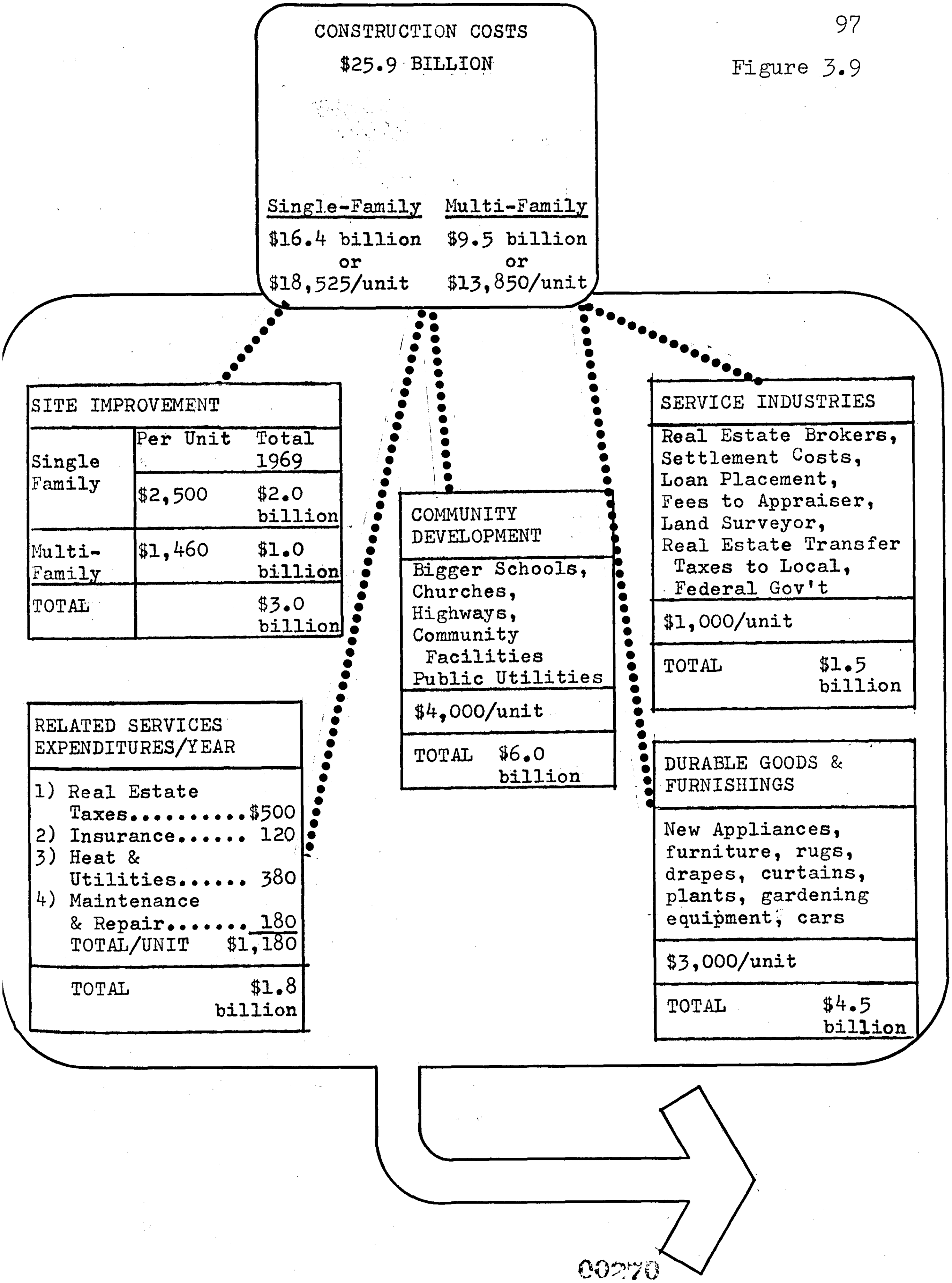
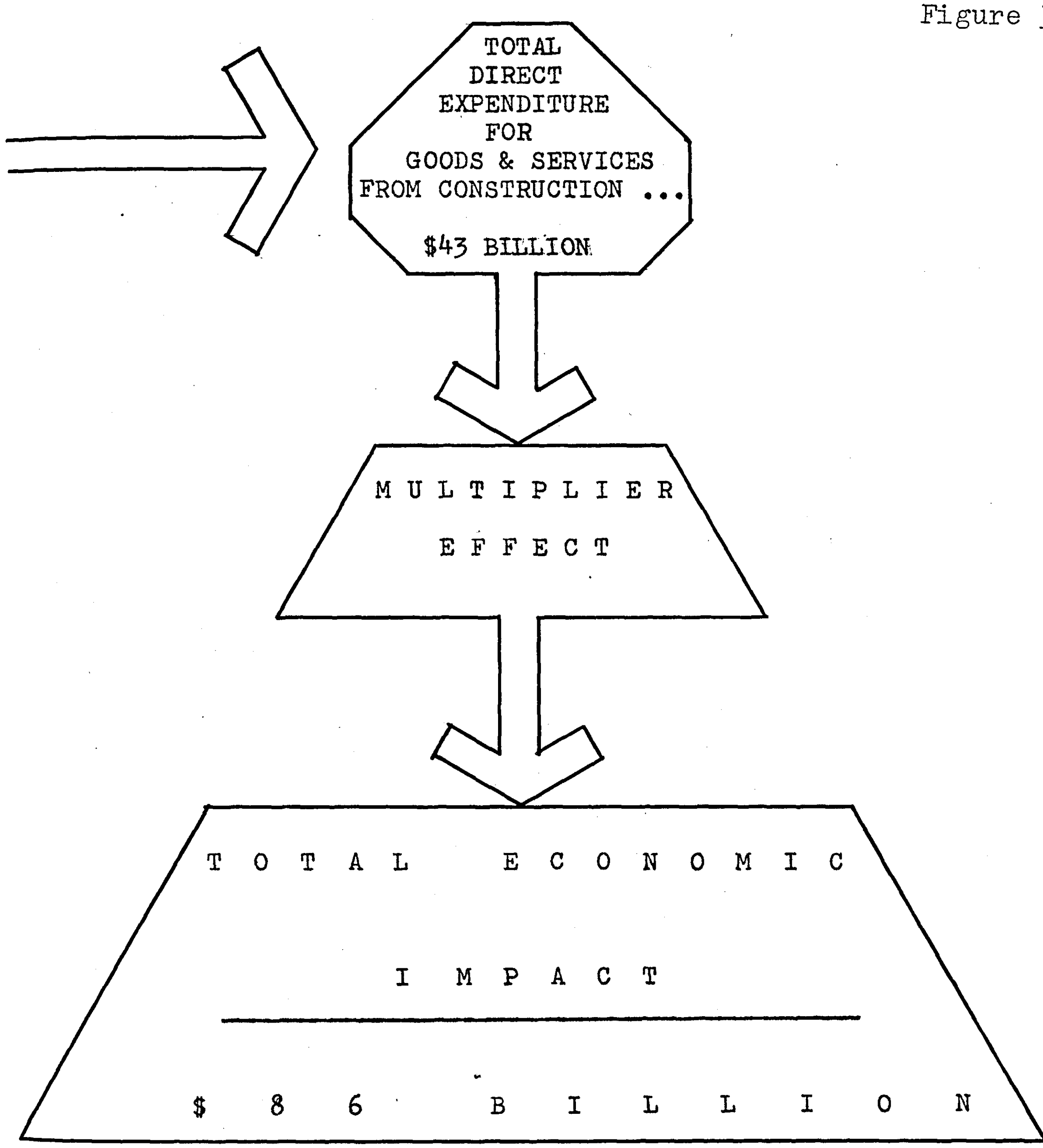


Figure 3.9



Sources:

1. Bureau of Domestic Commerce, U.S. Dept. of Commerce, Construction Review, Feb. 1972 (Washington,D.C.: U.S. Government Printing Office, 1972) p.12,17

2. Sumichrast, Michael, op.cit., p. 5,6

3. Most of Mr. Sumichrast's Construction Cost & Site Improvement Figures have been modified by the author from the figures supplied by the Bureau of Domestic Commerce.

The NAHB has estimated that each home provides a market for better than 3,000 different items.[34] Each $1,000 of a single-family home construction generates a demand for: 1) 72 manhours of on-site employment; 2) 35 manhours in transportation, trade, and related services; 3) 38 manhours in the manufacturing stage; 4) 12 manhours of off-site construction activity; 5) 47 secondary manhours,[35] totaling 204 manhours for each $1,000 of construction.

COMPONENTS OF HOUSING COSTS

Figure 3.8

3.4 COMPONENTS OF HOUSINGS COSTS		
SALES PRICE	MONTHLY OCCUPANCY COST	
Costs Incurred By The Builder	Costs Incurred By The Consumer (User)	
PRIMARY COSTS 1) <u>Development Costs</u> a) Land Acquisition b) Land Development Cost — Land Costs c) Fees (Arch.,Eng.,etc.) 2) <u>Direct Construction Costs</u> a) Materials b) Labor — Structure Costs 3) <u>Financing Expenses</u> — Sometimes Under Overhead & Profit 4) <u>Overhead & Profit</u> a) Selling Expense b) General & Administrative Expenses — Sometimes Seperate Items c) Other Costs d) Profit	1) Debt Retirement 2) Taxes 3) Utilities 4) Maintenance & Repairs 5) Insurance	Typical Occ. Costs
	6) Site Rent	Varies
	7) Payroll, Management, Administrative Expense 8) Vacancies 9) Profits & Reserves	For Multi-Fam. Rental Units
SECONDARY COSTS 1) Builder Volume 2) Construction Methods (Degree of Industrialization) 3) Structure Type 4) Time (Financing,Construction Methods) 5) Management 6) Materials Utilization 7) Labor Productivity 8) Location of Building Project (Metro vs Rural, Climatic Zones, City Indexes, Regional Differences) 9) Geography 10) Weather 11) Codes & Zones 12) Local & State Gov't Regulations, Ordinances, Taxes, Etc. 13) Owner of the Unit (Public or Private) 14) Role of Fed. Gov't		

3.4 Components Of Cost

A vast number of factors influence costs. Table 3.8 presents the major cost categories in their functional relationship for both a sales price and a monthly occupancy breakdown. Because the primary focus is oriented toward design and production efficiency, this section shall analyze in detail the primary and secondary costs associated with the sales price. It shall be assumed that occupancy costs were covered adequately in Section 3.3.2 (Occupancy Costs).

3.4.1 Land Costs

Land costs are dependent on three factors: 1) price for acquisition of the raw land; 2) cost of land development; 3) amount of land used.

A study by Sherman Maisel in the San Francisco Bay Area during the period 1950-1962, showed that 52% of the increased FHA lot prices was directly attributed to rising costs of raw land. Of this total: 1) 28% of the cost was directly due to higher development costs; and 2) 20% of the increase was related to larger lot sizes.[36]

The land costs fluctuate highly from locality to locality. There exists a tremendous difference between the central city and the suburb areas. As revealed by Table 3.1, land costs decrease with the increasing amount of units built on the site. For example, the land costs of a single family house range from 17% to 25% of the sales price. In comparison, land costs for an elevator apartment unit average between 10-13%. However, these are just average costs. A study by Elsie Eaves in 1969, revealed that land costs for five tract or sub-division developers in Ohio and the West had a 15% range (from a high of 32.0% of the total sales price to a low of 16.7%.). The range for HUD multi-unit housing is even greater, approximately 20%. Row housing fluctuated from 2.3% - 21.4%. Walkups ranged between 0.6% - 20.2% and elevator building units ranged between 1.8% - 22.4%.[37]

Development costs for land include: 1) financing and interest costs; 2) realty taxes; 3) bonding fees; 4) land planning fees; 5) engineering fees; 6) rough grading; 7) paving; 8) curbs; 9) gutters; 10) sidewalks, storm sewers and other drainage, sanitary sewer, water, electricity, gas, and other such street lighting.

The trends in land developments are directly related to construction costs. In recent years, the rapid advances in heavy construction equipment has caused labor productivity in land development work to increase proportionally. However, these costs still continue to rise. One reason for this rise is the higher quality of land development work - roads and curbs are larger, better materials are used and utility lines are put underground. A survey by the NAHB in 1969 showed the typical (median) development cost increasing from 1967-69: 1) a 22.9% increase for small builders; 2) 30.3% for medium builders; 3) 24.9% for large builders. The survey revealed that the average land development cost (including all fees) for single and multi-family structures was $29 per front foot in 1967 and $39 in 1969. The median increased from $25 to $33 in 1969. Small volume builders increased from $28 in 1967 to $34 in 1969. Medium and large-volume builders reported an average $30 in 1967. This grew to $38 in 1969.[38]

The price for raw land appears to be the major reason for increased land costs per housing unit. <u>The Profile of the Builder</u> states, "The increasing and accelerating price of land was one of the major problems confronting the residential construction industry as the decade of the sixties ended."[39]

From 1967 to 1969, the small builder found that his price for raw land had increased a phenomenal 95.3%. However, the medium and large builders were not as severely affected by the price rise - the medium builder only experienced a 27.5% increase and the large builder only a 20.8% increase.[40] The average front foot market value was $66 in 1969. The medium was $62 in 1969. Builders of single family units had a front foot market value of $62 in 1969. The front foot market value for the builder of multi-family units was up to $76 in 1969.[41]

The average land price is highly dependent on the region of the country. Table 3.9 shows the average land prices by region per front foot. The Pacific heads the list with $28.6 per front foot. It is followed by the Mid-Atlantic and East South Central with $24.1 and $21.3 respectively. Table 3.10 gives the 1969 average price of finished lots. Hawaii leads the total with an average price of $15,791 per finished lot. It is followed by New Jersey with $10,920. Texas is the lowest with an average price of $4,746 per lot. The reader is referred to Profile of the Builder (pages 43-50) for a very detailed listing of the typical finished lot prices by cities.

The following other tables are presented for the reader's analysis:

Table 3.11 & 3.12::Single-Family Lot Size, Typical Price of Finished Lot, By Size and Type of Operation.

Table 3.13: Comparative Average Value of Land in 1969 for Various Residential Uses.

Table 3.14: Densities and Numbers of People Per Acre in 1969 For Various Residential Uses.

Table 3.9

Average Land Development Cost Per Front Foot 1969

	Raw Land	Land Development Cost	Front Foot Market Value
Total 1969 Survey	$24	$36	$66
Single Family Only	23	35	62
Multifamily Only	23	36	76
Single and Multifamily	25	39	70
Small Volume	23	34	61
Medium Volume	25	38	68
Large Volume	24	38	74

Source

Sumichrast, Michael, *op. cit.*, p.142 (NAHB).

Table 3.10

Average Price of Finished Lots by States 1969

State	Average Price	State	Average Price
Alabama	$4,786	Montana	$4,833
Alaska	4,786	Nebraska	4,918
Arizona	5,298	Nevada	4,775
Arkansas	4,431	New Hampshire	4,809
California	9,507	New Jersey	10,920
Colorado	5,180	New Mexico	3,998
Connecticut	10,313	New York	7,958
Delaware	8,875	North Carolina	5,022
District of Columbia	9,267	North Dakota	4,455
Florida	5,316	Ohio	6,922
Georgia	5,919	Oklahoma	4,687
Hawaii	15,791	Oregon	5,203
Idaho	3,200	Pennsylvania	5,296
Illinois	7,563	Puerto Rico	6,100
Indiana	4,718	Rhode Island	4,858
Iowa	4,783	South Carolina	4,034
Kansas	3,709	South Dakota	4,842
Kentucky	5,582	Tennessee	4,099
Louisiana	6,017	Texas	4,746
Maine	5,500	Utah	6,205
Maryland	5,475	Vermont	5,400
Massachusetts	7,197	Virginia	5,190
Michigan	5,785	Washington	5,215
Minnesota	6,584	West Virginia	4,893
Mississippi	4,738	Wisconsin	6,555
Missouri	5,875	Wyoming	3,000

Source

Sumichrast, Michael, op. cit., p.42 (NAHB).

Table 3.11

Single-Family Lot Size and Typical Price of Finished Lot 1969; and 1969 Responses by Type and by Size of Operation

(Percent Distribution)

	Total 1969 Survey	1969 Survey Responses by Type and by Size of Operation				
		Single-Family Only	Single and Multi	Small (1-25 Units	Medium (26-100 Units)	Large (100 + Units)
Lot Size:						
Under 6,000 Sq.Ft.	9.0	9.5	8.0	9.7	6.4	8.4
6,000 - 7,499	9.6	8.8	11.0	6.0	12.9	19.9
7,500-- 9,999	21.6	19.4	26.2	17.8	26.5	31.3
10,000 - 14,999	29.6	29.0	30.7	30.6	31.5	22.7
15,000 - 19,999	14.6	16.2	11.6	16.9	12.2	9.4
20,000 - 39,999	12.1	13.2	9.7	14.7	8.5	6.2
40,000 - 87,119	3.2	3.5	2.5	3.8	1.9	1.8
87,120 and Over	0.3	0.4	0.3	0.4	0.1	0.3
Mean Sq. Ft.	12839	13273	11992	13864	11564	10673
Median Sq. Ft.	11654	12121	10782	12696	10667	7673

Table 3.12

(Percent Distribution)

	Total 1969 Survey	1969 Survey Responses by Type and by Size of Operation: Single-Family Only	Single and Multi	Small (1-25 Units)	Medium (26-100 Units)	Large (101 + Units)
Price Finished Lot:						
Under $1,000	0.1	0.1	0.0	0.1	0.1	0.0
1,000 - 1,999	1.3	1.7	0.7	1.7	0.4	0.3
2,000 - 3,999	26.5	27.1	25.6	26.0	29.2	24.2
4,000 - 5,999	32.1	32.2	31.3	31.3	33.5	33.0
6,000 - 7,999	17.9	17.6	18.9	17.7	16.9	22.7
8,000 - 9,999	8.6	7.9	10.2	8.5	7.8	11.1
10,000 - 14,999	8.4	8.6	7.9	9.0	8.4	5.8
15,000 and Over	5.0	4.9	5.3	5.8	3.7	2.9
Mean Price	$6,183	$6,111	$6,329	$6,311	$5,929	$5,646
Median Price	$5,377	$5,311	$5,514	$5,419	$5,212	$5,545

Note: Details may not add to 100% because of rounding. Nonrespondents to question deleted.

Source: Sumichrast, Michael; <u>op</u>. <u>cit</u>., p.110-111. (NAHB).

Table 3.13

Comparative Average Value of Land in 1969 for Various Residential Uses

Type	Average (Mean) Value Per Acre	Typical (Median)
High-Rise, $2,582 x 67.7 units per acre	$174,800	$91,823
Medium-Rise, $1,955 x 45 units per acre	88,018	49,506
Garden, $1,71 x 19.55 units per acre	33,547	30,439
Townhouse, $2,064 x 13.62 units per acre	28,107	24,047
Single, $6,183 x 2.5 units per acre	15,458	NA

Source

Sumichrast, Michael, op. cit., p.34 (NAHB).

Table 3.14

Densities and Number of People Per Acre in 1969 for Various Residential Uses

Type of Unit	Average Density Per Acre	Average Number of Persons Per Unit*	Total Average Number of People Per Acre
High-Rise	67.73	3.3	223.5
Medium-Rise	45.00	3.3	148.5
Garden	19.55	3.4	66.5
Townhouse	13.62	3.5	47.7
Single-Family	2.50**	3.6	9.0

* The average number of persons per unit based on U.S. Census of Housing 1960, HC(4), Part 1A-1, Table 2, p45.

** Average density for single-family units is based on the average lot size as shown in Chapter 3 of report by Michael Sumichrast.

Source

Sumichrast, Michael, op. cit., p.35 (NAHB).

Outlook

Land prices are expected to continue to increase. The NAHB expects urban land to double or triple in the next 10 years. To underscore the gravity of the situation, real income is only expected to rise 30-40% during this same period.[42]

3.4.2 Development Fees

A review of the housing process on Table 1.7 will reorient the reader to the fee structure required in the development stage. Fees must be paid to the: 1) lawyer; 2) real estate broker; 3) architects and engineers; 4) surveyor; 5) planners and consultants; and 6) numerous other liason individuals and firms in the housing process. The reader is referred to Figure 1.7.

Fees vary with the housing type, location, and other factors mentioned in the secondary costs. For a mass produced single-family unit or mobile home the fees will be minimized (especially since the architect's and engineer's fees will be small), but for an elevator apartment building these fees represent 5 percent or more of the total project costs.

The following is a list of architectural fees tabulated from the A.I.A. by Robert Snow Means Company, Building Construction Cost Data, 1971:[43]

Bldg Type	Total Project Size in Dollars 100,000	500,000	1,000,000	5,000,000	15,000,000	Add for Alterations
Repetitive housing	7.5%	7.0%	6.0%	4.4%	4.0%	2.0%
Apts.	9.0	8.25	7.5	5.5	5.0	2.5
Homes	10.5	10.0	9.0	7.0	6.5	3.0

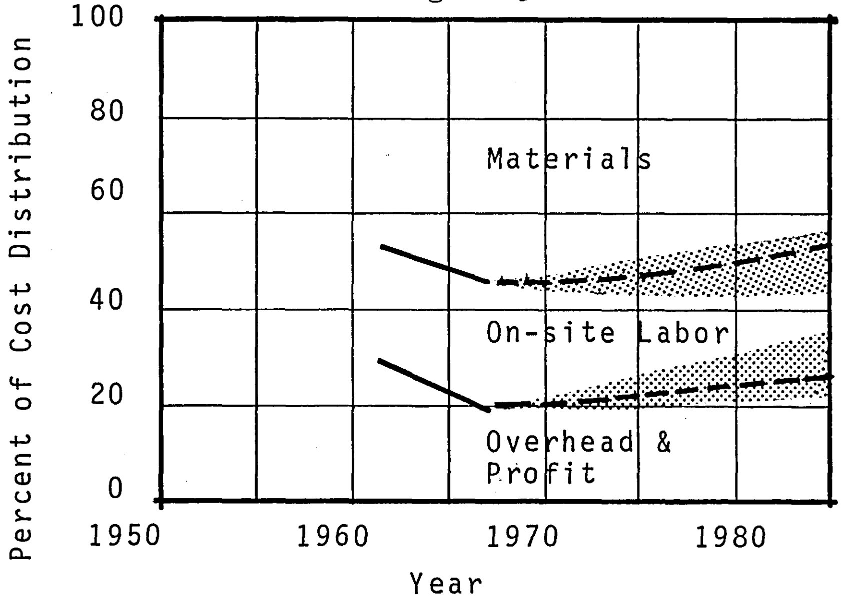
3.4.3 Building Materials

Building materials accounted for 55% of the construction cost of a single family home in 1967. By 1971, this figure was reduced to 54%. By 1985, further efficiency in the use of materials, a greater percentage of custom built units, and the faster rate of wage increases could reduce this portion to 45%.[44] Gains in material research has caused the housing industry to emphasize function more than material. The trend now is to think of a building in terms of its component parts (or building subsystems) rather than its raw materials. As industrialization grows, a greater percentage of the on-site labor costs will be incorporated into the material costs. Materials will be thought of as whole subsystem quantities, such as preassembled bathrooms, kitchens, and utility cores rather than formless substances.

In comparison to the single-family home, the materials in a multi-family home accounts for a large portion of the total construction cost. Industrialization is more applicable to the multi-family unit because of its lesser dependence on custom-building. The percentage cost of on-site labor is reduced through industrialization thus increasing the portions for materials and overhead/profit/miscellaneous. In 1960, materials accounted for only 48% of the construction cost but by 1967, this percentage rose to 52%. By 1985, the Institute of the Future predicts materials will account for 64% of the total.[45] The 1985 material costs compare favorably to the actual field data on factory produced box structures collected by the author. Mobile home materials account for 68%-70% of the total f.o.b. factory selling price. Modular home materials account for approximately 60% of the f.o.b. factory selling price. However, a common rule of thumb in determining the selling price of a modular home is to assume that materials makeup only 46% of the total and adjust the selling price accordingly.

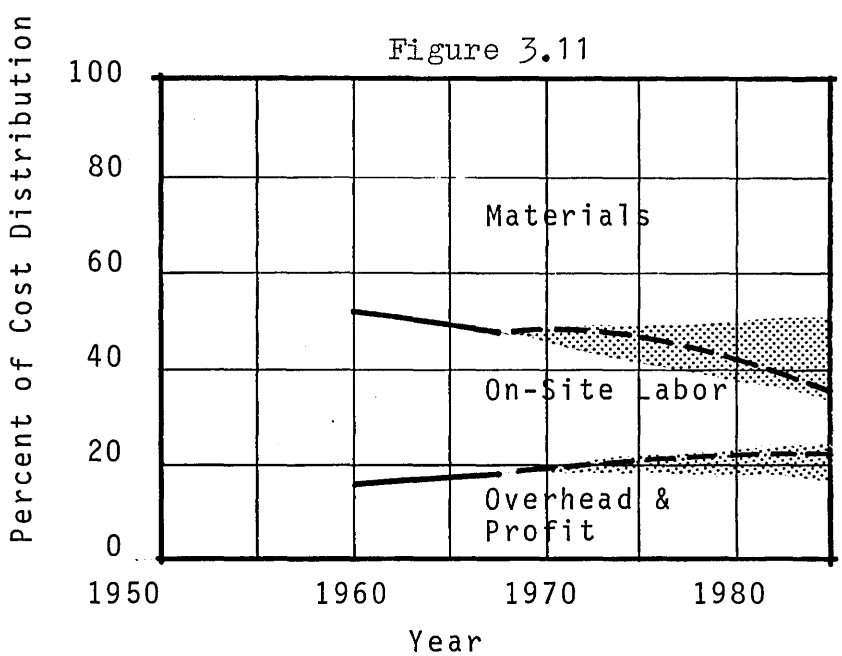
The cost of construction materials rose at a compounded average annual rate of 3.3% from 1965 to 1970.[46] Price increases were somewhat moderated by unstable demand levels (see section 2.1, An Aggregate Look At Housing Production) and strong competitive factors. These factors promoted increased productivity and technological advances in product development. Table 3.16a relates the price trends of the major construction materials for the periods 1965-70 and 1961-68. The materials are ranked by effect on the

Figure 3.10



CONSTRUCTION COST DISTRIBUTION, ONE-FAMILY HOMES

Figure 3.11



CONSTRUCTION COST DISTRIBUTION, MULTI-FAMILY HOMES

Sources: Enzer, Selwyn, op. cit., pp. 39, 40

Table 3.16

Impact of Individual Price Index Changes on Composite Construction Materials Wholesale Price Index 1961-68

Name	Average annual % increase 1961-68	Average annual effect on "Composite Construction Materials" index (%)[1] 1961-68
PRICE INDEX INCREASED 1961-68:		
Other softwoods	+4.8	+0.2780
Millwork	+2.2	+0.1630
Douglas fir	+5.0	+0.1293
Copper water tubing, straight lengths	+7.0	+0.1274
Fabricated structural steel for bldgs	+2.0	+0.0817
Prepared paint	+1.5	+0.0805
Southern pine	+3.4	+0.0798
Ready-mixed concrete, 5-sack mix	+0.8	+0.0560
Plywood	+1.1	+0.0515
Sand, gravel & crushed stone	+1.4	+0.0481
Nonmetallic sheathed cable	+6.0	+0.0467
Hardwood lumber used in construction	+2.9	+0.0395
Window glass, single B	+4.3	+0.0342
Building wire, type THW	+7.4	+0.0329
Plumbing fixtures and brass fittings	+1.4	+0.0280
Sheets, galvanized, carbon	+1.4	+0.0277
Structural shapes	+1.2	+0.0248
Metal doors, sash & trim	+0.8	+0.0240
Building block	+1.2	+0.0199
Building brick	+1.7	+0.0142
Other nonmetallic minerals used in construction	+0.7	+0.0128
Cement, Portland	+0.3	+0.0104
Clay tile	+0.9	+0.0066
Plaster, base coat	+3.2	+0.0051
Asphalt floor tile	+2.0	+0.0037
Heating equipment	+0.1	+0.0029
Prepared asphalt roofing	+0.1	+0.0011
Gypsum lath	+0.1	+0.0001

Impact of Individual Price Index Changes on Composite Construction Materials Wholesale Price Index 1961-68 (Continued)

Name	Average annual % increase 1961-68	Average annual effect on "Composite Construction Materials" index (%)[1] 1961-68
PRICE INDEX DECLINED 1961-68:		
Insulation board	-1.2	-0.0094
Hardboard & particleboard	-0.7	-0.0070
Bars, reinforcing	-0.8	-0.0063
Concrete culvert pipe, reinforced	-0.3	-0.0039
Aluminum siding noninsulated, manufacturer to distributor	-1.2	-0.0036
Gypsum wallboard	-0.4	-0.0036
Plate glass, ¼" thick	-0.3	-0.0036
Nails, wire, 8d common	-1.0	-0.0033
Vinyl sheet goods, semi-permanent	-0.6	-0.0033
Clay sewer pipe, vitridied clay	-0.4	-0.0013
SUMMARY:		
Gross increase accounted for by indexes	---	+1.4299
Gross decrease accounted for by indexes	---	-0.0453
Net changes in "Composite Construction Materials" Price Index	---	+1.7196

[1]Price change multiplied by weight.

Source: U.S. Department of Labor, Bureau of Labor Statistics. Table compiled by U.S. Department of Commerce.

Table 3.16

Impact of Individual Price Index Changes on Composite Construction Materials Wholesale Price Index 1965-70

Name	Relative importance 1963 wts.	% change in index 1965-70[2]	Effect on "Composite Construction Materials" Index (%)[1]
Millwork	7.411	+3.9	+0.2890
Ready-mixed concrete, 5-sack mix	6.995	+3.4	+0.2378
Other softwoods	5.791	+3.8	+0.2201
Prepared paint	5.364	+3.1	+0.1663
Copper water tubing, straight lengths	1.820	+8.4	+0.1529
Fabricated structural steel for buildings	4.087	+3.6	+0.1471
Cement, Portland	3.459	+3.4	+0.1176
Southern pine	2.347	+4.7	+0.1103
Sand, gravel & crushed stone	3.438	+3.2	+0.1100
Metal doors, sash & trim	2.998	+3.4	+0.1019
Douglas fir	2.586	+3.3	+0.0853
Other nonmetallic minerals used in construction	1.830	+4.4	+0.0805
Structural shapes	2.064	+3.7	+0.0764
Plumbing fixtures & brass fittings fittings	2.000	+3.8	+0.0760
Nonmetallic sheathed cable	0.779	+9.1	+0.0709
Heating equipment	2.863	+2.3	+0.0658
Builders' hardware	1.514	+4.1	+0.0621
Building block	1.662	+3.1	+0.0515
Plywood	4.686	+1.0	+0.0469
Sheets, galvanized, carbon	1.976	+1.9	+0.0375
Building wire type THW	0.444	+8.3	+0.0369
Hardwood lumber used in const.	1.362	+2.7	+0.0368
Window glass, single B	0.795	+4.2	+0.0334
Building brick	0.834	+3.3	+0.0275
Concrete culvert pipe, reinforced	1.287	+1.9	+0.0245
Insulation board	0.782	+2.4	+0.0188
Clay tile	0.737	+2.4	+0.0177
Bars, reinforcing	0.784	+1.8	+0.0141
Plaster, base coat	0.158	+7.2	+0.0114
Prepared asphalt roofing	1.105	+0.8	+0.0088
Asphalt floor tile	0.183	+3.2	+0.0059
Nails, wire, 8d common	0.331	+1.3	+0.0043
Clay sewer pipe, vitrified clay	0.322	+1.3	+0.0042
Aluminum siding, noninsulated, manufacturer to distributor	0.303	+1.3	+0.0039

Impact of Individual Price Index Changes on Composite Construction Materials Wholesale Price Index 1965-70 (Continued)

Name	Relative importance 1963 wts.	% change in index 1965-70[2]	Effect on "Composite Construction Index (%)[1]
Gypsum lath	0.132	+1.3	+0.0017
PRICE INDEX DECREASED 1965-70:			
Hardboard & particleboard	0.995	-2.1	-0.0209
Gypsum wallboard	0.905	-2.1	-0.0190
Vinyl sheet goods, semi-permanent	0.552	-1.7	-0.0094
SUMMARY:			
Gross increase accounted for by indexes	-----	----	2.5558
Gross decrease accounted for by indexes	-----	----	0.0493
Net change in "Composite Construction Materials" Price Index	100.000	----	3.2533

[1]Price change multiplied by weight.

[2]Average annual rate.

Source: U.S. Department of Labor, Bureau of Labor Statistics. Table compiled by U.S. Department of Commerce.

"Composite Construction Materials" Index (Percent change in index x Relative Importance). The highest annual percentage increases for 1965-70 were: 1) non-metallic sheathed cable: 9.1%; 2) copper water tubing: 8.4%; 3) building wire (type THW): 8.3%; 4) plaster base coat: 7.2%.

Those registering price declines were: 1) hardboard and particle board: 2.1%; 2) gypsum wall board: 2.1%; 3) vinyl sheet goods: 1.7%.

Only small average gains were experienced by: 1) prepared asphalt roofing: 0.8%; 2) plywood: 1.0%; 3) nails (wire, common, 8d): 1.3%; 4) clay sewer pipe: 1.3%; 5) gypsum lath: 1.3%.

The products showing the greatest gains for the first four months of 1971 were Douglas fir, other softwoods, prepared asphalt roofing, Southern pine, Portland cement and plywood. The indexes registering a decrease were building wire, nonmetallic sheathed cable and copper water tubing. However, it should be noted that these items experienced sizable price increases for 1970.

A large rise in the price of wood products is expected because of the inelastic supply of raw materials coupled with the large increase in demand for wood products.

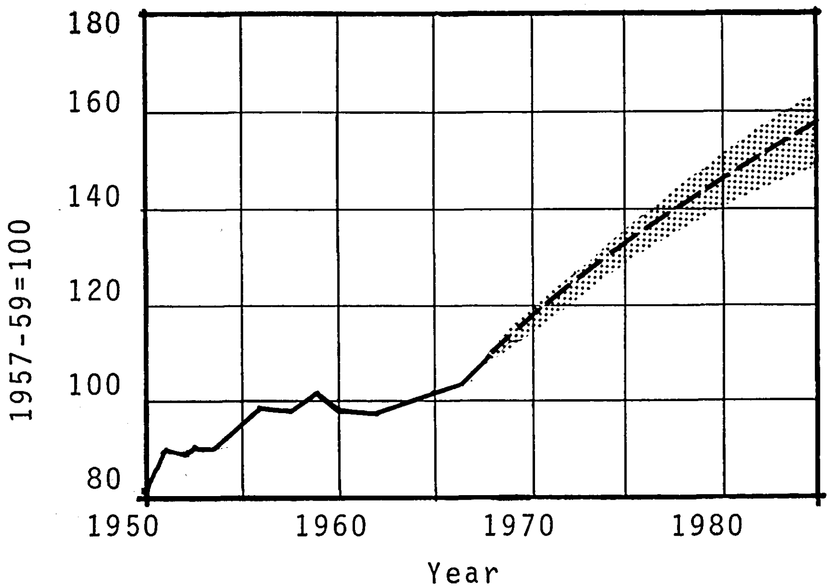
In the past, the total lumber supply which was controlled by annual allocations designed to perpetuate the harvest, had proven sufficient. However, since the 1960's, the Japanese have been buying logs for processing in their own country. This export has increased from under one million board feet in 1960, to 1.6 billion in 1968. Japanese pruchases had totaled 15% of the harvest in the Pacific Northwest by 1968. Because of the ability of the Japanese trading companies to outbid the U.S. mills and coupled with the inelastic supplies, raw material costs had doubled by 1967. These costs are expected to increase in the future.

Presented for the reader's analysis is a listing of indexes of wholesale prices for the period 1966-71. Also included is the basic 1972 material prices from the Dodge/1972 Construction Pricing & Scheduling Manual. It is hoped from reviewing these detailed indexes that a rational method of selecting materials based on material costs and trends would result.

Outlook

The Institute of the Future's prediction of the wholesale price index is presented. A tremendous increase is expected. Starting at 105 in 1967, continued inflation, sharply increased demands by mid-seventies, and coordinated pre-dimensional materials could cause the index to reach as high as 162. However, competition for markets, large-scale volume and competition between basic materials could offset this trend and cause the index to reach only 148. Nevertheless, a large increase in materials prices is expected.

Figure 3.12



WHOLESALE PRICE INDEX - CONSTRUCTION MATERIALS

Source: Enzer, Selwyn, op.cit., p.47

Table 3.15

Basic Material Prices 1972

Common Brick	61.00/M
Concrete Block 4"	.27/EA.
8 x 16 6"	.31/EA.
8"	.35/EA.
Lumber 2 x 4 Common	165.00/MBF
2 x 6 Common	160.00/MBF
Form Ply 5/8"	217.00/MSF
Form Ply 3/4"	238.00/MSF
Cement	5.85/BBL
Plaster, Gauging	2.50/CWT
Mortar Cement	5.20/BBL
Lime Hydrated Com.	2.65/CWT
Gypsum Board 1/2"	72.00/MSF
5/8"	79.00/MSF
Pipe: Stand. V.C. 6"	.83/LF
8"	1.12/LF
Concrete 12"	2.15/LF
15"	2.90/LF
Reinf. Steel	10.25/CWT
Structural Steel	10.75/CWT
Wire Mesh: 6" x 6" x 6/6	5.85/CSF
6" x 6" x 10/10	3.95/CSF
Equipment Rental - 90% of Green Book	
R. Mix Concrete 2500#	18.55/CY
3000#	19.50/CY
Pipe C.I. CL 150 6"	2.50/LF
8"	3.70/LF
Tubing Copper L 1/2"	0.37/LF

Source

Dodge - 1972, Construction Pricing in Scheduling Manual (N.Y., N.Y.: McGraw-Hill Information Systems Co., 1972) p.III.

Table 3.17

Indexes of Wholesale Prices of Materials Used in Construction, by Selected Groups and Commodities

Period	All construction materials	Softwood lumber: Douglas fir	Softwood lumber: Southern pine	Softwood lumber: Other	Selected hardwood lumber	Millwork: Group index	Millwork: General millwork	Millwork: Prefab. structural members	Plywood: Group index[1]	Plywood: Softwood
1966	98.8	96.8	100.2	97.5	116.2	98.0	98.7	94.8	104.0	106.1
1967	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1968	105.6	120.3	113.7	123.5	107.7	105.8	105.3	107.8	115.7	129.2
1969	111.9	131.7	126.0	139.0	127.7	117.8	117.6	119.2	122.5	139.2
1970	112.5	108.8	114.5	115.1	116.8	116.0	115.6	118.0	108.5	113.6
1971	119.5	137.6	133.8	145.3	114.4	120.7	121.4	117.5	114.7	127.2

Period	Building paper and board: Group index	Building paper and board: Insulation board	Building paper and board: Hardboard &particle-board	Prepared paint	Selected finished steel products: Structural shapes	Selected finished steel products: Reinforcing bars	Selected finished steel products: Galvanized sheets, carbon	Selected finished steel products: Wire nails, 8d common	Builder's hardware
1966	100.8	98.4	103.4	97.7	99.9	100.8	100.0	101.6	97.0
1967	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1968	100.9	103.0	99.1	104.8	101.8	99.3	102.7	100.1	101.7
1969	105.5	108.8	102.9	109.1	108.1	100.3	105.7	107.8	105.4
1970	101.2	110.8	93.4	112.4	115.3	109.2	109.7	114.7	112.9
1971	103.0	115.1	93.3	115.6	126.8	117.1	114.9	124.7	117.7

Table 3.17

Period	Selected Nonferrous Metal Products			Plumbing Fixtures and Brass Fittings			
	Copper water tubing, straight lengths	Building wire, type THW, 12 AWG	Nonmetallic sheathed cable	Group Index[1]	Enameled iron fixtures	Vitreous china fixtures	Brass fittings
1966	104.6	97.5	97.1	98.1	99.4	99.3	97.2
1967	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1968	105.0	98.1	97.1	103.3	102.4	102.9	104.7
1969	115.7	99.3	101.5	107.3	108.5	106.3	108.8
1970	123.1	123.0	131.7	112.5	111.4	108.9	115.8
1971	108.5	97.9	107.3	116.4	114.4	111.8	120.0

Period	Heating Equipment			
	Group index[1]	Steam and hot water	Warm air furnaces and attachments	Water heaters, domestic
1966	99.8	99.5	98.6	101.9
1967	100.0	100.0	100.0	100.0
1968	102.7	103.8	103.2	100.7
1969	105.4	107.4	105.2	103.6
1970	110.6	110.7	111.1	109.6
1971	115.5	116.4	114.5	115.2

Table 3.17

Period	Selected fabricated structural metal products			Concrete ingredients			Concrete products			
	Steel for bldgs	Metal doors sash & trim	Aluminum siding, noninsulated, mft. to distr.	Group index	Sand gravel& crushed stone	Portland cement	Group index	Bldg block	Concrete culvert pipe reinforced	Ready-mixed concrete
1966	97.7	97.7	102.4	98.1	97.8	98.4	97.7	98.8	95.0	98.0
1967	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1968	100.7	103.9	100.3	103.2	103.8	102.5	102.6	104.2	100.3	102.6
1969	104.0	108.5	101.0	106.7	107.8	105.6	106.5	107.9	101.6	107.2
1970	110.6	112.9	104.6	114.6	113.5	115.7	112.2	113.2	103.5	113.6
1971	118.7	118.1	105.2	121.9	119.1	124.6	120.6	118.3	112.0	122.7

Period	Prepared asphalt roofing	Flat glass		Other nonmetallic menerals			Selected floor coverings	
		Plate	Window glass single B	Group index	Insulation materials	Asbestos cement siding shingles	Asphalt floor tile	Vinyl sheet goods, semi-permanent
1966	102.6	92.9	94.2	98.1	98.9	97.3	97.2	103.8
1967	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1968	104.0	104.1	108.3	104.6	106.4	103.2	106.7	103.5
1969	103.4	109.7	113.9	112.2	115.4	108.2	108.6	97.8
1970	101.8	n.a.	116.1	120.0	123.1	116.4	112.9	97.5
1971	126.5	n.a.	124.8	126.9	131.7	120.7	113.3	102.9

Table 3.17

Period	Structural clay products				Gypsum products			
	Group index[1]	Bldg brick	Clay tile	Clay sewer pipe vitrified	Group index	Lath	Wallboard	Plaster base coat
1966	98.2	98.3	97.9	98.6	99.6	100.0	101.2	91.5
1967	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1968	102.6	103.4	102.9	100.0	103.6	102.8	101.3	115.5
1969	106.2	107.8	106.2	101.0	103.6	105.0	99.2	125.2
1970	109.8	112.2	108.7	105.3	100.0	108.0	93.4	128.5
1971	114.2	117.4	112.4	109.4	106.8	118.5	99.7	n.a.

[1] Includes items not shown separately.

n.a. - Not available

Source: U.S. Department of Labor, Bureau of Labor Statistics.

3.4.4 Labor

The costs for labor are highly variable. Labor fluctuates due to: 1) unionization of the project; 2) percentage of skilled or unskilled workers; 3) location of the job (metropolitan or nonmetropolitan); 4) region of the country; 5) worker productivity; 6) degree of industrialization of the project; 7) distribution of skill specializations required; 8) availability of labor.

According to the Institute of the Future's analysis, on-site labor accounted for 24% of the construction cost of a one-family house in 1962. By 1967, this figure had risen to 26%. By 1985, on-site labor is predicted to reach 29% of the total construction cost. A number of reasons are given for this rise. The two main factors are: 1) predicted increase in custom-built units; and 2) higher rate of increase of labor costs over material costs.

The opposite trend is expected for the multi-family home. Starting from a high of 36% of the total construction cost in 1960, on-site labor is expected to be reduced to 14%. The major reason for the huge reduction is the growing usage of industrialized techniques for building. This figure is in keeping with the author's collected field data on mobile home construction and modular home construction. Labor presently accounts for 12% of the f.o.b. factory sales price in a mobile home. For modular production, labor accounts for $13\frac{1}{2}\%$ of the f.o.b. sales price.

Wage rates have increased significantly faster than material costs in recent years. A look at Figure 3.13 will immediately show this. The main factor for this rise is the shortage of skilled labor. A 1968 NAHB survey showed that there was a moderate to severe shortage of labor among most of the trades. Its findings are presented in Table 3.18. Because of the large need for wood working skills for all types of structures, the most severe labor shortages were indicated for carpenters. The second most severe shortage was found among plumbers. Third was brick masons, while laborers followed with a 26% severe shortage.

Indexes of union hourly wage rates are included for the readers analysis of the trends of the various skills. Included also is the 1972 labor rates (including benefits) from the Dodge/1972 Construction Pricing and Scheduling Manual.

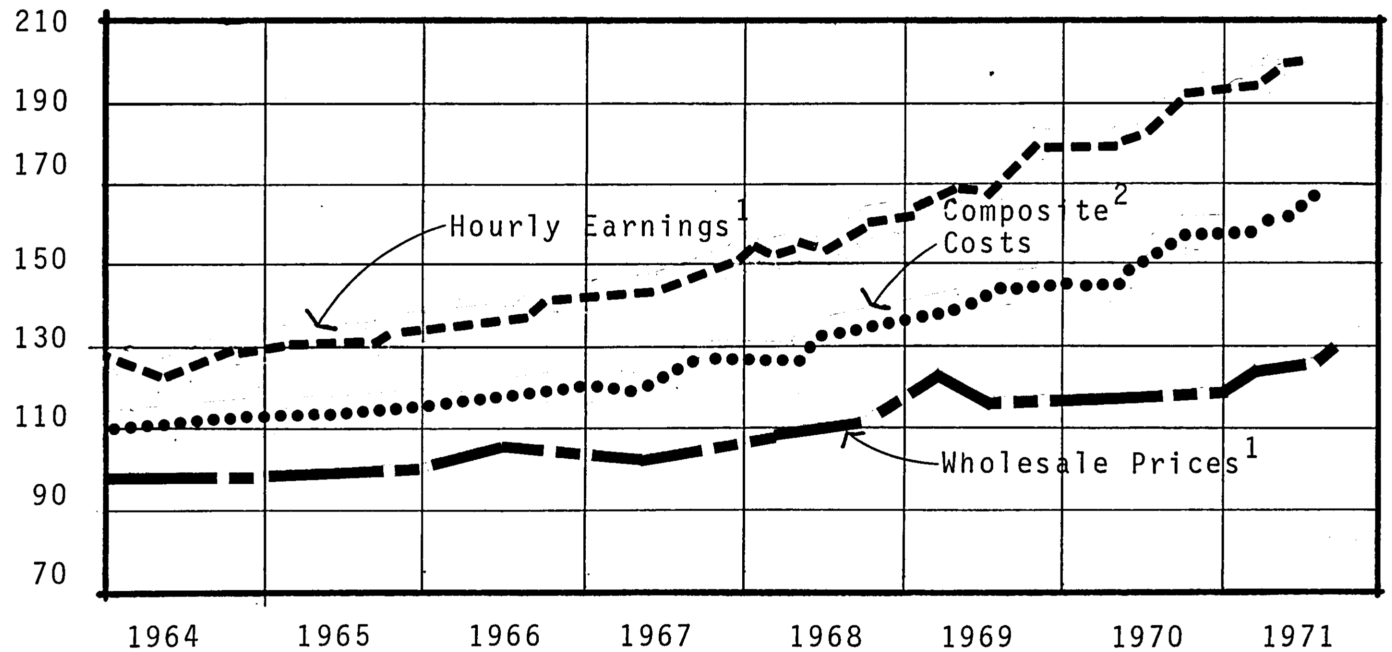
Outlook

From Figure 3.14, one can analyze the trends of the hourly earnings of building construction workers. The trend since 1950 is the steady increase in wages. Starting from $2.00 per hour in 1950, strong unionization, general inflation, competition with office and professional salaries and high demand for skilled workers will cause earnings to reach between $6.80 to $9.40 per hour.

CONSTRUCTION COST INDICATORS

Index, 1957-59 = 100

Figure 3.13



Source: 1. Department of Labor, Bureau of Labor Statistics
2. Department of Commerce, Bureau of the Census

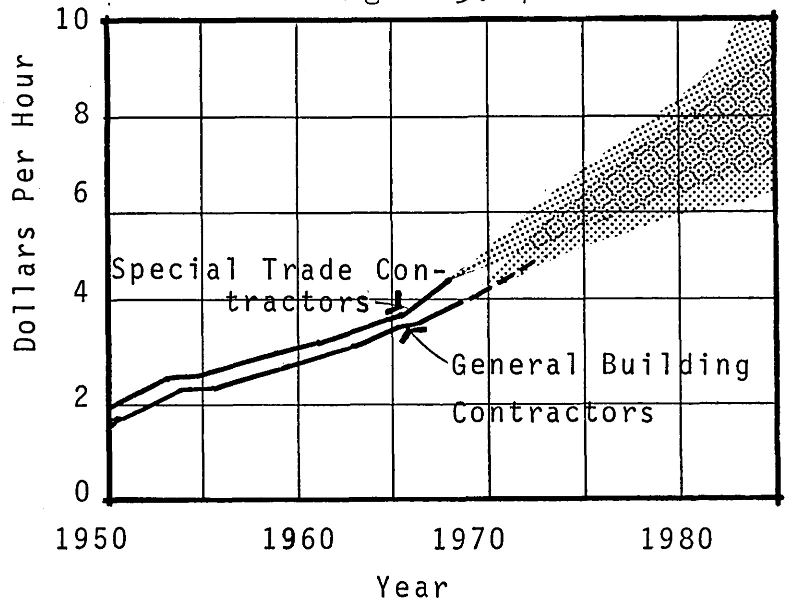
Table 3.18

Relative Supply Of Workers For Selected Building Trades

Trade	% Over Supply	% Adequate	Shortage % Moderate	Shortage % Severe
Carpenters	1%	15%	49%	35%
Brick Masons	1	15	52	32
Cement Masons	1	27	48	24
Electricians	1	38	37	24
Painters	1	37	48	14
Equipment Operators	1	52	33	14
Laborers	4	34	36	26
Truck Drivers	2	51	37	10
Plumbers	1	20	44	35
Sheet Metal	1	34	48	17
Tile & Linoleum	1	46	43	10

Source: NAHB

Figure 3.14



HOURLY EARNINGS - BUILDING CONSTRUCTION WORKERS

Source: Enzer, Selwyn, op. cit., p.48

Table 3.19

Labor Rates 1972

Fringe Benefits Included

Bricklayer		$ 9.40
Carpenter		9.10
Cement Finisher		9.00
Electrician		9.65
Engineer:	Crane	9.45
	Hosit	9.30
	Compressor	8.65
Glazier		8.50
Ironworker		9.70
Laborer:	Heavy Construction	6.60
Laborer:	Common	6.75
	Tender	7.00
	Air Tool	7.10
Painter		8.20
Plasterer		8.55
Plumber		10.15
Roofer		8.80
Steamfitter		10.20
Stone Mason		9.40
Truck Driver		6.85

Note: Payroll taxes and insurance must be added to labor when using the rates given in this manual.

Source

Dodge - 1972, Construction Pricing in Scheduling Manual (N.Y., N.Y.: McGraw-Hill Information Systems Co., 1972) p.III.

Table 3.20

Indexes of Union Hourly Wage Rates for Selected Building Trades

Date	All trades	Brick-layers	Carpenters	Elec-tricians	Painters	Plasterers	Plumbers	Building laborers
1954: July 1	58.0	63.6	57.6	59.0	58.5	64.7	58.8	53.7
1955: July 1	60.0	65.3	59.8	60.3	60.9	66.7	60.3	56.1
1956: July 1	62.8	68.3	62.3	63.6	63.4	69.2	62.9	59.3
1957: July 1	66.0	70.9	65.6	66.8	66.7	71.7	66.4	63.0
1958: July 1	69.0	73.3	68.6	70.3	69.1	74.0	69.3	66.1
1959: July 1	72.4	76.5	72.1	72.7	71.8	76.4	72.9	70.5
1960: July 1	75.4	78.8	75.0	76.4	74.9	79.6	75.3	73.8
1961: July 1	78.4	81.8	77.9	79.4	77.7	81.4	78.1	77.4
1962: July 1	81.3	84.3	80.7	83.6	80.6	84.0	81.1	80.0
1963: July 1	84.2	86.7	83.6	86.2	84.3	86.0	84.4	82.9
1964: July 1	87.3	89.3	86.6	89.2	87.3	89.7	87.8	86.4
1965: July 1	90.9	91.8	90.7	91.5	90.9	92.1	91.4	90.5
1966: July 1	94.7	95.0	94.6	94.9	94.6	95.6	94.6	94.5
1967: July 1	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1968: July 1	106.6	106.8	107.0	106.5	106.3	105.1	106.8	106.5
1969: July 1	115.4	115.0	115.8	117.1	115.1	113.3	115.9	114.8
1970: July 1	128.8	127.7	128.9	130.4	126.6	126.0	130.5	129.3
October 1	*130.8							
1971: January 4	*133.2							
April 1	*134.6	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
July 1	*143.8							
October 1	*145.2							

* Estimated. n.a. - Not available. [1967 = 100]

Source: U.S. Department of Labor, Bureau of Labor Statistics.

3.4.5 Financing Costs

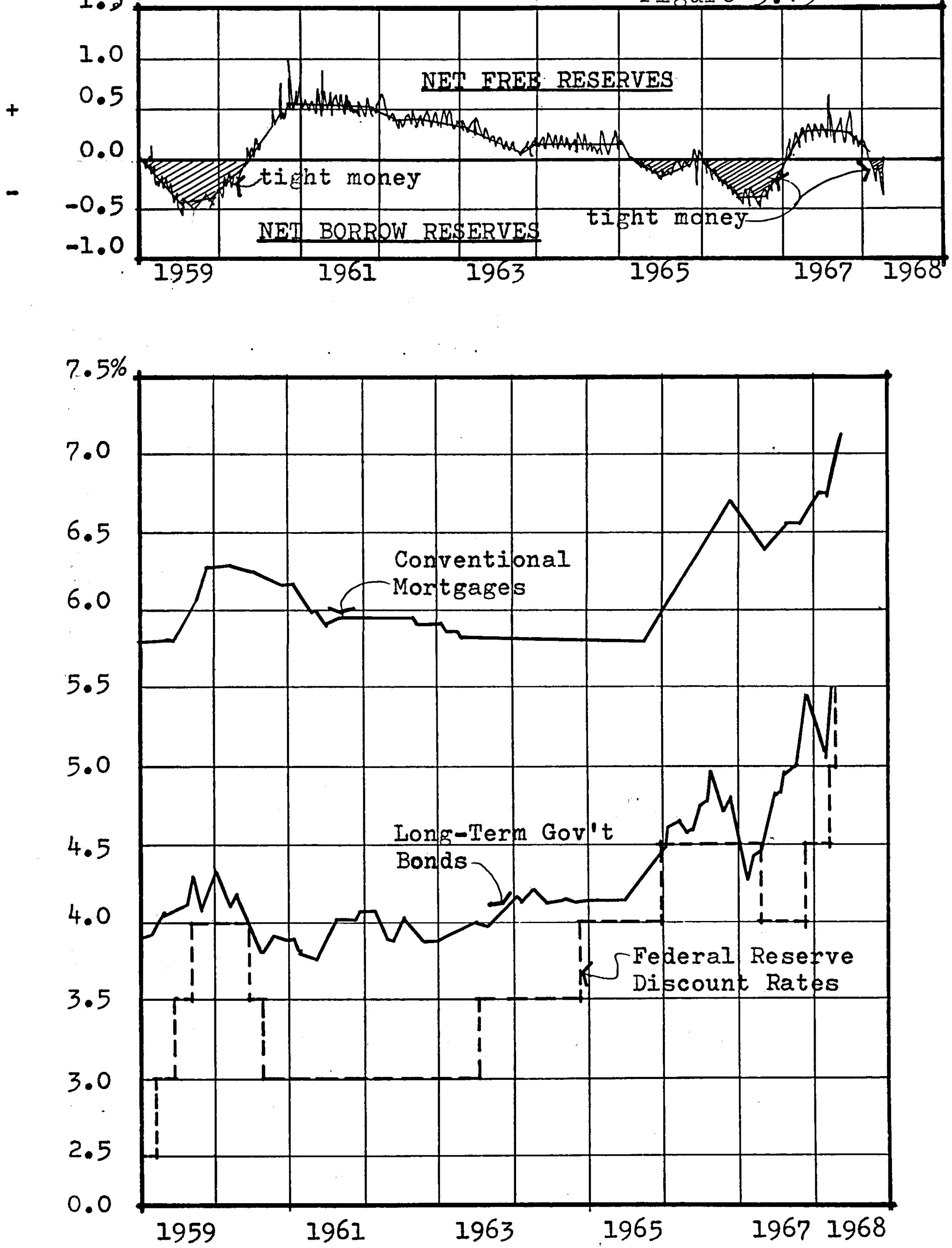
It was shown earlier (Section 2.1) that housing production is quite dependent on the business cycles in the country. Tight money conditions have affected cost in two ways; 1) the high costs of money will increase the costs of new housing since all segments of the housing industry borrow money; 2) the cost of borrowing money directly effects the monthly mortgage payments.

The charts on Figures 3.15, 3.16, and 3.17 reveal the effects that high interest rates and tight money have on housing starts. When the discount rate is increased, a tight money situation exists (1959, 1965, 1966). The cost of bonds and a decline of applications for FHA homes eventually follow.

Housing production is said to be "counter cyclical". When industrial production is high, the expansion of capital investment tends to increase the cost of money. The investors in turn find the savings and loan institutions less attractive. Since the savings and loan institutions are the primary source of financing for permanent mortgages, less money will be available for housing, and higher housing costs will result. As the economic situation starts down, the cost of money will be reinvested in savings and loan institutions, and housing production will increase proportionally.

BORROWING OF MEMBER BANKS
Billions of Dollars

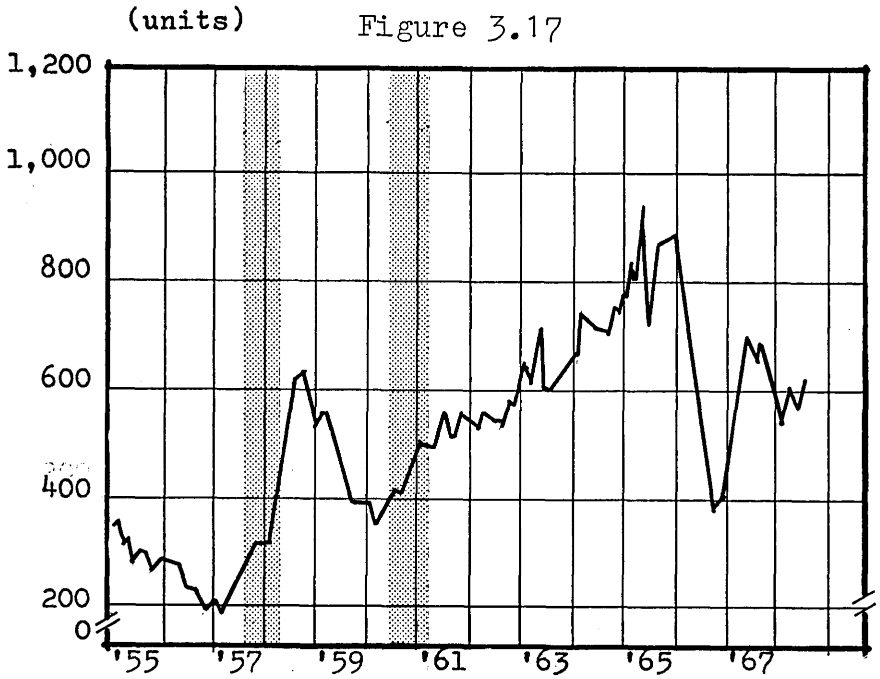
Figure 3.15



Source: 1. Kaiser, Edgar F., op. cit., p.128

2. Board of Governors of the Federal Reserve System. Plotted April 17, 1968

Figure 3.17



<u>FHA EXISTING HOME APPLICATIONS</u>

Seasonally Adjusted Annual Rates
(Shaded areas represent business cycle recessions)

Source:

1. Kaiser, Edgar F. , <u>op</u>. <u>cit</u>., p. 129
2. Federal Housing Administration, Division of Research and Statistics

The builders financing costs include interim financing costs for: 1) construction loans; 2) fees for committents; 3) origination or standby fees; 4) interest on notes or mortgages; 5) discounts for mortgages (points); 6) closing costs paid for the consumer; 7) hazard or builders' risk insurance; 8) other financing costs. Interim financing costs could be further broken into: 1) interest or construction loans; 2) fees; 3) appraisals; 4) inspections by lending institutions and government agencies; 5) title and recording fees.

Three significant shifts have happened in the last 10 years in the sources of financing: 1) single-family builders have increased in the use of savings and loan institutions as the primary source of permanent financing (from 38% in 1959, to 43% in 1964, to 54% in 1969); 2) the mortgage bankers have declined in use for both permanent and construction financing - from 32% in 1959, to 30% in 1964, to 12% in 1969; 3) the commercial banks are increasing in usage as the source for construction financing - from 37% in 1959. This percentage has grown to 47.6% in 1969.[47] The accompanying Table 3.21 shows the distribution of financing of the various institutions.

Outlook

Interest rates are expected to decline gradually from the

Table 3.21

Primary Source of Construction and Permanent Financing 1959, 1964, 1969; and 1969 Responses by Type and by Size of Operation and by Region

(Percent Distribution)

Primary Source of Financing	Total 1959 Survey	Total 1964 Survey	Total 1969 Survey	1969 Survey Responses by Type & Size of Operation: Single-Family Only	Single and Multi	Small (1-25 Units)	Medium (26-100 Units	Large (100 + Units)
Construction:								
Commercial Bank	37.1		47.6	45.5	51.2	46.4	48.2	57.8
FNMA			0.2	0.2	0.2	0.1	0.4	0.5
Insurance Co.			0.8	0.6	0.9	0.8	0.7	0.3
Lumber or Material Dealer	2.5		0.8	0.9	0.4	0.9	0.2	0.5
Mutual Savings Bank	8.2		4.6	4.4	5.0	5.1	4.5	4.2
Pension Funds			0.0	.0.0	0.1	0.0	0.0	0.2
Private Investor			0.9	1.0	0.7	1.1	0.5	0.8
Savings & Loan Assoc.	40.1		35.2	36.3	34.4	37.8	33.6	26.5
Buyer Arranges Own			2.8	3.3	1.2	2.1	0.9	0.3
Mortgage Banker			7.0	7.7	5.9	5.7	10.9	8.9
Other	12.0							
Permanent:								
Commercial Bank	5.5	8.5	14.1	14.2	13.6	14.6	11.7	12.3
FNMA	0.7		3.7	3.3	4.3	2.0	5.7	7.4
Insurance Company	8.1	8.5	5.0	3.3	7.2	3.6	5.5	8.1
Lumber or Material Dealer	0.1	0.2	0.1	0.1	0.1	0.2	0.0	0.0
Mutual Savings Bank	7.6	5.5	5.2	5.0	5.8	5.5	5.7	6.0
Pension Funds		0.0	0.1	0.1	0.1	0.0	0.0	0.5
Private Investor			0.7	0.8	0.7	0.9	0.6	0.6

Table 3.21

(Percent Distribution)

Primary Source of Financing	Total 1959 Survey	Total 1964 Survey	Total 1969 Survey	1969 Survey Responses by Type & Size of Operation				
				Single-Family Only	Single and Multi	Small (1-25 Units)	Medium (26-100 Units)	Large (100 + Units
Savings & Loan Assoc	38.2	42.8	53.5	54.5	53.0	58.9	50.9	42.2
Buyer Arranges Own	6.1	3.4	5.5	6.4	3.0	5.8	1.9	0.6
Mortgage Banker	31.9	30.4	12.1	12.2	12.1	8.6	18.1	22.3
Other	1.8							

Note: Details may not add to 100% because of rounding. Nonrespondents to question deleted.

Source: Sumichrast, Michael; op. cit., p. 175. (NAHB).

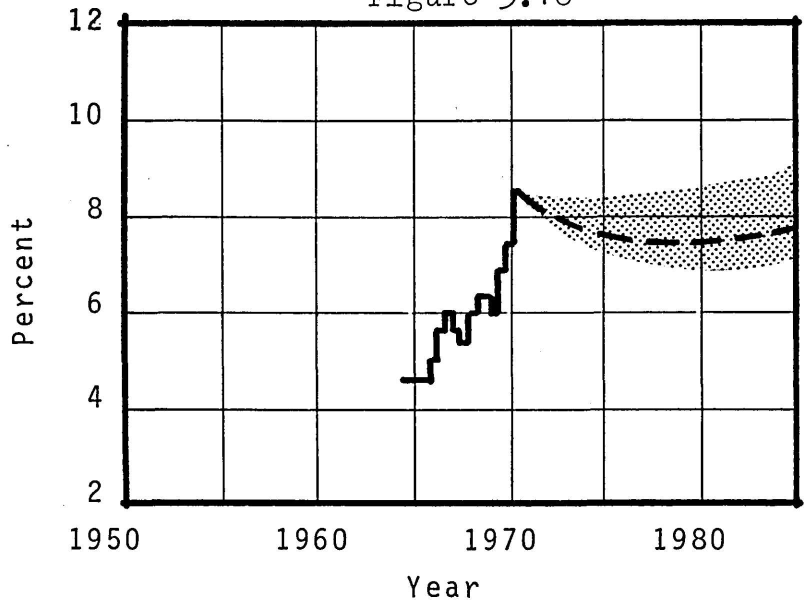
high of 8.5% experienced in 1970, to a low of 7½% in 1980, and then rise again gradually. The 1985 forecast is uncertain. Government support of easy money promoting increased productivity and a deflationary period in the early 70's, could cause the prime interest rate to drop as low as 7%. However, worldwide money competition and government control inhibiting a deflationary spiral, may cause the prime interest rate to soar as high as 9%.[48]

A number of trends are predicted for mortgage financing by the panel of experts in the Institute of the Future's study:

1) Down payments will not be required from low and moderate income families for government insured mortgages.
2) Increasing cost of housing will necessitate increases in the portion financed.
3) Subsidies for low and moderate income home buyers will be in the form of down payments.
4) Continued tight money.
5) Investor preferences will favor fixed income as opposed to equity investments.
6) The upper middle class will try to maintain social separation by keeping the downpayments required for conventional mortgages high.[49]

Financing terms are expected to be more liberal in the

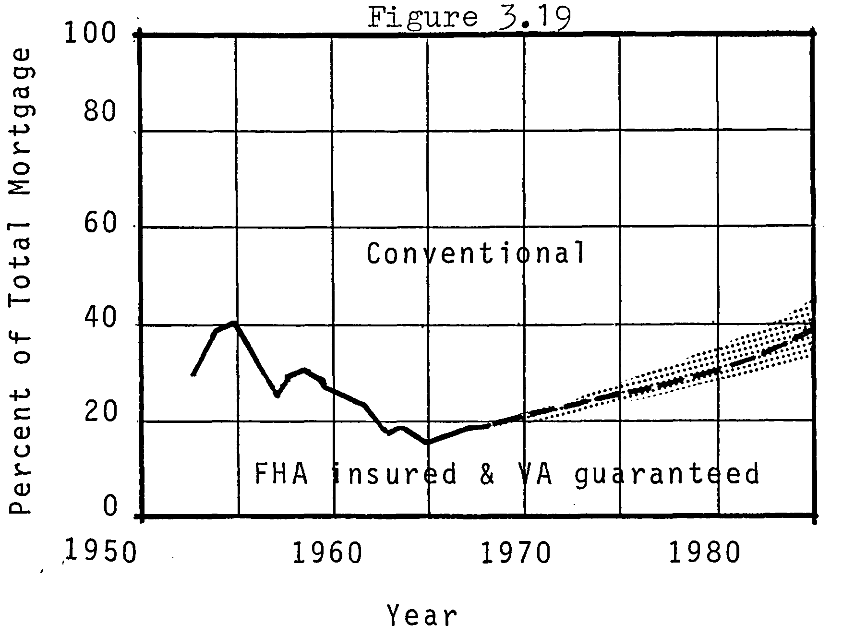
Figure 3.18



PRIME INTEREST RATE

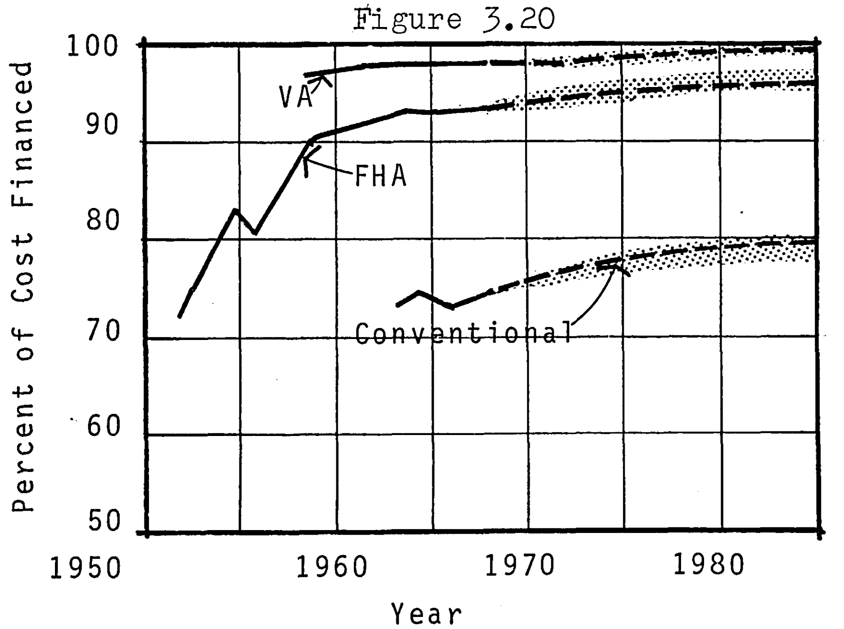
Source: Enzer, Selwyn, *op. cit.*, p.57

Figure 3.19



PRIVATE HOUSING STARTS (NONFARM)
BY FINANCING TYPE

Figure 3.20



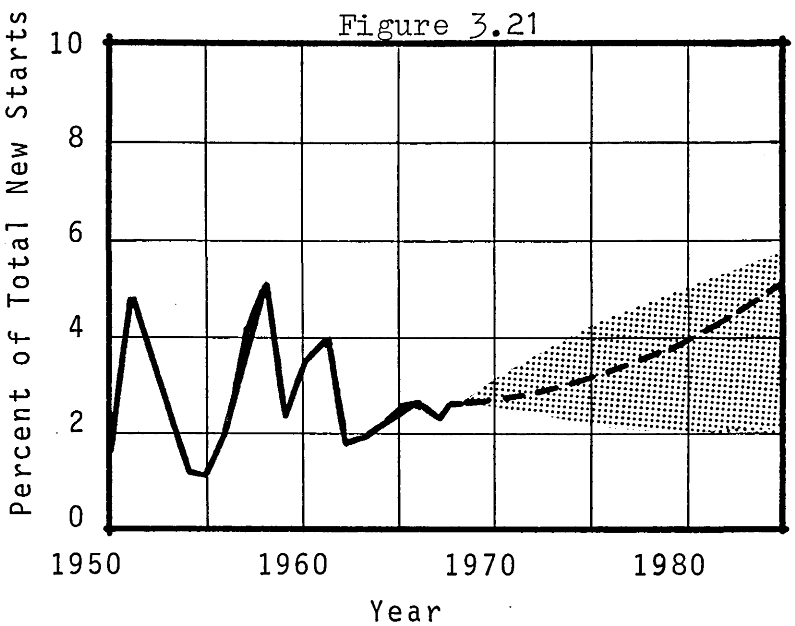
PERCENTAGE OF HOUSING PURCHASE PRICE
FINANCED BY ALTERNATIVE FIRST MORTGAGES

Sources: Enzer, Selwyn, op. cit., pp. 49, 59 future. Conventional mortgage financing is expected to continue to finance up to 80% of the purchase price. By 1985, FHA will finance 95% of the cost. And by 1985, VA loans will finance the total purchase price of the house, requiring no down payment.

Because of the increasing cost of financing, the government is expected to play a larger role in the following areas:

1) Greater government support of mortgage financing, perhaps involving new agencies.
2) More government housing programs.
3) Generally increasing government involvement in housing programs through subsidies, guarantees, and so on.

Figure 3.21



PUBLICLY OWNED NEW HOUSING STARTS (NONFARM)

Source: Enzer, Selwyn, op. cit., p.61

3.4.6 Overhead & Profit

Overhead & profit, like labor and materials, is highly variable. While material and labor costs are well defined items, overhead cost is a more ambiguous "catch all" term. It may include: 1) general and administrative expenses; 2) marketing or selling expenses; 3) other miscellaneous expenses. Often general & administrative and selling or marketing expenses are isolated as separate items.

General and administrative expenses consist of salaries, office expenses, depreciation and amortization, taxes insurance, professional fees, travel, entertainment, contributions and other expenses - bonding company employees, corporate expenses, profit-sharing, director's fee, dues and subscriptions, and others. Building Construction Cost Data, 1971, claims typical office expense ranges from 20% to 2%, with the median about 7.2% of the total volume. The following is a breakdown of the expenses:[50]

	Typical Range	Average
Managers, clerical & estimators salaries	40% to 55%	48%
Profit sharing, pension & bonus plans	2 to 20	12
Insurance	5 to 8	6
Estimating & project management (not including salaries)	5 to 9	7
Legal, accounting & data processing	0.5 to 5	3

	Typical Range	Average
Automobile & light truck expense	2% to 8%	5%
Depreciation of overhead capital expenditures	2 to 6	4
Maintenance of office equipment	0.1 to 1.5	1
Office rental	3 to 5	4
Utilities incl. phone & light	1 to 3	2
Miscellaneous	5 to 15	8
		100%

Selling expenses will include salaries and commissions, advertising costs, sales office expense, model house maintenance, sales showroom expense, sales training expense, market research and consultation, and other selling or marketing expenses.

Other expenses will vary according to the housing type, scale of operation, and construction methods employed. It may include provisions for income taxes, bad debt, loss on sale of assets, or warehouse storage fees.

For conventional construction, the Building Construction Cost Data, 1971 Manual (Means) suggests 25% be allowed for overhead & profit. The overhead breakdown includes:[51]

	% of Direct Costs
Field Supervision	3.2

	% of Direct Costs
Main Office Expense	7.7
Tools and Minor Equipment	0.6
Workmens Compensation & Employers Liability	2.0
Field Office, Sheds, Photos, etc.	1.0
Performance Bond 0.5 to 1.0% Average	0.7
Unemployment Tax (Combined Federal & State)	1.5
Social Security & Medicare (5.2% of 1st $7,800)	2.1
Sales Tax - add if applicable 48/80 x % (Only six states do not have sales tax but project may be exempt)	---
Sub Total	18.8%
Builders Risk Insurance Usually Paid by Owner	0.3
Public Liability	0.5
Grand Total	19.6%

The resulting profit is between 5 - 7%.

The Dodge/1972 Construction Pricing and Scheduling Manual gives no breakdown but suggests the following percentages be used for cost of job overhead excluding bond (insurances and payroll taxes included):[52]

$ 50,000 Jobs	9.0% of the total job
200,000 "	8.0% " " " "
500,000 "	7.5% " " " "
1,500,000 "	6.5% " " " "
4,000,000 "	6.0% " " " "

Outlook

In the Institute of the Future's analysis found on Figure 3.10, overhead, profit, and miscellaneous for one-family homes is a highly variable quantity. Starting at 30% of the total construction in 1962, it dropped to 20% in 1967. After 1967, this factor is expected to increase between 20% and 32%. The reason for its decline between 1962 - 1967 is not clear. It might be assessed that the drop from 1962 to 1967 was caused by the increase of custom-built homes by smaller construction companies with lower overhead costs. However, as the demand gets larger, merchant builders and other large scale builders with higher overheads are expected to obtain a larger share of the market, thus increasing the overhead cost per unit.

The reasons for the rise of overhead, profit and miscellaneous are more obvious in the case of the multi-family home. Industrialization is expected to cause a huge reduction in the percentage cost of on-site labor (from 36% in 1960, to 14% in 1985), the gap will be taken up by material costs and overhead, profit and miscellaneous. The overhead is expected to increase as larger construction firms require more overhead.

3.5 A Detailed Look At Construction Costs

A careful survey of all the accessible information on housing costs has been performed. Unfortunately, very little in-depth information has been uncovered. Two problems were encountered when an attempt was made to relate housing costs. The first case is immediately obvious. Costs become quickly outdated. It is impossible to compare costs having different time periods without applying some type of cost factor. This cost factor varies from company to company. Thus, an innaccuracy is immediately introduced. Recognizing the problem, this study shall compare costs on a percentage basis. No costs will be compared using actual dollars. However, dollars will be presented for the user's need in the case where he may need dollars for cost estimating purposes or for recomputing percentages. It will be assumed that current costs can be obtained from the various cost manuals (Dodge Pricing and Scheduling Manual, Building Construction Cost Data (Means), Building Cost File, Building Cost Calculator and Valuation Guide) and other future cost studies to be performed by the various federal agencies - HUD, Bureau of Labor Statistics, or the National Bureau of Standards. Future studies planned are by the Department of Labor, Bureau of Labor Statistics include: the development of price indexes for construction materials and for mobile homes; information on the straight-time hourly earnings of employees in various occupations in the construction industry;

and data on labor and materials requirements and productivity change for major types of construction.

A second problem arises when comparing costs. Careful attention must be paid to make certain that the same quantities are being compared. There exists no uniform system of cost reporting. Each organization or firm has its own cost accounting system. Most of the more widely used cost accounting systems are materials oriented (NAHB, CSI/AIA/AGC) rather than component or functionally oriented. While the materials oriented system is good for the contractor when he orders from the raw materials supplier, it is of no use to the designer of housing or the contractor when he desires strict cost control of his project. It is imperative to relate materials cost categories to component or functional categories so that an accurate estimate (or control) of the labor costs, labor productivity, and material costs can be assessed together. This is one reason why so many housing manufacturers have such a hard time cost controlling their operations. One rule of thumb used by manufacturers is to assume that materials cost is 46% of the sales price and adjust their sales price accordingly. While this practice is not common, the fact still remains that most manufacturers <u>don't</u> have an accurate assessment of their labor productivity costs per subsystem. Labor is usually an approximate or an "educated guess", while the materials cost is very accurate.

The major reason results because the subassembly operations or other indirect costs are difficult to determine precisely.

Sources

Because of the inconsistency and scarcity of the available data, the construction cost picture presented in this section will be fragmented and inconclusive. It is impossible to find a collected set of data from which any true conclusions can be drawn. However, the data pieced together should give the reader a perspective of the manhour and material requirements for a cost analysis of a single-family house.

The author is conducting a questionnaire survey of builders and manufacturers in the housing industry. Up to this date, very little good information has been gathered. The following reports were used as the main data bank for this section's study:

1) Bureau of Labor Statistics Survey:

   Performed during 1968-69. A sample of 250 one-family homes in the continental U.S. was surveyed. The sample was stratified by geographic location, estimated cost, and degree of urbanization. In total, 4,000 personal visits were made to general and special trade contractors.

   a) Preliminary Report, Labor and Material Requirements for One-Family Houses, 1968-69, unpublished report performed by the Bureau of Labor Statistics for the United States

Department of Housing and Urban Development.

b) Williams, Franklin E., "Materials Requirements For Single-Family Houses", Construction Review, February 1972 (Washington,D.C.: U.S. Government Printing Office, 1972) p.4-9, only the materials study of the survey.

2) Eaves, Elsie, How The Many Costs of Housing Fit Together, Research Report No. 16 (Washington, D.C.: U.S. Government Printing Office, 1969).

An in-depth study completed in 1969 by Elsie Eaves for the Douglas Commission. Contains pieced together cost information supplied by the FHA, HAA, HUD, Public Housing in New York City, and data supplied to the Douglas Commission by individual builders.

3) Kaiser, Edgar F., et. al., The Report of The President's Committee On Urban Housing, Technical Studies, Volume II (Washington, D.C.: U.S. Government Printing Office, 1968) p.1-52.

A comparative time and cost study for building five selected types of low-cost housing. Performed by the Marketing Research Department of the McGraw-Hill Information Systems Company, McGraw-Hill Inc. for the Kaiser Commission (1968). The costs are broken down in construction operation levels rather than component categories.

4) Goody-Clancey Associates, Tishman Research Corporation, <u>Construction Technology And Its Application To UDC Housing</u>, Volume I & II, unpublished report, June 1970.

A report of the cost assessment (called Cost-Analog) developed by Goody-Clancey Associates with the Tishman Research Corporation for the New York State Urban Development Corporation. Report contains detailed cost information of four basic building types: 1) 25 story fireproof flat plate concrete frame; 2) 7 story fireproof steel frame and bar joist; 3) 7 story semi-fireproof bearing wall; 4) 2 story wood frame non-fireproof garden apartment.

5) The author's collected information from questionnaire survey.

Footnotes for Chapter III

1. Interdisciplinary panel of housing experts. See Appendix, Volume II for list.

2. Enzer, Selwyn, Some Prospects for Residential Housing by 1985, Report R-13 (Middletown, Conn.: Institute of the Future, 1971) p.38.

3. Letter to the author, January 14, 1972, from Mr. Richard L. Bullock, Executive Vice-President, National Association of Building Manufacturers. See Appendix, Volume I.

4. Letter to the author dated April 16, 1972, from a conventional construction company. See Appendix, Volume I.

5. Douglas, Paul H., Building The American City (Washington, D.C.: U.S. Government Printing Office, 1968) p.417.

6. Enzer, Selwyn, op. cit., p.62.

7. Bureau of Domestic Commerce, U.S. Department of Commerce, Construction Review, February 1972 (Washington, D.C.: U.S. Government Printing Office, 1972) p.47 ; calculated by the author.

8. Ibid., p. 48; calculated by the author.

9. Construction Review, October/November 1971, op. cit., p.22.

10. Construction Review, February 1972, op. cit., p.10,17; calculated by the author.

11. Sumichrast, Michael & Frankel, Sara A. Profile of the Builder and His Industry (Washington, D.C.: NAHB-NHC, 1970) p.19.

12. Kaiser, Edgar F. op. cit., p.119.

13. Ibid., p.119.

14. Enzer, Selwyn, op. cit., p.42.

15. Ibid., p.43.

16. Ibid., p.44.

17. Enzer, Selwyn, op. cit., p.60.

18. U.S. Department of Housing and Urban Development, Federal Housing Administration, Minimum Property Standards For One And Two Living Units (Washington, D.C.: U.S. Government Printing Office, 1966), p.32.

19. Bernhardt, Arthur D., "The Mobile-Home Industry: A Case Study In Industrialization", Industrialized Building Systems for Housing (Cambridge, Mass.: M.I.T. Press, 1971) p.178.

20. Economic Report of the President, 1972, op. cit., p.240,242.

21. Construction Review, February 1972, op. cit., p.17.

22. Sumichrast, Michael, op. cit., p.5.

23. Construction Review, February 1972, op. cit., p.10.

24. Ibid., p.10,11.

25. Business and Defense Services Administration, U.S. Department of Commerce, Construction Review, March 1970 (Washington, D.C.: U.S. Government Printing Office, 1970) p.13.

26. Construction Review, February 1972, p.17.

27. Bureau of Labor Statistics, U.S. Department of Labor, Labor and Material Requirements for Private One-Family House Construction, Bulletin 1404, June 1964 (Washington, D.C.: U.S. Government Printing Office, 1964).

28. Ibid., p.5.

29. Ibid., p.5.
Based on Housing and Home Financing Agency Annual Reports (Washington, D.C.: U.S. Government Printing Office) modified to new sales price of new homes. As published by the Bureau of the Census in Construction Reports, Series C-25.

30. $(1.15 \times 10^6)\ (2.5 \times 10^3) = 2.88 \times 10^9$

31. Construction Review, February 1972, p.17.

32. Ibid., p.10.

33. Sumichrast, Michael, op. cit., p.5.

34. Sumichrast, Michael, op. cit., p.7.

35. Bureau of Labor Statistics, Labor and Materials Requirements, Bulletin 1404, p.5.

36. Kaiser, Edgar F., op. cit., p.140.

37. Eaves, Elsie, How The Many Costs of Housing Fit Together, Research Report No. 16 (Washington D.C.: U.S. Government Printing Office, 1969) p.5.

38. Sumichrast, Michael, *op. cit.*, p.37, Table 5.1.

39. *Ibid.*, p.37.

40. *Ibid.*, p.37.

41. *Ibid.*, p.142.

42. *Ibid.*, p.41, See Figure 3.1 (Volume II).

43. *Building Construction Cost Data 1971* (Duxbury, Mass.: Robert Snow Means Company, Inc., 1971) p.157.

44. Enzer, Selwyn, *op. cit.*, p.39.

45. *Ibid.*, p.40.

46. *Construction Review*, June 1971, p.4.

47. Sumichrast, Michael, *op. cit.*, p.59.

48. Enzer, Selwyn, *op. cit.*, p.57.

49. *Ibid.*, p.49.

50. *Building Construction Cost Data 1971*, p.155.

51. *Ibid.*, p.155.

52. *Dodge/1972 Construction Pricing And Scheduling Manual*, (New York: McGraw-Hill, 1972) p.143.

3.5.1 SINGLE FAMILY HOUSE

(TRADITIONAL CONSTRUCTION)

Profile: 1 **Classification:** Traditional/Single Family

I. SOURCE

1.	Name	
2.		
3.		
4.		

II. BACKGROUND INFORMATION

REGION

1.	Name	Pacific (California)
2.	Region #	9
3.	Metropolitan or Rural Area	Suburban Development

COST

4.	Total Sales Price (with Land)	$ Total	25,000
5.		$/SqFt	14.90
6.		$/CuFt	1.85
7.	Construction Cost	$ Total	17,000
8.	(includes / excludes) foundation & excavation costs	$/SqFt	10.12
9.		$/CuFt	1.26
10.	Structure Cost	$ Total	10,450
11.	(includes / excludes) foundation & excavation costs	$/SqFt	6.24
12.		$/CuFt	.78
13.	Construction Date		1967
14.	Current Cost Index 1971	Boeckh Residence Index	132.8
15.	Project Cost Index 1967	Boeckh Residence Index	100.0
16.	Revised Sales Price (with land)	$ Total	33,000
17.		$/SqFt	19.70
18.		$/CuFt	2.44
19.	Revised Construction Cost	$ Total	22,420
20.		$/SqFt	13.40
21.		$/CuFt	1.04

Profile # 1

22.	Revised Structure Cost	$ Total	13,800
23.		$/SqFt	8.24
24.		$/CuFt	1.04

PHYSICAL CHARACTERISTICS OF DWELLING UNITS

25.	Generic Type	Traditional
26.	Housing type	Single-Family
27.	Structural Material	Wood
28.	Structural Type	Frame

29.	Story Height	1

30.	Net Floor Area	1,678
31.	Ceiling Height	8' (assume)
32.	Total Volume of Dwelling Unit (CuFt)	13,424
33.	Number of Bedrooms	
34.	Number of Bathrooms	
35.	Carport?	
36.	Garage?	

37.	Wall Thickness	-
38.	Panel Sizes	-

39.	Total Weight of Dwelling Unit (Tons)	-
40.	Pounds/cubic feet	-

LABOR CHARACTERISITCS

41.	Unskilled Workers	Percentage	-
42.		Average Wage Rate	-
43.		Union?	-
44.	Skilled Workers	Percentage	-
45.		Average Wage Rate	-
46.		Union?	-

Profile # 1

VOLUME OF BUSINESS

47.	Dwelling Units/Year	500/year

FACTORY

48.	Factory Size	-
49.	Production Rate	-
50.	Plant Design Capacity	-

POSSIBLE HOUSING TYPES

51.	Housing Type # 1	-
52.	Housing Type # 2	-
53.	Housing Type # 3	-
54.	Housing Type # 4	-
55.	Housing Type # 5	-

BUILDING CODES CONFORMING TO

56.	Building Code # 1	-
57.	Building Code # 2	-
58.	Building Code # 3	-
59.	Building Code # 4	-
60.	Building Code # 5	-
61.	Building Code # 6	-

Single Family
TRADITIONAL

Profile # 1

III. SALES PRICE BREAKDOWN (includes land)

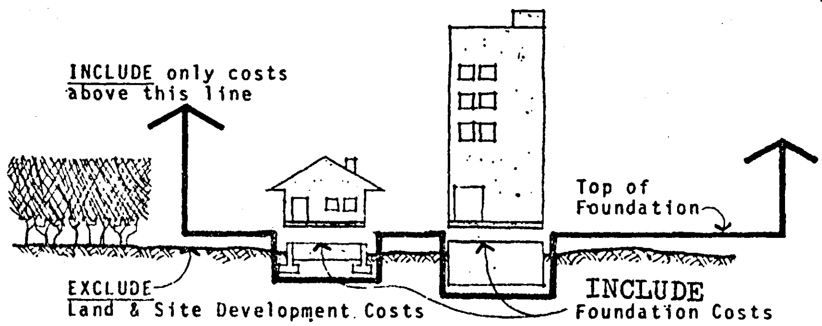
				General %	Detailed %	$
1.	Development Cost	Land Acquisition		32.0	24.0	6,000
2.		Site Improvement			8.0	2,000
3.		Development Fees			-	-
4.	Structure Cost "A"	Foundation & Excavation	Material		-	
5.			Equip.		-	
6.			Labor		-	
7.		Structure Cost "B" "A"	Material	41.8	-	10,450
8.			Equip.		-	
9.			Labor		-	
10.	Selling Expenses			4.0	4.0	1,000
11.	General & Administrative Expenses			0.7	0.7	175
12.	Financing Expenses 1			10.8	4.8 6.0	2,700
13.	Overhead & Profit	Overhead		10.7	4.7	1,175
14.		Profit			6.0	1,500
				100.0%	100.0%	$25,000

1 (includes / excludes) Mortgage Points

Profile # 1

Single Family
TRADITIONAL

IV. CONSTRUCTION COST "A" (includes foundation & excavation)



				General %	Detailed %	$
1.	Structure	Foundation	Material			
2.	Cost "A"	& Excavation	Equip.			
3.			Labor			
4.		Structure	Material			
5.		Cost "B"	Equip.	61.6	61.6	10,450
6.		"A"	Labor			
7.	Selling Expenses			5.9	5.9	1,000
8.	General & Administrative Expenses			1.0	1.0	175
9.	Financing Expenses[1]			15.9	15.9	2,700
10.	Overhead &	Overhead		15.6	6.9	1,175
11.	Profit	Profit			8.8	1,500
				100.0%	100.0%	17,000

1 (includes / excludes) Mortgage Points

Profile # 1

Cost/SqFt $8.24 (1971)

Area: 1,678

V. GENERAL STRUCTURE COST "A"

(includes foundation & excavation)

		General %	Detailed %	$
FOUNDATION	Foundation[1]			
SHELL	Structural System	58	58 -	5,288 -
	Exterior Closure		-	
	Roofing System		7.4	763
	Interior Vertical*		-	
FINISHES	Exterior Finishes	14	14	1494
	Interior Finishes			
MECHANICAL	Vertical Circulation[3]		-	-
	Plumbing		12.3	1,285
	HVAC		2.0	1,985 209
	Electrical		4.7	491
	Refuse Disposal System		-	-
APPLIANCES & FURNISHINGS	Appliances & Furnishings[2]	8	8.0	324
DELIVERY	Delivery[4]	-	-	-
LIFT & SECURE	Lift & Secure	-	-	-
		100%	100%	10,450

[1] (includes / excludes) foundation, footing, piling, excavation, fill, septic system

[2] (includes / excludes) kitchen, bathroom, utility appliances & furnishings

[3] (includes / excludes) Stairs, elevators

[4] miles delivery distance

*Non-load bearing only

Profile # 1

Cost/SqFt: $8.24(1971)

Area: 1,678

VI. DETAILED STRUCTURE COST "A"
(includes foundation & excavation)

			General %	Detailed %	$
FOUNDATION	Excavation & Fill		58.3	-	
	Septic System			-	
	Footing or Piling			-	
	Foundation			-	
STRUCTURAL SYSTEM (load-bearing)	Columns			-	
	Walls	Exterior		-	
		Interior		-	
	Stairs			-	5,288
				-	
	Ceiling			-	
	Roof			-	
	Floors			-	
EXTERIOR CLOSURE (non-load bearing)	Exterior Walls			4.9	507
	Exterior Doors			-	
	Exterior Windows			-	
ROOFING SYSTEM	Roofing System			-	
INTERIOR VERTICAL ELEMENTS	Partitions (non-load)			2.8	298
	Interior Door			-	
	Interior Windows			-	
EXTERIOR FINISHES	Exterior Painting		14.3	included with interior painting	
	Exterior Trim & Ornm't.				
INTERIOR FINISHES	Wall Finish	Dry Wall (Finishing only)			
		Plaster (1)		3.8	397
		Tile ceramic		1.3	136
		Tile other		-	-
	Ceiling Finish	Plaster (1)		w/ walls.....	
		Suspended Clg.		-	-
	Finish Flooring	Wood Flooring		2.8	293
		Tile ceramic		-	-
		Tile other		-	-
		Carpeting (2)		-	-
	Interior Painting			5.1	533
	Other Int. Trim & Touchup				

(1) (includes / excludes) lath, furring, stucco

(2) (includes / excludes) carpeting (include only if no other floor finish)

Profile # 1

		General %	Detailed %	$
VERTICAL CIRCULATION	Stairs**	-	-	-
	Elevators		-	-
PLUMBING	Distribution System	12.3	-	1,285
	Fixtures & Hardware		-	
HVAC	Heating Equipment	2.0	-	209
	Cooling Equipment		-	
	Fans, Ventilating Equipment		-	
	Distribution System		-	
	Hardware & Fixtures		-	
ELECTRICAL	Distribution System	4.7	-	491
	Fixtures & Hardware		-	
REFUSE DISPOSAL SYST.	Bins & Equipment	-	-	-
	Distribution System		-	-
APPLIANCES & FURNISHINGS***	Kitchen Appliances	8.4		324
	Kitchen cabinets & counters			
	Utility Equipment[1]		3.1	
	Bathroom Furnishings			
	Other cabinets & enclosures		5.3	554
DELIVERY (miles)		-	-	-
LIFT & SECURE		-	-	-
		100.0%	100.0%	$10,450

**Non-load bearing only

***No furninture will be included

Note: Only the items listed above will be used for comparison.

[1](includes / excludes) Clothes washer, dryer, utility sink

Profile # 1 Trad/Single Family

Cost/SqFt

V. GENERAL STRUCTURE COST "B"
(excludes foundation & excavation)

Area: 1,678

		General %	Detailed %	$
SHELL	Structural System			
	Exterior Closure		53.6	4,881
	Roofing System			
	Interior Vertical*			
FINISHES	Exterior Finishes		14.9	1,359
	Interior Finishes			
MECHANICAL	Vertical Circulation [2]			
	Plumbing		14.1	1,285
	HVAC		2.4	209
	Electrical		5.4	491
	Refuse Dispo'l System		-	-
APPLIANCES & FURNISHINGS	Appliances & Furnishings [1]		9.6	878
DELIVERY	Delivery [3]		-	-
LIFT & SECURE	Lift & Secure		-	-
		100 %	100 %	9,103

[1] (includes / excludes) kitchen, bathroom, utility appliances & furnishings

[2] (includes / excludes) Stairs, elevators

[3] miles delivery distance

*Non-load bearing only

Profile #__1__ Trad/Single Family Cost/SqFt________

V. GENERAL STRUCTURE COST "B" W/O HVAC Area: 1,678
(excludes foundation & excavation)

		General %	Detailed %	$
SHELL	Structural System	54.9		
	Exterior Closure			
	Roofing System		54.9	4,881
	Interior Vertical*			
FINISHES	Exterior Finishes	15.3	-	-
	Interior Finishes		15.3	1,359
MECHANICAL	Vertical Circulation [2]	19.9	-	-
	Plumbing		14.4	1,285
	HVAC		-	-
	Electrical		5.5	491
	Refuse Dispo'l System			
APPLIANCES & FURNISHINGS	Appliances & Furnishings [1]	9.9	9.9	878
DELIVERY	Delivery [3]	-	-	-
LIFT & SECURE	Lift & Secure	-	-	-
		100.0%	100.0%	8,894

1 (includes / excludes) kitchen, bathroom, utility appliances & furnishings

2 (includes / excludes) Stairs, elevators

3 miles delivery distance

*Non-load bearing only

3.5.2 ROW HOUSING

(TRADITIONAL CONSTRUCTION)

3.5.3 LOW RISE

(TRADITIONAL CONSTRUCTION)

Profile: 1 Classification: Multi-Family Low-Rise

I. SOURCE

1.	Name	
2.		
3.		
4.		

II. BACKGROUND INFORMATION

REGION

1.	Name	Middle Atlantic (New York)
2.	Region #	2
3.	Metropolitan or Rural Area	Suburban

COST

4.	Total Sales Price (with Land)	$ Total	
5.		$/SqFt	
6.		$/CuFt	
7.	Construction Cost	$ Total	
8.	(includes foundation &	$/SqFt	
9.	excludes) excavation costs	$/CuFt	
10.	Structure Cost	$ Total	
11.	(includes foundation &	$/SqFt	
12.	excludes) excavation costs	$/CuFt	
13.	Construction Date		Jan. ,1970
14.	Current Cost Index		
15.	Project Cost Index		
16.	Revised Sales Price (with land)	$ Total	
17.		$/SqFt	
18.		$/CuFt	
19.	Revised Construction Cost	$ Total	
20.		$/SqFt	
21.		$/CuFt	

Profile #_____

22.	Revised Structure Cost	$ Total	
23.		$/SqFt	
24.		$/CuFt	

PHYSICAL CHARACTERISTICS OF DWELLING UNITS

25.	Generic Type	Trad.
26.	Housing type	Multi-Family Low-Rise
27.	Structural Material	Wood
28.	Structural Type	Frame

29.	Story Height	2

30.	Net Floor Area	782
31.	Ceiling Height	8'
32.	Total Volume of Dwelling Unit (CuFt)	5792
33.	Number of Bedrooms	2
34.	Number of Bathrooms	1
35.	Carport?	No
36.	Garage?	No

37.	Wall Thickness	
38.	Panel Sizes	

39.	Total Weight of Dwelling Unit (Tons)	
40.	Pounds/cubic feet	

LABOR CHARACTERISITCS

41.	Unskilled Workers	Percentage	
42.		Average Wage Rate	
43.		Union?	
44.	Skilled Workers	Percentage	
45.		Average Wage Rate	
46.		Union?	

Profile #____

VOLUME OF BUSINESS

47.	Dwelling Units/Year	

FACTORY

48.	Factory Size	
49.	Production Rate	
50.	Plant Design Capacity	

POSSIBLE HOUSING TYPES

51.	Housing Type # 1	
52.	Housing Type # 2	
53.	Housing Type # 3	
54.	Housing Type # 4	
55.	Housing Type # 5	

BUILDING CODES CONFORMING TO

56.	Building Code # 1	
57.	Building Code # 2	
58.	Building Code # 3	
59.	Building Code # 4	
60.	Building Code # 5	
61.	Building Code # 6	

Profile # 1 Trad/Multi-Family Low Rise Cost/SqFt ______

V. GENERAL STRUCTURE COST "B" Area: 782

(excludes foundation & excavation)

		General %	Detailed %	$
SHELL	Structural System	55.2	21.6	2,251
	Exterior Closure		12.5	1,294
	Roofing System		2.6	269
	Interior Vertical*		18.5	1,913
FINISHES	Exterior Finishes	10.3	0.4	40
	Interior Finishes		9.9	1,029
MECHANICAL	Vertical Circulation [2]	21.6	-	-
	Plumbing		6.8	707
	HVAC		8.9	923
	Electrical		5.9	609
	Refuse Dispo'l System		-	-
APPLIANCES & FURNISHINGS	Appliances & Furnishings [1]	12.9	12.9	1,341
DELIVERY	Delivery [3]	-	-	-
LIFT & SECURE	Lift & Secure	-	-	-
		100 %	100 %	10,376

[1] (includes / excludes) kitchen, bathroom, utility appliances & furnishings

[2] (includes / excludes) Stairs, elevators

[3] miles delivery distance

*Non-load bearing only

Profile # 1 Trad/Multi-Fam. Low-Rise   Cost/SqFt ______

V. GENERAL STRUCTURE COST "B" w/o HVAC   Area: 782
(excludes foundation & excavation)

		General %	Detailed %	$
SHELL	Structural System	60.6	23.8	2,251
	Exterior Closure		13.8	1,294
	Roofing System		2.8	269
	Interior Vertical*		20.2	1,913
FINISHES	Exterior Finishes	11.3	0.4	40
	Interior Finishes		10.9	1,029
MECHANICAL	Vertical Circulation 2	13.9	-	-
	Plumbing		7.5	707
	HVAC		-	-
	Electrical		6.4	609
	Refuse Dispo'l System		-	-
APPLIANCES & FURNISHINGS	Appliances & Furnishings 1	14.2	14.2	1,341
DELIVERY	Delivery 3	-	-	-
LIFT & SECURE	Lift & Secure	-	-	-
		100 %	100 %	9,453

1 (includes / excludes) kitchen, bathroom, utility appliances & furnishings

2 (includes / excludes) Stairs, elevators

3 miles delivery distance

*Non-load bearing only

Profile # 1 Multi-Family Low Rise

Cost/SqFt: 175

Area: 782

VI. DETAILED STRUCTURE COST "B"
(excludes foundation & excavation)

			General %	Detailed %	$
STRUCUTRAL SYSTEM (load-bearing)	Columns		21.6		
	Walls	Exterior			
		Interior			
	Stairs			0.5	57
	Ceiling				
	Roof			3.1	322
	Floors			18.0	1,872
EXTERIOR CLOSURE (non-load bearing)	Exterior Walls		12.5	7.4	764
	Exterior Doors			2.0	210
	Exterior Windows			3.1	320
ROOFING SYSTEM	Roofing System		2.6	2.6	269
INTERIOR VERTICAL ELEMENTS	Partitions (non-load)		18.5	17.1	1,772
	Interior Doors			1.4	141
	Interior Windows			-	-
EXTERIOR FINISH	Exterior Painting		0.4		
	Exterior Trim & Ornamentation			0.4	40
INTERIOR FINISHES	Wall Finish	Dry Wall	9.9		
		Plaster[1]			
		Tile ceramic		1.6	171
		Tile other			
	Ceiling Finish	Plaster[1]			
		Suspended Clg.			
	Finish Flooring	Wood Flooring			
		Tile ceramic		0.3	31
		Tile other		1.9	195
		Carpeting[2]			
	Interior Painting			5.6	578
	Other Int. Trim & Touchup			0.5	54

[1] (includes / excludes) lath, furring, stucco

[2] (includes / excludes) carpeting (include only is no other floor finish)

Profile # 1 Trad/Multi-Family Low Rise

		General %	Detailed %	$
VERTICAL CIRCULATION	Stairs**			
	Elevators			
PLUMBING	Distribution System	6.8	6.8	707
	Fixtures & Hardware		-	-
HVAC	Heating Equipment	8.9	1.3	138
	Cooling Equipment		-	-
	Fans, Ventilating Equipment		-	-
	Distribution System		5.3	545
	Hardware & Fixtures		2.3	240
ELECTRICAL	Distribution System	5.9	3.5	361
	Fixtures & Hardware		2.4	248
REFUSE DISPOSAL SYST.	Bins & Equipment	-	-	-
	Distribution System			
APPLIANCES & FURNISHINGS***	Kitchen Appliances	12.9	2.6	269
	Kitchen cabinets & counters		2.7	284
	Utility Equipment[1]			
	Bathroom Furnishings		7.4	771
	Other cabinets & enclosures		0.2	17
DELIVERY (miles)		-	-	-
LIFT & SECURE		-	-	-
		100%	100%	10,376

**Non-load bearing only

***No furninture will be included

Note: Only the items listed above will be used for comparison.

[1](includes / excludes) Clothes washer, dryer, utility sink

3.5.4 ELEVATOR APARTMENT

(TRADITIONAL CONSTRUCTION)

Profile: 1 Classification: Traditional/Medium Rise
7 Story Fireproof

I. SOURCE

1.	Name	
2.		
3.		
4.		

II. BACKGROUND INFORMATION

REGION

1.	Name	Middle Atlantic (New York)
2.	Region #	2
3.	Metropolitan or Rural Area	Urban

COST

4.	Total Sales Price (with Land)		$ Total	
5.			$/SqFt	
6.			$/CuFt	
7.	Construction Cost		$ Total	
8.	(includes/excludes) foundation & excavation costs		$/SqFt	
9.			$/CuFt	
10.	Structure Cost		$ Total	
11.	(includes/excludes) foundation & excavation costs		$/SqFt	
12.			$/CuFt	
13.	Construction Date			January, 1970
14.	Current Cost Index	1971	Boeckh Resi-	132.8
15.	Project Cost Index	1970	dence Index	122.4
16.	Revised Sales Price (with land)		$ Total	
17.			$/SqFt	
18.			$/CuFt	
19.	Revised Construction Cost		$ Total	
20.			$/SqFt	
21.			$/CuFt	

22.	Revised Structure Cost	$ Total	
23.		$/SqFt	
24.		$/CuFt	

PHYSICAL CHARACTERISTICS OF DWELLING UNITS

25.	Generic Type	Traditional
26.	Housing type	Medium Rise Apt.
27.	Structural Material	Steel & Bar Joist
28.	Structural Type	Frame

29.	Story Height	7

30.	Net Floor Area	825
31.	Ceiling Height	8'
32.	Total Volume of Dwelling Unit (CuFt)	6600
33.	Number of Bedrooms	2
34.	Number of Bathrooms	1
35.	Carport?	No
36.	Garage?	No

37.	Wall Thickness	Face Brick w/ 4" Air Space (4"-2"-4")
38.	Panel Sizes	-

39.	Total Weight of Dwelling Unit (Tons)	-
40.	Pounds/cubic feet	-

LABOR CHARACTERISITCS

41.	Unskilled Workers	Percentage	
42.		Average Wage Rate	
43.		Union?	
44.	Skilled Workers	Percentage	
45.		Average Wage Rate	
46.		Union?	

Profile # 1 Trad/Medium Rise (7 Stories)

VOLUME OF BUSINESS

47.	Dwelling Units/Year	83 Apartments/ Building

FACTORY

48.	Factory Size	
49.	Production Rate	
50.	Plant Design Capacity	

POSSIBLE HOUSING TYPES

51.	Housing Type # 1	
52.	Housing Type # 2	
53.	Housing Type # 3	
54.	Housing Type # 4	
55.	Housing Type # 5	

BUILDING CODES CONFORMING TO

56.	Building Code # 1	State Code
57.	Building Code # 2	
58.	Building Code # 3	
59.	Building Code # 4	
60.	Building Code # 5	
61.	Building Code # 6	

Profile # 1 Trad/Medium Rise Cost/SqFt___

V. GENERAL STRUCTURE COST "B" Area: 825
(excludes foundation & excavation)

		General %	Detailed %	$
SHELL	Structural System	56.6	25.6	3,994
	Exterior Closure		11.4	1,760
	Roofing System		1.4	212
	Interior Vertical*		18.2	2,821
FINISHES	Exterior Finishes	16.9	1.2	186
	Interior Finishes		15.7	2.437
MECHANICAL	Vertical Circulation 2	17.9	1.1	158
	Plumbing		2.1	343
	HVAC		6.8	1,078
	Electrical		6.2	969
	Refuse Dispo'l System		1.7	259
APPLIANCES & FURNISHINGS	Appliances & Furnishings 1	8.6	8.6	1,360
DELIVERY	Delivery 3	-	-	-
LIFT & SECURE	Lift & Secure	-	-	-
		100 %	100 %	15,577

1 (includes/excludes) kitchen, bathroom, utility appliances & furnishings

2 (includes/excludes) Stairs, elevators

3 miles delivery distance

*Non-load bearing only

Profile # 1 Trad/Medium Rise (7 stories) Cost/SqFt________

V. GENERAL STRUCTURE COST "B" w/o HVAC   Area: 825
(excludes foundation & excavation)

		General %	Detialed %	$
SHELL	Structural System	60.6	27.5	3,994
	Exterior Closure		12.1	1,760
	Roofing System		1.5	212
	Interior Vertical*		19.5	2,821
FINISHES	Exterior Finishes	18.1	1.3	186
	Interior Finishes		16.8	2,437
MECHANICAL	Vertical Circulation [2]	11.9	1.0	158
	Plumbing		2.4	343
	HVAC		-	-
	Electrical		6.7	969
	Refuse Dispo'l System		1.8	259
APPLIANCES & FURNISHINGS	Appliances & Furnishings [1]	9.4	9.4	1,360
DELIVERY	Delivery [3]	-	-	-
LIFT & SECURE	Lift & Secure	-	-	-
		100 %	100 %	14,499

1 (includes / excludes) kitchen, bathroom, utility appliances & furnishings

2 (includes / excludes) Stairs, elevators

3 miles delivery distance

*Non-load bearing only

Profile # 1

Cost/SqFt: 20.48 (1971)

Area: 825

VI. DETAILED STRUCTURE COST "B"
(excludes foundation & excavation)

				General %	Detailed %	$
STRUCUTRAL SYSTEM (load-bearing)	Columns			25.6		
	Walls	Exterior				
		Interior				
	Stairs				0.8	123
	Ceiling				16.4	2,560
	Roof					
	Floors				8.4	1,311
EXTERIOR CLOSURE (non-load bearing)	Exterior Walls			11.4	9.3	1,436
	Exterior Doors				0.8	117
	Exterior Windows				1.3	207
ROOFING SYSTEM	Roofing System			1.4	1.4	212
INTERIOR VERTICAL ELEMENTS	Partitions (non-load)			18.2	11.6	1,796
	Interior Doors				6.6	1,025
	Interior Windows				-	-
EXTERIOR FINISH	Exterior Painting			1.2	-	-
	Exterior Trim & Ornamentation				1.2	186
INTERIOR FINISHES	Wall Finish	Dry Wall		15.7	-	-
		Plaster[1]				
		Tile	ceramic		1.1	177
			other		-	-
	Ceiling Finish	Plaster[1]			-	-
		Suspended Clg.			4.9	757
	Finish Flooring	Wood Flooring				
		Tile	ceramic		0.2	32
			other		2.2	335
		Carpeting[2]			-	-
	Interior Painting				7.3	1,136
	Other Int. Trim & Touchup				-	-

[1] (includes / excludes) lath, furring, stucco

[2] (includes / excludes) carpeting (include only is no other floor finish)

Profile # 1

		General %	Detailed %	$
VERTICAL CIRCULATION	Stairs**	1.1	0.5	72
	Elevators		0.6	86
PLUMBING	Distribution System	2.1	2.1	330
	Fixtures & Hardware		-	13
HVAC	Heating Equipment	6.8	1.1	177
	Cooling Equipment		-	-
	Fans, Ventilating Equipment		.3	45
	Distribution System		3.8	597
	Hardware & Fixtures		1.6	259
ELECTRICAL	Distribution System	6.2	3.2	495
	Fixtures & Hardware		3.0	474
REFUSE DISPOSAL SYST.	Bins & Equipment	1.7	1.7	259
	Distribution System		-	-
APPLIANCES & FURNISHINGS***	Kitchen Appliances	8.6	2.3	365
	Kitchen cabinets & counters		2.0	305
	Utility Equipment[1]		-	6
	Bathroom Furnishings		3.8	599
	Other cabinets & enclosures		0.5	85
DELIVERY (miles)		-	-	-
LIFT & SECURE		-	-	-
		100%	100%	15,577

**Non-load bearing only

***No furninture will be included

Note: Only the items listed above will be used for comparison.

1 (includes / excludes) Clothes washer, dryer, utility sink

Profile: 1   Classification: Traditional/ High Rise
15 Stories
(Conc)

I. SOURCE

1.	Name	
2.		
3.		
4.		

II. BACKGROUND INFORMATION

REGION

1.	Name	Northeast
2.	Region #	1 & 2
3.	Metropolitan or Rural Area	Urban Core Area

COST

4.	Total Sales Price (with Land)	$ Total	20,000	
5.		$/SqFt	23.50	
6.		$/CuFt	2.94	
7.	Construction Cost	$ Total	including 15,925	exclude 14,950
8.	(includes / excludes) foundation & excavation costs	$/SqFt	18.75	17.60
9.		$/CuFt	2.34	2.20
10.	Structure Cost	$ Total		
11.	(includes / excludes) foundation & excavation costs	$/SqFt		
12.		$/CuFt		
13.	Construction Date		1967	
14.	Current Cost Index 1971	Boeckh Residence Index	132.8	
15.	Project Cost Index 1967		100.0	
16.	Revised Sales Price (with land)	$ Total	26,500	
17.		$/SqFt	31.30	
18.		$/CuFt	3.91	
19.	Revised Construction Cost	$ Total	21,150	19,820
20.		$/SqFt	24.90	23.30
21.		$/CuFt	3.11	2.92

Profile # 1 Traditional/Hi-Rise

22.	Revised Structure Cost	$ Total	
23.		$/SqFt	
24.		$/CuFt	

PHYSICAL CHARACTERISTICS OF DWELLING UNITS

25.	Generic Type	Traditional
26.	Housing type	Hi-Rise
27.	Structural Material	Concrete (Reinf)
28.	Structural Type	Frame

29.	Story Height	15

30.	Net Floor Area	850
31.	Ceiling Height	8'
32.	Total Volume of Dwelling Unit (CuFt)	6,800
33.	Number of Bedrooms	3
34.	Number of Bathrooms	1
35.	Carport?	No
36.	Garage?	NO

37.	Wall Thickness	-
38.	Panel Sizes	-

39.	Total Weight of Dwelling Unit (Tons)	-
40.	Tons/CuFt	-

LABOR CHARACTERISITCS

41.	Unskilled Workers	Percentage	-
42.		Average Wage Rate	-
43.		Union?	-
44.	Skilled Workers	Percentage	-
45.		Average Wage Rate	-
46.		Union?	-

Profile # 1 Traditional/Hi-Rise

VOLUME OF BUSINESS

47.	Dwelling Units/Year	Building has 125-150 d.u.

FACTORY

48.	Factory Size	-
49.	Production Rate	-
50.	Plant Design Capacity	-

POSSIBLE HOUSING TYPES

51.	Housing Type # 1	-
52.	Housing Type # 2	-
53.	Housing Type # 3	-
54.	Housing Type # 4	-
55.	Housing Type # 5	-

BUILDING CODES CONFORMING TO

56.	Building Code # 1	-
57.	Building Code # 2	-
58.	Building Code # 3	-
59.	Building Code # 4	-
60.	Building Code # 5	-
61.	Building Code # 6	-

Hi-Rise/
TRADITIONAL

Profile # 1

III. SALES PRICE BREAKDOWN (includes land)

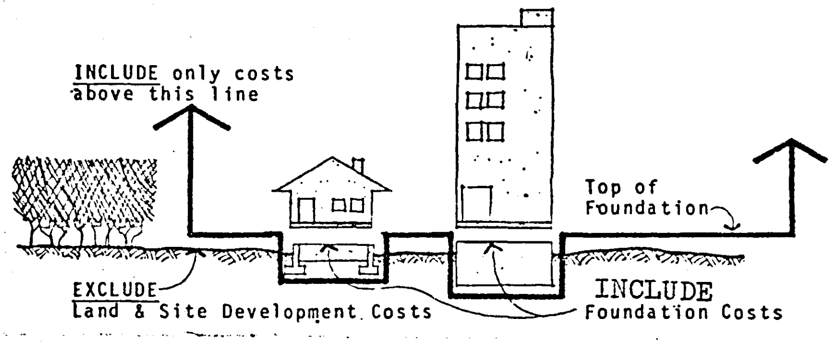
				General %	Detailed %	$
1.	Development Cost	Land Acquisition		20.4	9.0	1,800
2.		Site Prep. & Finish'g			6.4	1,275
3.		Development Fees			5.0	1,000
4.	Structure Cost "A"	Foundation & Excavation	Material	4.9	3.4	675
5.			Equip.			
6.			Labor		1.5	300
7.		Structure Cost "B"	Material	53.1	33.8	6,775
8.			Equip.			
9.			Labor		19.3	3,865
10.	Selling Expenses			2.0	2.0	400
11.	General & Administrative Expenses			-	-	-
12.	Financing Expenses[1]			NIL	NIL	NIL
13.	Overhead & Profit	Overhead		19.6	19.6	3,910
14.		Profit				
				100%	100%	20,000

[1] (includes / excludes) Mortgage Points

Hi-Rise/
TRADITIONAL

Profile # 1

IV. CONSTRUCTION COST "A" (includes foundation & excavation)



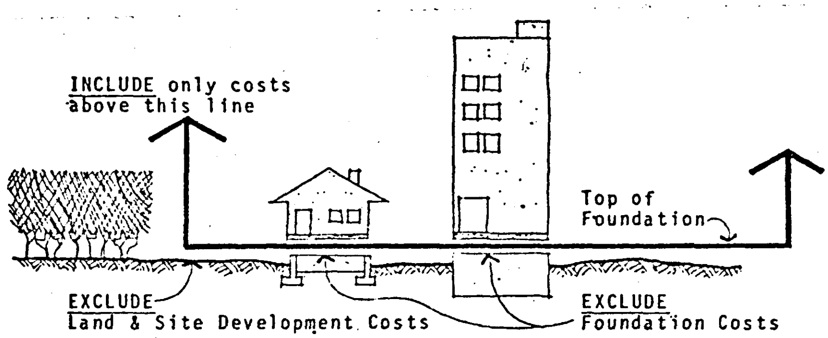
				General %	Detailed %	$
1.	Structure Cost "A"	Foundation & Excavation	Material	73.0		
2.			Equip.		4.3	675
3.			Labor		1.9	300
4.		Structure Cost "B"	Material		42.6	6,775
5.			Equip.			
6.			Labor		24.2	3,865
7.	Selling Expenses			2.5	2.5	400
8.	General & Administrative Expenses			-	-	-
9.	Financing Expenses[1]			NIL	NIL	NIL
10.	Overhead & Profit	Overhead		24.5	24.5	3,910
11.		Profit				
				100 %	100 %	15,925

[1] (includes / excludes) Mortgage Points

Hi-Rise
TRADITIONAL

Profile # 1

IV. CONSTRUCTION COST "B" (excludes foundation & excavation)



			General %	Detailed %	$
1.	Structure Cost "B"	Materials	71.1	45.3	6,775
2.		Equipment			
3.		Labor		25.8	3,865
4.	Selling Expenses		2.7	2.7	400
5.	General & Administrative Expenses		-	-	-
6.	Financing Expenses[1]		NIL	NIL	NIL
7.	Overhead & Profit	Overhead	26.2	26.2	3,910
8.		Profit			
			100 %	100 %	14,950

[1] (includes / excludes) Mortgage Points

Profile # 1 Trad./Hi-Rise

Cost/SqFt 18.18 (1971)

Area: 850

V. GENERAL STRUCTURE COST "A"
(includes foundation & excavation)

		General %	Detailed %	$
FOUNDATION	Foundation[1]	8.4	8.4	
SHELL	Structural System	45.0	21.2	
	Exterior Closure		16.0	
	Roofing System		1.5	
	Interior Vertical*		6.3	
FINISHES	Exterior Finishes	13.4	3.9	
	Interior Finishes		9.5	
MECHANICAL	Vertical Circulation[3]	25.4	2.8	
	Plumbing		7.5	
	HVAC		5.6	
	Electrical		7.5	
	Refuse Disposal System		2.0	
APPLIANCES & FURNISHINGS	Appliances & Furnishings[2]	7.8	7.8	
DELIVERY	Delivery[4]	-	-	
LIFT & SECURE	Lift & Secure	-	-	
		100 %	100 %	$ 11,615

1 (includes / excludes) foundation, footing, piling, excavation, fill, septic system

2 (includes / excludes) kitchen, bathroom, utility appliances & furnishings

3 (includes / excludes) Stairs, elevators

4 miles delivery distance

*Non-load bearing only

Profile #_1_ Trad/Hi-Rise

Cost/SqFt: 18.18 (1971)

Area: 850

VI. DETAILED STRUCTURE COST "A"
(includes foundation & excavation)

			General %	Detailed %	$
FOUNDATION	Excavation & Fill		8.4	2.8	325
	Septic System			-	-
	Footing or Piling			2.8	325
	Foundation			2.8	325
STRUCTURAL SYSTEM (load-bearing)	Columns		21.2		
	Walls	Exterior			
		Interior			
	Stairs			21.2	2,475
				Structural	
	Ceiling			Frame	
	Roof				
	Floors				
EXTERIOR CLOSURE (non-load bearing)	Exterior Walls		16.0	10.4	1,205
	Exterior Doors			-	-
	Exterior Windows			5.6	650
ROOFING SYSTEM	Roofing System		1.5	1.5	175
INTERIOR VERTICAL ELEMENTS	Partitions*		6.3	5.6	650
	Interior Door			0.7	80
	Interior Windows			-	-
EXTERIOR FINISHES	Exterior Painting		3.9	1.1	125
	Exterior Trim & Ornm't.			2.8	325
INTERIOR FINISHES	Wall Finish	Dry Wall	9.5	-	-
		Plaster[1]		4.1	475
		Tile ceramic			-
		Tile other		-	-
	Ceiling Finish	Plaster[1]		-	-
		Suspended Clg.		-	-
	Finish Flooring	Wood Flooring		-	-
		Tile ceramic		2.8	325
		Tile other		1.5	175
		Carpeting[2]		-	-
	Interior Painting			1.1	125

*Non-load bearing only

1 (includes / excludes) lath, furring, stucco

2 (includes / excludes) carpeting (include only if no other floor finish)

Profile # 1 STRUCTURE COST "A" Trad/Hi-Rise

		General %	Detailed %	$
VERTICAL CIRCULATION	Stairs**	2.8		-
	Elevators		2.8	325
PLUMBING	Distribution System	7.5	7.5	875
	Fixtures & Hardware			
HVAC	Heating Equipment	5.6		
	Cooling Equipment			
	Fans, Ventilating Equipment			
	Distribution System		5.6	650
	Hardware & Fixtures			
ELECTRICAL	Distribution System	7.5	7.5	875
	Fixtures & Hardware			
REFUSE DISPOSAL SYST.	Bins & Equipment	2.0	0.7	80
	Distribution System		1.3	150
APPLIANCES & FURNISHINGS***	Kitchen Appliances	7.8	2.8	325
	Utility Equipment[1]		included	in kit.appl.
	Bathroom Furnishings		-	-
	Cabinets & Enclos'r		5.0	575
DELIVERY (miles)		-	-	-
LIFT & SECURE		-	-	-
		100 %	100 %	11,615

**Non-load bearing only

***No furninture will be included

Note: Only the items listed above will be used for comparison.

1 (includes / excludes) Clothes washer, dryer, utility sink

Profile # 1 Trad/Hi-Rise

Cost/SqFt 16.60 (1971)

V. GENERAL STRUCTURE COST "B"
(excludes foundation & excavation)

Area: 850

		General %	Detailed %	$
SHELL	Structural System	49.1	23.2	2,475
	Exterior Closure		17.4	1,855
	Roofing System		1.6	175
	Interior Vertical*		6.9	730
FINISHES	Exterior Finishes	14.7	4.2	450
	Interior Finishes		10.5	1,100
MECHANICAL	Vertical Circulation 2	27.7	3.1	325
	Plumbing		8.2	875
	HVAC		6.1	650
	Electrical		8.2	875
	Refuse Dispo'l System		2.1	230
APPLIANCES & FURNISHINGS	Appliances & Furnishings 1	8.5	8.5	900
DELIVERY	Delivery 3	-	-	-
LIFT & SECURE	Lift & Secure	-	-	-
		100 %	100 %	$ 10,640

1 (includes / excludes) kitchen, bathroom, utility appliances & furnishings

2 (includes / excludes) Stairs, elevators

3 miles delivery distance

*Non-load bearing only

Profile # 1 Trad/Hi-Rise (15 Stoires) Cost/SqFt ______

V. GENERAL STRUCTURE COST "B" w/o HVAC Area: 850
(excludes foundation & excavation)

		General %	Detailed %	$
SHELL	Structural System	52.5	24.8	2,475
	Exterior Closure		18.6	1,855
	Roofing System		1.8	175
	Interior Vertical*		7.3	730
FINISHES	Exterior Finishes	15.5	4.5	450
	Interior Finishes		11.0	1,100
MECHANICAL	Vertical Circulation [2]	23.0	3.3	325
	Plumbing		8.7	875
	HVAC		-	-
	Electrical		8.7	875
	Refuse Dispo'l System		2.3	230
APPLIANCES & FURNISHINGS	Appliances & Furnishings [1]	9.0	9.0	900
DELIVERY	Delivery [3]	-	-	-
LIFT & SECURE	Lift & Secure	-	-	-
		100 %	100 %	9,990

[1] (includes / excludes) kitchen, bathroom, utility appliances & furnishings

[2] (includes / excludes) Stairs, elevators

[3] miles delivery distance

*Non-load bearing only

Profile # 1 Trad/Hi-Rise

Cost/SqFt: 16.60(1971)

Area: 850

VI. DETAILED STRUCTURE COST "B"
(excludes foundation & excavation)

				General %	Detailed %	$
STRUCUTRAL SYSTEM (load-bearing)	Columns			23.2		
	Walls	Exterior				
		Interior				
	Stairs				23.2	2,475
	Ceiling					
	Roof					
	Floors					
EXTERIOR CLOSURE (non-load bearing)	Exterior Walls			17.4	11.3	1,205
	Exterior Doors					
	Exterior Windows				6.1	650
ROOFING SYSTEM	Roofing System			1.6	1.6	175
INTERIOR VERTICAL ELEMENTS	Partitions*			6.9	6.1	650
	Interior Doors				0.8	80
	Interior Windows				-	-
EXTERIOR FINISH	Exterior Painting			4.2	1.2	125
	Exterior Trim & Ornamentation				3.0	325
INTERIOR FINISHES	Wall Finish	Dry Wall		10.5	-	-
		Plaster[1]			4.6	475
		Tile	ceramic		-	-
			other		-	-
	Ceiling Finish	Plaster[1]			-	-
		Suspended Clg.			-	-
	Finish Flooring	Wood Flooring			-	-
		Tile	ceramic		3.1	325
			other		1.6	175
		Carpeting[2]			-	-
	Interior Painting				1.2	125

*Non-load bearing only

1 (includes / excludes) lath, furring, stucco

2 (includes / excludes) carpeting (include only is no other floor finish)

STRUCTURE COST "B"

Profile # 1 Trad./Hi-Rise

		General %	Detailed %	$
VERTICAL CIRCULATION	Stairs**	3.1		-
	Elevators		3.1	325
			-	-
PLUMBING	Distribtuion System	8.2	8.2	875
	Fixtures & Hardware			
HVAC	Heating Equipment	6.1		
	Cooling Equipment			
	Fans, Ventilating Equipment			
	Distribution System		6.1	650
	Hardware & Fixtures			
ELECTRICAL	Distribution System	8.2	8.2	875
	Fixtures & Hardware			
REFUSE DISPOSAL SYSTEM	Bins & Equipment	2.1	0.7	80
	Distribution System		1.4	150
APPLIANCES & FURNISHINGS***	Kitchen Appliances	8.5	3.1	325
	Utility Equipment[1]		included	in kit.appl.
	Bathroom Furnishings		-	-
	Cabinets & Enclos's		5.4	575
DELIVERY (miles)		-	-	-
LIFT & SECURE		-	-	-
		100 %	100 %	10,640

**Non-load bearing only

***No Furniture will be included

Note: Only the items listed above will be used for comparison.

1 (includes / excludes) Clothes washer, dryer, utility sink

Profile: 2 Classification: Traditional Hi-Rise (Conc) (25 Stories)

I. SOURCE

1.	Name	
2.		
3.		
4.		

II. BACKGROUND INFORMATION

REGION

1.	Name	Middle Atlantic (New York City)
2.	Region #	2
3.	Metropolitan or Rural Area	

COST

4.	Total Sales Price (with Land)	$ Total	
5.		$/SqFt	
6.		$/CuFt	
7.	Construction Cost (Low Base)	$ Total	18,969
8.	(includes / excludes) foundation & excavation costs	$/SqFt	18.60
9.		$/CuFt	
10.	Structure Cost	$ Total	15,618
11.	(includes / excludes) foundation & excavation costs	$/SqFt	15.31
12.		$/CuFt	
13.	Construction Date		January, 1970
14.	Current Cost Index 1971	Boeckh Residence Index	132.8
15.	Project Cost Index 1970		122.4
16.	Revised Sales Price (with land)	$ Total	
17.		$/SqFt	
18.		$/CuFt	
19.	Revised Construction Cost	$ Total	20,500
20.		$/SqFt	20.15
21.		$/CuFt	

Profile # 2 Trad/Hi-Rise (25 Stories)

22.	Revised Structure Cost	$ Total	16,945
23.		$/SqFt	18.82 (1971)
24.		$/CuFt	

PHYSICAL CHARACTERISTICS OF DWELLING UNITS

25.	Generic Type	Traditional
26.	Housing type	Hi-Rise Apt.
27.	Structural Material	Concrete (Flat Plate)
28.	Structural Type	Bearing Wall

29.	Story Height	25

30.	Net Floor Area (only gross available)	900
31.	Ceiling Height	8'
32.	Total Volume of Dwelling Unit (CuFt)	7200
33.	Number of Bedrooms	1
34.	Number of Bathrooms	1
35.	Carport?	No
36.	Garage?	No

37.	Wall Thickness (4" hollow cinder block)	4"
38.	Panel Sizes	-

39.	Total Weight of Dwelling Unit (Tons)	-
40.	Pounds/cubic feet	-

LABOR CHARACTERISITCS

41.	Unskilled	Percentage	
42.	Workers	Average Wage Rate	
43.		Union?	
44.	Skilled	Percentage	
45.	Workers	Average Wage Rate	
46.		Union?	

Profile # 2 Trad/Hi-Rise (25 Stories)

VOLUME OF BUSINESS

47.	Dwelling Units/Year	316 apartments in building

FACTORY

48.	Factory Size	
49.	Production Rate	
50.	Plant Design Capacity	

POSSIBLE HOUSING TYPES

51.	Housing Type # 1	
52.	Housing Type # 2	
53.	Housing Type # 3	
54.	Housing Type # 4	
55.	Housing Type # 5	

BUILDING CODES CONFORMING TO

56.	Building Code # 1	State Code
57.	Building Code # 2	City Code
58.	Building Code # 3	
59.	Building Code # 4	
60.	Building Code # 5	
61.	Building Code # 6	

Profile # 2 Trad/Hi-Rise (25 Stories)

201
Cost/SqFt: 18.82 (1971)
Area: 900

VI. DETAILED STRUCTURE COST "B"
(excludes foundation & excavation)

			General %	Detailed %	$
STRUCUTRAL SYSTEM (load-bearing)	Columns		31.5		
	Walls	Exterior		31.2	4,875
		Interior			
	Stairs				
	Ceiling				
	Roof				
	Floors (Slab on grade)			0.3	41
EXTERIOR CLOSURE (non-load bearing)	Exterior Walls (Cavity Wall)(4"-2"-4")		11.4	8.3	1,300
	Exterior Doors			0.4	71
	Exterior Windows			2.7	426
ROOFING SYSTEM	Roofing System		0.4	0.4	61
INTERIOR VERTICAL ELEMENTS	Partitions (non-load)		8.1	5.8	912
	Interior Doors			2.3	364
	Interior Windows			-	-
EXTERIOR FINISH	Exterior Painting (ext. brick)		1.7	-	-
	Exterior Trim & Ornamentation			1.7	263
INTERIOR FINISHES	Wall Finish	Dry Wall (Finishing Only)	7.3	-	-
		Plaster[1]		1.8	280
		Tile ceramic			
		Tile other		-	-
	Ceiling Finish	Plaster[1]		-	-
		Suspended Clg.		0.0	2
	Finish Flooring	Wood Flooring		0.3	42
		Tile ceramic			
		Tile other		1.5	232
		Carpeting[2]		-	-
	Interior Painting			3.6	555
	Other Int. Trim & Touchup			0.1	15

1 (includes / excludes) lath, furring, stucco

2 (includes / excludes) carpeting (include only is no other floor finish)

Profile # 2 Traditional Hi-Rise (25 Stories) Cost/SqFt

V. GENERAL STRUCTURE COST "B" Area: 900

(excludes foundation & excavation)

		General %	Detailed %	$
SHELL	Structural System	51.4	31.5	4,916
	Exterior Closure		11.4	1,797
	Roofing System		0.4	61
	Interior Vertical*		8.1	1,276
FINISHES	Exterior Finishes	9.0	1.7	263
	Interior Finishes		7.3	1,126
MECHANICAL	Vertical Circulation 2	31.1	4.7	727
	Plumbing		8.4	1,300
	HVAC		8.2	1,266
	Electrical		9.8	1,546
	Refuse Dispo'l System		-	-
APPLIANCES & FURNISHINGS	Appliances & Furnishings 1	8.5	8.5	1,340
DELIVERY	Delivery 3	-	-	-
LIFT & SECURE	Lift & Secure	-	-	-
		100 %	100 %	15,618

1 (includes / excludes) kitchen, bathroom, utility appliances & furnishings

2 (includes / excludes) Stairs, elevators

3 miles delivery distance

*Non-load bearing only

Profile # 2 Trad/Hi-Rise (25 Stories)

Cost/SqFt: 18.82 (1971)

Area: 900

VI. DETAILED STRUCTURE COST "B"
(excludes foundation & excavation)

			General %	Detailed %	$
STRUCUTRAL SYSTEM (load-bearing)	Columns		31.5		
	Walls	Exterior		31.2	4,875
		Interior			
	Stairs				
	Ceiling				
	Roof				
	Floors (Slab on grade)			0.3	41
EXTERIOR CLOSURE (non-load bearing)	Exterior Walls (Cavity Wall)(4"-2"-4")		11.4	8.3	1,300
	Exterior Doors			0.4	71
	Exterior Windows			2.7	426
ROOFING SYSTEM	Roofing System		0.4	0.4	61
INTERIOR VERTICAL ELEMENTS	Partitions (non-load)		8.1	5.8	912
	Interior Doors			2.3	364
	Interior Windows			-	-
EXTERIOR FINISH	Exterior Painting (ext. brick)		1.7	-	-
	Exterior Trim & Ornamentation			1.7	263
INTERIOR FINISHES	Wall Finish	Dry Wall[1] (Finishing Only)	7.3	-	-
		Plaster[1]			
		Tile ceramic		1.8	280
		Tile other		-	-
	Ceiling Finish	Plaster[1]		-	-
		Suspended Clg.		0.0	2
	Finish Flooring	Wood Flooring			
		Tile ceramic		0.3	42
		Tile other		1.5	232
		Carpeting[2]		-	-
	Interior Painting			3.6	555
	Other Int. Trim & Touchup			0.1	15

[1] (includes / excludes) lath, furring, stucco

[2] (includes / excludes) carpeting (include only is no other floor finish)

Profile # 2 Trad/Hi-Rise 25 Stories

		General %	Detailed %	$
VERTICAL CIRCULATION	Stairs**	4.7	0.5	77
	Elevators		4.2	650
PLUMBING	Distribtuion System	8.4	5.7	884
	Fixtures & Hardware		2.7	416
HVAC	Heating Equipment	8.2	2.0	305
	Cooling Equipment			
	Fans, Ventilating Equipment		0.2	24
	Distribution System		4.6	712
	Hardware & Fixtures		1.4	225
ELECTRICAL	Distribution System	9.8	7.4	1,164
	Fixtures & Hardware		2.4	382
REFUSE DISPOSAL SYSTEM	Bins & Equipment	-		
	Distribution System			
APPLIANCES & FURNISHINGS***	Kitchen Appliances	8.5	2.6	401
	Kitchen cabinets & counters		0.3	53
	Utility Equipment[1]		-	6
	Bathroom Furnishings		2.4	381
	Other Cabinets & enclosures		3.2	499
DELIVERY (miles)		-	-	-
LIFT & SECURE		-	-	-
		100%	100%	15,618

**Non-load bearing only

***No Furniture will be included

Note: Only the items listed above will be used for comparison.

1 (includes / excludes) Clothes washer, dryer, utility sink

3.5.5 SINGLE-FAMILY HOUSE

(COMPONENTIZED CONSTRUCTION)

Profile: 1 **Classification:** Single Family/Component (Concrete)

I. SOURCE

1.	Name	Puerto Rico
2.		
3.		
4.		

II. BACKGROUND INFORMATION

REGION

1.	Name	
2.	Region #	
3.	Metropolitan or Rural Area	

COST

4.	Total Sales Price (with Land)	$ Total	
5.		$/SqFt	
6.		$/CuFt	
7.	Construction Cost	$ Total	
8.	(includes / excludes) foundation &	$/SqFt	
9.	excavation costs	$/CuFt	
10.	Structure Cost	$ Total	
11.	(includes / excludes) foundation &	$/SqFt	
12.	excavation costs	$/CuFt	
13.	Construction Date		
14.	Current Cost Index		
15.	Project Cost Index		
16.	Revised Sales Price (with land)	$ Total	
17.		$/SqFt	
18.		$/CuFt	
19.	Revised Construction Cost	$ Total	
20.		$/SqFt	
21.		$/CuFt	

22.	**Revised Structure Cost**	**$ Total**	
23.		**$/SqFt**	
24.		**$/CuFt**	

PHYSICAL CHARACTERISTICS OF DWELLING UNITS

25.	Generic Type	Component
26.	Housing type	Single-Family
27.	Structural Material	Concrete
28.	Structural Type	Bearing Wall

29.	Story Height	1

30.	**Net Floor Area**	912
31.	**Ceiling Height**	8'
32.	**Total Volume of Dwelling Unit (CuFt)**	7,296
33.	Number of Bedrooms	3
34.	Number of Bathrooms	1
35.	Carport?	no
36.	**Garage?**	no

37.	**Wall Thickness**	
38.	Panel Sizes	16',13',12',11'-6",11',10',9',8', 6'-6",5',2'-6"

39.	Total Weight of Dwelling Unit (Tons)	89.1
40.	**Pounds/cubic feet**	24.5

LABOR CHARACTERISITCS

41.	Unskilled Workers	**Percentage**	66%
42.		**Average Wage Rate**	$2.10
43.		Union?	yes
44.	Skilled Workers	**Percentage**	34%
45.		Average Wage Rate	$2.70
46.		**Union?**	yes

Profile # 1 Single-Family/Component

VOLUME OF BUSINESS

47.	Dwelling Units/Year	

FACTORY

48.	Factory Size	
49.	Production Rate	
50.	Plant Design Capacity	

POSSIBLE HOUSING TYPES

51.	Housing Type # 1	
52.	Housing Type # 2	
53.	Housing Type # 3	
54.	Housing Type # 4	
55.	Housing Type # 5	

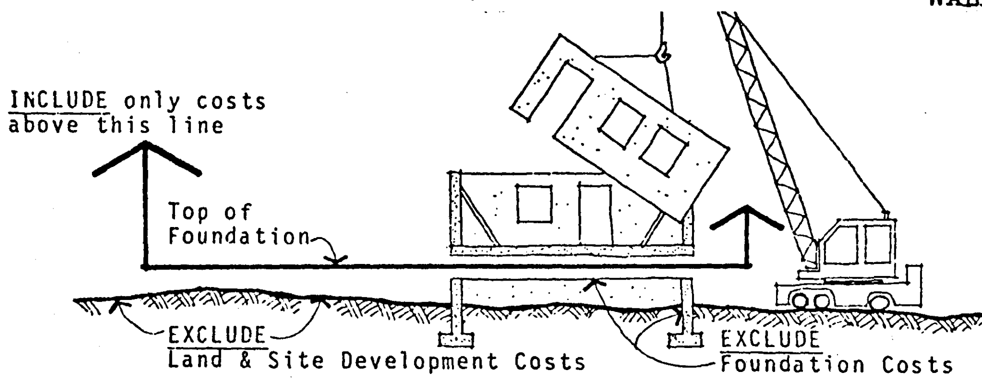
BUILDING CODES CONFORMING TO

56.	Building Code # 1	
57.	Building Code # 2	
58.	Building Code # 3	
59.	Building Code # 4	
60.	Building Code # 5	
61.	Building Code # 6	

Profile # 1

Single Family/
COMPONENT/BEARING
WALL

IV. CONSTRUCTION COST "B"
(exclude foundation & excavation)



	F.O.B. FACTORY PRICE		General %	Detailed %	$
1.	~~Structure Cost~~ General ~~XBX~~ Contractor	Materials		42.1	3,941
2.		Equipment	67.9	5.2	484
3.		Labor		20.6	1,920
4.	Delivery Expenses (miles)				
5.	Selling Expenses				
6.	General & Administrative Expenses				
7.	Overhead & Profit	Overhead	5.8	5.8	546
8.		Profit			
9.	Other Subcontracts		26.3	26.3	2,460
			100%	100%	9,351

	ON-SITE CONSTRUCTION COSTS				
1.	F.O.B. Factory Price				
2.	Delivery Expenses (miles)				
3.	Lift & Secure	Materials			
4.		Equipment			
5.		Labor			
6.	On-Site Finishing	Materials			
7.		Equipment			
8.		Labor			
9.	Selling Expense				
10.	General & Administrative Expenses				
11.	Financing Expenses [1]				
12.	Overhead & Profit	Overhead			
13.		Profit			

[1] (excludes / includes) Mortgage Points

Profile # 1 Single-Family/Component Cost/SqFt 9.66 (1972)

V. GENERAL STRUCTURE COST "B" Area: 912
(excludes foundation & excavation)

		General %	Detailed %	$
SHELL	Structural System	58.5	38.1	3,368
	Exterior Closure		10.5	932
	Roofing System		-	-
	Interior Vertical*		9.9	869
FINISHES	Exterior Finishes	15.7	1.3	110
	Interior Finishes		14.4	1,263
MECHANICAL	Vertical Circulation[2]	19.6	-	-
	Plumbing		4.6	390
	HVAC		-	-
	Electrical		15.0	1,323
	Refuse Dispo'l System		-	-
APPLIANCES & FURNISHINGS	Appliances & Furnishings[1]	6.3	6.3	550
DELIVERY	Delivery[3]	-	-	-
LIFT & SECURE	Lift & Secure	-	-	-
		100 %	100 %	8,805

1 (includes / excludes) kitchen, bathroom, utility appliances & furnishings

2 (includes / excludes) Stairs, elevators

3 miles delivery distance

*Non-load bearing only

Profile # 1 Cost/SqFt: 9.66(1972)

Area: 912

VI. DETAILED STRUCTURE COST "B"
(excludes foundation & excavation)

			General %	Detailed %	$
STRUCUTRAL SYSTEM (load-bearing)	Columns		38.1		
	Walls	Exterior		12.6	1,113
		Interior			
	Stairs				
	Other			0.9	79
	Ceiling				
	Roof			12.6	1,119
	Floors			12.0	1,057
EXTERIOR CLOSURE (non-load bearing)	Exterior Walls		10.5	3.0	268
	Exterior Doors			2.8	250
	Exterior Windows			4.7	414
ROOFING SYSTEM	Roofing System		-	-	-
INTERIOR VERTICAL ELEMENTS	Partitions (non-load)		9.9	2.5	216
	Interior Doors			7.4	653
	Interior Windows				
EXTERIOR FINISH	Exterior Painting		1.3	1.3	110
	Exterior Trim & Ornamentation				
INTERIOR FINISHES	Wall Finish	Dry Wall	14.4		
		Plaster[1]		0.8	66
		Tile ceramic			
		Tile other			
	Ceiling Finish	Plaster[1]		2.3	205
		Suspended Clg.			
	Finish Flooring	Wood Flooring			
		Tile ceramic / other		9.0	792
		Carpeting[2]			
	Interior Painting			2.3	200
	Other Int. Trim & Touchup				

[1] (includes / excludes) lath, furring, stucco

[2] (includes / excludes) carpeting (include only is no other floor finish)

Profile # 1 Single-Family/Comp.		General %	Detailed %	$
VERTICAL CIRCULATION	**Stairs****	-	-	-
	Elevators		-	-
PLUMBING	**Distribution System**	4.6	3.8	330
	Fixtures & Hardware		0.8	60
HVAC	**Heating Equipment**	-	-	-
	Cooling Equipment		-	-
	Fans, Ventilating Equipment		-	-
	Distribution System		-	-
	Hardware & Fixtures		-	-
ELECTRICAL	**Distribution System**	15.0	7.7	677
	Fixtures & Hardware		7.3	646
REFUSE DISPOSAL SYST.	**Bins & Equipment**	-	-	-
	Distribution System		-	-
APPLIANCES & FURNISHINGS***	**Kitchen Appliances**	6.3	4.0	350
	Kitchen cabinets & counters			
	Utility Equipment[1]			
	Bathroom Furnishings		2.3	200
	Other cabinets & enclosures			
DELIVERY (miles)				
LIFT & SECURE				
		100%	100%	8,805

**Non-load bearing only

***No furninture will be included

Note: Only the items listed above will be used for comparison.

[1](includes / excludes) Clothes washer, dryer, utility sink

3.5.6 LOW-RISE APARTMENT

(COMPONENTIZED CONSTRUCTION)

3.5.7 ELEVATOR APARTMENT

(COMPONENTIZED CONSTRUCTION)

3.5.8 MODULAR HOME

Profile: 3   **Classification:** Single Family/Modular Builder

I. SOURCE

1.	Name	
2.		
3.		
4.		

II. BACKGROUND INFORMATION

REGION

1.	Name	New England
2.	Region #	1
3.	Metropolitan or Rural Area	Suburban

COST

4.	Total Sales Price (with Land)	$ Total	25,590
5.		$/SqFt	27.00
6.		$/CuFt	3.41
7.	Construction Cost	$ Total	20,590
8.	(includes/excludes) foundation &	$/SqFt	21.40
9.	excavation costs	$/CuFt	2.74
10.	Structure Cost	$ Total	
11.	(includes/excludes) foundation &	$/SqFt	
12.	excavation costs	$/CuFt	
13.	Construction Date		Feb. 1972
14.	Current Cost Index	/	
15.	Project Cost Index		
16.	Revised Sales Price (with land)	$ Total	
17.		$/SqFt	
18.		$/CuFt	
19.	Revised Construction Cost	$ Total	
20.		$/SqFt	
21.		$/CuFt	

Profile # 3 Single-Family/Modular (Builder)

22.	Revised Structure Cost	$ Total	
23.		$/SqFt	
24.		$/CuFt	

PHYSICAL CHARACTERISTICS OF DWELLING UNITS

25.	Generic Type	Box
26.	Housing type	Single-Family
27.	Structural Material	Wood
28.	Structural Type	Frame

29.	Story Height	1

30.	Net Floor Area	960
31.	Ceiling Height	
32.	Total Volume of Dwelling Unit (CuFt)	7,500
33.	Number of Bedrooms	3
34.	Number of Bathrooms	1
35.	Carport?	No
36.	Garage?	No

37.	Wall Thickness	-
38.	Panel Sizes	-

39.	Total Weight of Dwelling Unit (Tons)	
40.	Tons/CuFt	

LABOR CHARACTERISITCS

41.	Unskilled	Percentage	70%
42.	Workers	Average Wage Rate	$4.50
43.		Union?	No
44.	Skilled	Percentage	30%
45.	Workers	Average Wage Rate	$7.00
46.		Union?	No

Profile #____

VOLUME OF BUSINESS

47.	Dwelling Units/Year	

FACTORY

		Builder
48.	Factory Size	
49.	Production Rate	
50.	Plant Design Capacity	

POSSIBLE HOUSING TYPES

51.	Housing Type # 1	Single-Family
52.	Housing Type # 2	
53.	Housing Type # 3	
54.	Housing Type # 4	
55.	Housing Type # 5	

BUILDING CODES CONFORMING TO

56.	Building Code # 1	Uniform Building Code
57.	Building Code # 2	BOCA Code
58.	Building Code # 3	FHA Minimum Property Standards
59.	Building Code # 4	Underwriter's Lab.
60.	Building Code # 5	Local Code
61.	Building Code # 6	

Profile # 3 Single-Family/Modular (Builder) INDUSTRIALIZED

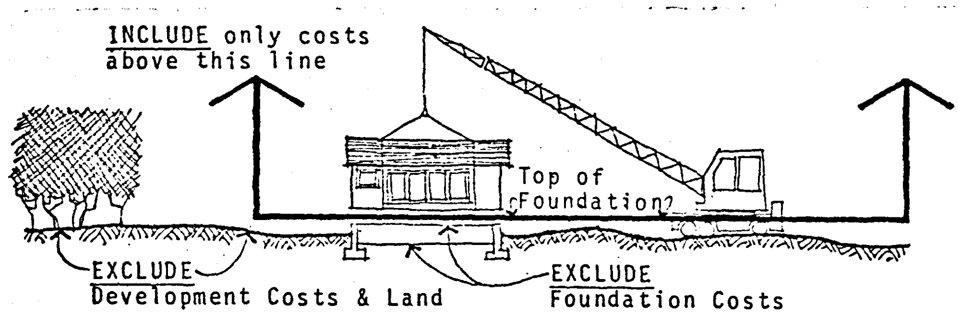
III. SALES PRICE BREAKDOWN (includes land)

				General %	Detailed %	$
1.	Development Cost	Land Acquisition		19.5	19.5	5,000
2.		Site Prep. & Finish'g				
3.		Development Fees				
4.	Structure Cost "A"	Foundation & Excavation	Material	51.9		
5.			Equip.			
6.			Labor			
7.		F.O.B. Factory Price			45.0	11,500
8.		Lift & Secure	Material		1.0	
9.			Equip.			255
10.			Labor			
11.		On-Site Finishing	Material		1.0	~~255~~
12.			Equip.			
13.			Labor		4.9	1,255
14.	Selling Expenses			0	0	0
15.	General & Administrative Expenses			4.9	4.9	1,265
16.	Financing Expenses[1]			4.9	4.9	1,255
17.	Overhead & Profit	Overhead		18.8	4.9	1,265
18.		Profit			13.9	3,540
				100 %	100 %	25,590

[1] (includes / excludes) Mortgage Points

Profile # 3 Single-Family/Modular (Builder)

IV. CONSTRUCTION COST "B" BOX/FRAME
(exclude foundation & excavation)



F.O.B. FACTORY PRICE

1.	Structure Cost "B"	Materials			
2.		Equipment			
3.		Labor			
4.	Delivery Expenses (miles)				
5.	Selling Expenses				
6.	General & Administrative Expenses				
7.	Overhead & Profit	Overhead			
8.		Profit			
9.	Other				

ON-SITE CONSTRUCTION COSTS

			General %	Detailed %	$
1.	F.O.B. Factory Price		56.0	56.0	11,500
2.	Delivery Expenses (miles)		0	0	0
3.	Lift & Secure	Materials	1.2	1.2	255
4.		Equipment			
5.		Labor			
6.	On-Site Finishing	Materials	7.3		
7.		Equipment		1.2	255
8.		Labor		6.1	1,255
9.	Selling Expense		0	0	0
10.	General & Administrative Expenses		6.2	6.2	1,265
11.	Financing Expenses[1]		6.0	6.0	1,255
12.	Overhead & Profit	Overhead	23.3	6.2	1,265
13.		Profit		17.1	3,540
			100%	100%	20,590

[1] (includes / excludes) Mortgage Points

FINISHING COSTS
Profile # 3   Single Family/Modular (Builder)   Cost/SqFt 1.25 (1972)
Area: 960

V. GENERAL STRUCTURE COST "B"
(excludes foundation & excavation)

		General %	Detailed %	$
SHELL	Structural System	15.6	0	
	Exterior Closure		5.9	
	Roofing System		3.9	
	Interior Vertical*		5.8	
FINISHES	Exterior Finishes	55.5	48.8	
	Interior Finishes		6.7	
MECHANICAL	Vertical Circulation [2]	8.0	-	
	Plumbing		4.0	
	HVAC		-	
	Electrical		4.0	
	Refuse Dispo'l System		-	
APPLIANCES & FURNISHINGS	Appliances & Furnishings [1]	-	-	
DELIVERY	Delivery [3]	-	-	
LIFT & SECURE	Lift & Secure	20.9	20.9	
		100 %	100 %	1,196

1 (includes / excludes) kitchen, bathroom, utility appliances & furnishings

2 (includes / excludes) Stairs, elevators

3 miles delivery distance

*Non-load bearing only

Profile # 3 Finishing Costs Cost/SqFt: 1.25(1972)
Single-Family/Modular Builder Area: 960

VI. DETAILED STRUCTURE COST "B"
(excludes foundation & excavation)

				General %	Detailed %	$
STRUCUTRAL SYSTEM (load-bearing)	Columns					
	Walls	Exterior				
		Interior				
	Stairs					
				0	0	0
	Ceiling					
	Roof					
	Floors					
EXTERIOR CLOSURE (non-load bearing)	Exterior Walls				5.9	70
	Exterior Doors			5.9	0	0
	Exterior Windows				0	0
ROOFING SYSTEM	Roofing System			3.9	3.9	46
INTERIOR VERTICAL ELEMENTS	Partitions*				2.9	35
	Interior Doors			5.8	2.9	35
	Interior Windows					
EXTERIOR FINISH	Exterior Painting				48.8	584
	Exterior Trim & Ornamentation			48.8		
INTERIOR FINISHES	Wall Finish	Dry Wall			1.2	14
		Plaster[1]				
		Tile	ceramic			
			other			
	Ceiling Finish	Plaster[1]			0.6	7
		Suspended Clg.		6.7		
	Finish Flooring	Wood Flooring				
		Tile	ceramic			
			other		2.3	28
		Carpeting[2]				
	Interior Painting				2.6	31

*Non-load bearing only

1 (includes / excludes) lath, furring, stucco

2 (includes / excludes) carpeting (include only is no other floor finish)

FINISHING COSTS ONLY

Profile # 3	Single-Family/Modular Builder	General %	Detailed %	$
VERTICAL CIRCULATION	Stairs**			
	Elevators			
PLUMBING	Distribtuion System	4.0		
	Fixtures & Hardware		4.0	48
HVAC	Heating Equipment			
	Cooling Equipment			
	Fans, Ventilating Equipment			
	Distribution System			
	Hardware & Fixtures			
ELECTRICAL	Distribution System	4.0		
	Fixtures & Hardware		4.0	48
REFUSE DISPOSAL SYSTEM	Bins & Equipment			
	Distribution System			
APPLIANCES & FURNISHINGS***	Kitchen Appliances			
	Utility Equipment[1]			
	Bathroom Furnishings			
	Cabinets & Enclos's			
DELIVERY (miles)				
LIFT & SECURE		20.9	20.9	250
		100 %	100 %	1,196

**Non-load bearing only

***No Furniture will be included

Note: Only the items listed above will be used for comparison.

[1] (includes / excludes) Clothes washer, dryer, utility sink

Single Family/Modular (Builder) Finishing Only

Profile # 3 Cost/SqFt 1.25

Area: 960

V. GENERAL STRUCTURE COST "B"
(excludes foundation & excavation)

		General Manhours	Gneral Manhours	Detailed Manhours
SHELL	Structural System	28		0
	Exterior Closure			10
	Roofing System			8
	Interior Vertical*			10
FINISHES	Exterior Finishes	83		76
	Interior Finishes			7
MECHANICAL	Vertical Circulation 2	12		0
	Plumbing			6
	HVAC			0
	Electrical			6
	Refuse Dispo'l System			0
APPLIANCES & FURNISHINGS	Appliances & Furnishings 1	0		0
DELIVERY	Delivery 3			
LIFT & SECURE	Lift & Secure			

1 (includes / excludes) kitchen, bathroom, utility appliances & furnishings

2 (includes / excludes) Stairs, elevators

3 miles delivery distance

*Non-load bearing only

Single Family/Modular (Builder)
Profile # 3 Manhour Profile - Finishing Only Cost/SqFt: 1.25
Area: 960

VI. DETAILED STRUCTURE COST "B"
(excludes foundation & excavation)

					Manhours
STRUCUTRAL SYSTEM (load-bearing)	Columns				
	Walls	Exterior			
		Interior			
	Stairs				0
	Ceiling				
	Roof				
	Floors				
EXTERIOR CLOSURE (non-load bearing)	Exterior Walls				10
	Exterior Doors				
	Exterior Windows				
ROOFING SYSTEM	Roofing System				8
INTERIOR VERTICAL ELEMENTS	Partitions*				5
	Interior Doors				5
	Interior Windows				
EXTERIOR FINISH	Exterior Painting				76
	Exterior Trim & Ornamentation				
INTERIOR FINISHES	Wall Finish	Dry Wall			2
		Plaster[1]			
		Tile ceramic			
		Tile other			
	Ceiling Finish	Plaster[1]			1
		Suspended Clg.			
	Finish Flooring	Wood Flooring			
		Tile ceramic			
		Tile other			
		Carpeting[2]			4
	Interior Painting				

*Non-load bearing only

1 (includes / excludes) lath, furring, stucco

2 (includes / excludes) carpeting (include only is no other floor finish)

Single Family.Modular (Builder) Finishing Only

Profile # 3 Manhour Profile

				Manhours
VERTICAL CIRCULATION	Stairs**			
	Elevators			
PLUMBING	Distribtuion System			6
	Fixtures & Hardware			
HVAC	Heating Equipment			
	Cooling Equipment			
	Fans, Ventilating Equipment			
	Distribution System			
	Hardware & Fixtures			
ELECTRICAL	Distribution System			6
	Fixtures & Hardware			
REFUSE DISPOSAL SYSTEM	Bins & Equipment			
	Distribution System			
APPLIANCES & FURNISHINGS***	Kitchen Appliances			
	Utility Equipment[1]			
	Bathroom Furnishings			
	Cabinets & Enclos's			
DELIVERY (miles)				
LIFT & SECURE				

**Non-load bearing only

***No Furniture will be included

Note: Only the items listed above will be used for comparison.

[1](includes / excludes) Clothes washer, dryer, utility sink

3.5.9 MOBILE HOME

Profile: 1 **Classification:** Mobile Home

Figures for park development, factory cost, ...no fine det breakdown.....

I. SOURCE

1.	Name	
2.		
3.		
4.		

II. BACKGROUND INFORMATION Park Development Costs Included in Construction Cost Breakdown.......

REGION

1.	Name	Northeast
2.	Region #	1 & 2
3.	Metropolitan or Rural Area	

COST

4.	Total Sales Price (~~with~~ Land)	$ Total	6,000
5.	without Land	$/SqFt	9.10
6.		$/CuFt	1.30
7.	Construction Cost	$ Total	
8.	(includes / excludes) foundation & excavation costs	$/SqFt	
9.		$/CuFt	
10.	Structure Cost	$ Total	
11.	(includes / excludes) foundation & excavation costs	$/SqFt	
12.		$/CuFt	
13.	Construction Date		1967
14.	Current Cost Index		
15.	Project Cost Index		
16.	Revised Sales Price (with land)	$ Total	
17.		$/SqFt	
18.		$/CuFt	
19.	Revised Construction Cost	$ Total	
20.		$/SqFt	
21.		$/CuFt	

Profile # 1 Mobile Home

22.	Revised Structure Cost	$ Total	
23.		$/SqFt	
24.		$/CuFt	

PHYSICAL CHARACTERISTICS OF DWELLING UNITS

25.	Generic Type	Box
26.	Housing type	Mobile Home
27.	Structural Material	Wood
28.	Structural Type	Frame

29.	Story Height	1

30.	Net Floor Area	660
31.	Ceiling Height (MHMA Minimum Height)	7' (assume)
32.	Total Volume of Dwelling Unit (CuFt)	4,620
33.	Number of Bedrooms	2
34.	Number of Bathrooms	1
35.	Carport?	No
36.	Garage?	No

37.	Wall Thickness	-
38.	Panel Sizes	-

39.	Total Weight of Dwelling Unit (Tons)	6 - 10 tons
40.	~~Tons/CuFt~~ Pounds/cu. ft.	2.60 - 4.32

LABOR CHARACTERISITCS

41.	Unskilled Workers	Percentage	-
42.		Average Wage Rate	-
43.		Union?	-
44.	Skilled Workers	Percentage	-
45.		Average Wage Rate	-
46.		Union?	-

Profile #____

VOLUME OF BUSINESS

47.	Dwelling Units/Year	

FACTORY

48.	Factory Size	
49.	Production Rate	
50.	Plant Design Capacity	

POSSIBLE HOUSING TYPES

51.	Housing Type # 1	
52.	Housing Type # 2	
53.	Housing Type # 3	
54.	Housing Type # 4	
55.	Housing Type # 5	

BUILDING CODES CONFORMING TO

56.	Building Code # 1	
57.	Building Code # 2	
58.	Building Code # 3	
59.	Building Code # 4	
60.	Building Code # 5	
61.	Building Code # 6	

Profile #____ INDUSTRIALIZED

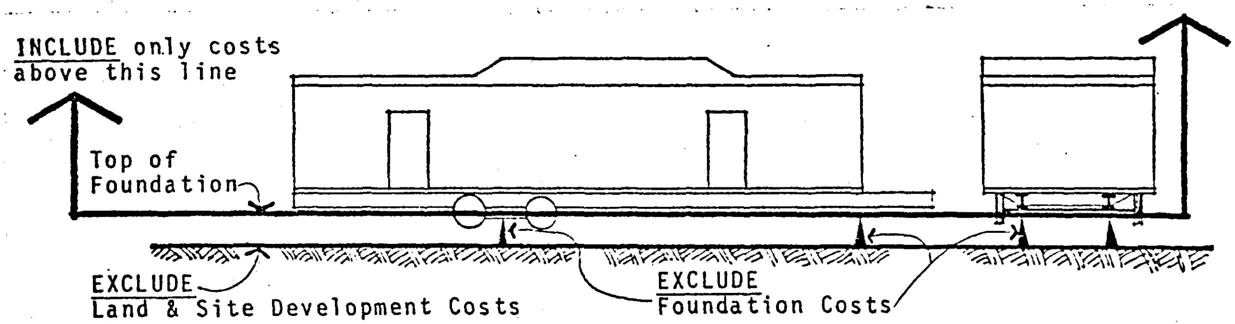
IV. MOBILE HOME PARK DEVELOPMENT COST (includes land)

1.	Development Cost	Land Acquisition		98.3	14.4	375
2.		Site Prep. & Finish'g			80.4	2,090
3.		Development Fees			3.5	90
4.		Foundation & Excavation	Material		-	-
5.			Equip.		-	-
6.			Labor			-
7.						
8.	Structure Finishing Cost	Lift & Secure	Material		-	-
9.			Equip.			-
10.			Labor			-
11.		On-Site Finishing	Material		-	-
12.			Equip.			-
13.			Labor			-
14.	Selling Expenses				-	-
15.	General & Administrative Expenses				-	-
16.	Financing Expenses[1]			1.7	1.7	45
17.	Overhead & Profit	Overhead			-	-
18.		Profit				-
				100 %	100 %	2,600

[1] (includes / excludes) Mortgage Points

Profile #____

IV. CONSTRUCTION COST "B" (exclude foundation & excavation) — MOBILE HOME



F.O.B. FACTORY PRICE

			General %	Detailed %	$
1.	Structure Cost "B"	Materials	79.5	68.0	~~3,180~~
2.		Equipment			
3.		Labor		11.5	540
4.	Delivery Expenses (miles)		-	-	-
5.	Selling Expenses		3.9	3.9	180
6.	General & Administrative Expenses		5.1	5.1	240
7.	Overhead & Profit	Overhead	11.5	5.1	240
8.		Profit		6.4	300
9.	Other		-	-	-
			100%	100%	4,680

DEALER'S SELLING PRICE

			General %	Detailed %	$
1.	F.O.B. Factory Price		78	78	4,680
2.	Delivery Expenses (miles)		-	-	-
3.	Lift & Secure	Materials	-	-	-
4.		Equipment			-
5.		Labor		-	-
6.	On-Site Finishing	Materials	-	-	-
7.		Equipment			-
8.		Labor		-	-
9.	Selling Expense		-	-	-
10.	General & Administrative Expenses		5	5	300
11.	Financing Expenses [1]		7	7	420
12.	Overhead & Profit	Overhead	10	3	180
13.		Profit		7	420
			100 %	100 %	6,000

[1] (includes / excludes) Mortgage Points

3.5.10 LOW RISE

(BOX CONSTRUCTION)

3.5.11 ELEVATOR APARTMENT

(BOX CONSTRUCTION)

APPENDIX

Panel Of Experts For The Institute Of The Future's Study On Prospects For Residential Housing In 1985

Harold K. Bell, Director of Urban Action and Experimentation Program, Columbia University School of Architecture

Jack A. Bono, Jr., Assistant Chief, Underwriters Laboratories, Inc.

Carlton Coulter III, Building Research Division, National Bureau of Standards

Frank P. Davidson, Special Consultant, Institute for the Future

John P. Eberhard, Dean, School of Architecture and Environmental Design, State University of New York, Buffalo

Nils Frederiksen, Campus Planner, Wesleyan University

Harvey Geiger, Architect, Battelle Memorial Institute

Herbert Gerjouy, Psychologist, Monterey, California

Frank J. Heger, Associate Engineer, Simpson, Gumpertz and Heger, Inc., Cambridge, Massachusetts

Marvin Hoffenberg, Professor of Political Science, University of California, Los Angeles

Ralph Johnson, Staff Vice President, National Association of Home Builders

James Lash, President, Hill Development Corporation

Frank LaQue, President, U.S.A. Standards Institute

Orvil Lee, Chief of Technical Services Section, Federal Housing Administration

Charles Mahaffey, Building Research Division, National Bureau of Standards

Rudy Matthes, Corporate Economist, Owens Corning Fiberglas

Glendon R. Mayo, Consulting Engineer, Glendon R. Mayo Associates

John McHale, Director, Center for Integrative Studies, State University of New York, Binghamton, New York

Donald A. Salvetti, Jr., Director of Marketing Research, Levitt and Sons

Harry Schwartz, Vice President and Economist, Federal National Mortgage Association

Noel Seney, Building Editor, Better Homes & Gardens

Sidney Sonenblum, Research Economist, University of California, Los Angeles

Michael Sumichrast, Chief Economist, National Association of Home Builders

Richard F. Wierman, President, Lane Wood Industries, Inc.

Source: Enzer, Selwyn, Some Prospects for Residential Housing By 1985, (Middletown, Conn.:Institute of the Future, 1971) Report R-13, pp. iv-v.

FIGURE 2.1

Data

A. Basic graph redrawn from: Sumichrast, Michael & Frankel, Sara A., Profile of the Builder & His Industry (Washington, D.C.: NAHB-NHC, 1970) p.4.

B. Information to update graph: [nonfarm]

1970 GNP* = $974.1 billion[1]

Total Private Construction = $63.1 billion[2] = 6.5% GNP**

Total Public Construction = $28.2 billion[2] = 2.9% GNP**

* Measured in current dollars

** Calculated by the author

Sources

1. U.S. Council of Economic Advisers, Economic Report of the President (Washington, D.C.: U.S. Government Printing Office, 1972) p.195, Table B-1.

2. Bureau of Domestic Commerce, U.S. Department of Commerce, Construction Review, October-November 1971 (Washington, D.C.: U.S. Government Printing Office, 1972) p.13.

FIGURE 2.2

Tabulated Data (Millions /Millions of dollars measured in/)
/constant 1958 dollars - nonfarm/

YEAR	GNP[1]	TOTAL NEW CONSTRUCTION	HOUSING STARTS TOTAL(PUBLIC & PRIVATE)	HOUSING STARTS PRIVATE	HOUSING STARTS PUBLIC
1959	475,900	54,222 [2]	19,692 *	18,751 [2]	941 [2]
1960	487,700	52,171	16,433	15,747	686
1961	497,200	53,087	16,277	15,474	803
1962	529,800	55,761	18,390	17,508	882
1963	551,000	57,681 [3]	18,879	18,465 [3]	414 [3]
1964	581,100	59,153	18,872	18,453	419
1965	617,800	62,140	18,394	17,992	402
1966	658,100	62,941 [4]	15,972	15,412 [4]	560 [4]
1967	675,200	61,144	15,204	14,623	581
1968	706,600	64,432	17,980	17,399	581
1969	724,700	64,169	18,079	17,311	768
1970	720,000	60,170 [5]	16,121	15,345	776
1971[p]	739,500				

p Projected

* Calculated by the author from private & public housing starts.

Sources

1. U.S. Council of Economic Advisers, Economic Report of the President (Washington, D.C.: U.S. Government Printing Office, 1972) p.196, Table B-2.

2. Business and Defense Services Administration, U.S. Department of Commerce, Construction Review, October-November 1964 (Washington, D.C.: U.S. Government Printing Office, 1964) p.9, 11.

3. Business and Defense Services Administration, U.S. Department of Commerce, Construction Review, September 1966 (Washington, D.C.: U.S. Government Printing Office, 1966) p. 12, 14.

4. Bureau of Domestic Commerce,—U.S. Department of Commerce, Construction Review, October-November 1971 (Washington, D.C.: U.S. Government Printing Office, 1971) p. 15, 17.

FIGURE 2.3

Data

A. Basic graph redrawn from: Sumichrast, Michael & Frankel, Sara A., Profile of the Builder & His Industry (Washington, D.C. : NAHB-NHC, 1970) p.4.

B. Information to update graph: [nonfarm]

1970 GNP* = $974.1 billion[1]

New Residential Construction (Private & Public) = $29.3 (Private)[2] + $1.1 (Public)[2] = $30.4 billion = 3.1% GNP**

1971 GNP* = $1046.8 billion[1]

New Residential Construction (Private only, Public not available) = $42.05 billion[3] = 4.0% GNP

* Measured in current dollars

** Calculated by the author

Sources

1. U.S. Council of Economic Advisers, Economic Report of the President (Washington, D.C. : U.S. Government Printing Office, 1972) p.195, Table B-1.

2. Bureau of Domestic Commerce, U.S. Department of Commerce, Construction Review, October-November 1971 (Washington, D.C.: U.S. Government Printing Office, 1971) p.13,14.

3. Bureau of Domestic Commerce, U.S. Department of Commerce, Construction Review, February 1972 (Washington, D.C. : U.S. Government Printing Office, 1972).

FIGURE 2.4 & 2.6

Number of Units: /Accumulated Numbers7

YEAR	TOTAL*	1 FAMILY UNITS	2 FAMILY UNITS	3-4 FAMILY UNITS	5 OR MORE UNITS	MOBILE HOMES
1959	1,554	1,251	1,310	1,554		1,675
1960	1,296	1,009	1,059	1,296		1,400
1961	1,365	989	1,039	1,365		1,455
1962	1,492	996	1,052	1,492		1,610
1963	1,642	1,022	1,083	1,642		1,792
1964	1,561	972	1,034	1,093	1,561	1,752
1965	1,510	965	1,023	1,065	1,509	1,726
1966	1,196	780	821	851	1,197	1,413
1967	1,322	845	893	930	1,322	1,562
1968	1,546	901	955	997	1,547	1,864
1969	1,500	811	859	909	1,499	1,913
1970	1,467	815	863	911	1,467	1,368
1971	2,081	1,150	1,216	1,284	2,081	2,573

* Total does not include Mobile Homes

Percent: /Accumulated Numbers7

YEAR	1 FAMILY UNITS	2 FAMILY UNITS	3-4 FAMILY UNITS	5 OR MORE FAMILY UNITS	MOBILE HOMES
1959	80.5	84.3	100		7.2
1960	77.8	81.7	100		7.4
1961	72.4	76.1	100		6.2
1962	66.7	70.5	100		7.3
1963	62.3	66.0	100		8.4
1964	62.3	66.3	70.0	100	10.9
1965	64.0	67.8	70.6	100	12.5
1966	65.2	68.6	71.1	100	15.3
1967	64.0	67.6	70.4	100	15.3
1968	58.2	61.7	64.4	100	17.0
1969	54.1	57.3	60.6	100	21.6
1970	55.5	58.8	62.1	100	21.5
1971	55.0	58.1	61.5	100	19.1

FIGURE 2.5 /WHAT TYPE OF STRUCTURE?/

New Privately-Owned and Publicly-Owned Housing Units Started, Including Farm Housing, 1959-70, and Projected to 1972 (In thousand units and percent)

Mobile Homes				1 Family		2 Family		3-4 Family		5or more Family	
# Units	%***	Year	Total	# Units	%	# Units	%	# Units	%	# Units	%
121	7.2**	1959	1,554[1]	1,251[1]	80.5 **	59[1]	3.8 **	244[1]			15.7 **
104	7.4	1960	1,296 [2]	1,009 [2]	77.8	50 [2]	3.9	237 [2]			18.3
90	6.2	1961	1,365	989	72.4	50	3.7	326			23.9
118	7.3	1962	1,492	996	66.7	56	3.8	440			29.5
150	8.4	1963	1,642	1,022	62.3	61	3.7	559			34.0
191 [3]	10.9	1964	1,561	972	62.3	62	4.0	59 [2]	3.7 **	468 [2]	30.0
216	12.5	1965	1,510	965	64.0	58	3.8	42	2.8	444	29.4
217	15.3	1966	1,196	780	65.2	41	3.4	30	2.5	346	28.9
240	15.3	1967	1,322	845	64.0	48	3.6	37	2.8	392	29.6
318	17.0	1968	1,546	901	58.2	54	3.5	42	2.7	550	35.6
413	21.6	1969	1,500	811	54.1	48	3.2	50	3.3	590	39.4
401	21.5	1970	1,467	815	55.5	48	3.3	48	3.3	556	37.9
492 [5]	9.1	1971	2,081 [5]	1,150	55.0 [5]	64 [5]	3.1	70 [5]	3.4	797 [5]	38.4
500 *		1972	2,100 *								

* 1971 and 1972 estimated by Bureau of Domestic Commerce

** Calculated by the author

*** Calculated with total including mobile homes by author

Sources for Figure 2.5

1. Business and Defense Services Administration, U.S. Department of Commerce, Construction Review, October-November 1964 (Washington, D.C. : U.S. Government Printing Office, 1964) p.14,17.

2. Bureau of Domestic Commerce, U.S. Department of Commerce, Construction Review, October-November 1971 (Washington, D.C. : U.S. Government Printing Office, 1971) p.20.

3. Bureau of Domestic Commerce, U.S. Department of Commerce, Construction Review, January 1972 (Washington, D.C. : U.S. Government Printing Office, 1972) p.28.

4. Bureau of Domestic Commerce, U.S. Department of Commerce, Construction Review, September 1971 (Washington, D.C. : U.S. Government Printing Office, 1971) p.4.

5. Bureau of Domestic Commerce, U.S. Department of Commerce, Construction Review, February 1972 (Washington, D.C. : U.S. Government Printing Office, 1972) p.20.

FIGURE 2.7 [WHERE?]

<u>Housing Starts By Location, 1959-70</u> [In thousand units & percent]

Year	Inside Metropolitan Area		Outside Metropolitan Area		Total Units
	# Units	%	# Units	%	
1959	1,076.9 [1*]	69.3	476.6 [1]	30.7	1,554
1960	889.0	68.6	407.0	31.4	1,296
1961	947.9	69.4	417.1	30.6	1,365
1962	1,053.5	70.6	438.9	29.4	1,472
1963	1,150.6 [2]	70.1	490.3 [2]	29.9	1,641
1964	1,118.3	70.2	472.4	29.8	1,591
1965	1,068.1 [3]	69.3	474.6 [3]	30.7	1,543
1966	808.4	67.6	387.6	32.4	1,196
1967	920.3	69.7	401.6	30.3	1,322
1968	1,116.1	72.2	429.4	27.8	1,546
1969	1,096.5	73.1	403.1	26.9	1,500
1970	1,034.4	70.3	434.6	29.7	1,469
1971	1,515.1	72.9	565.4	37.6	2,081

* Calculated by the author

<u>Sources</u>

1. Business and Defense Services Administration, U.S. Department of Commerce, Construction Review, October-November 1964 (Washington, D.C. : U.S. Government Printing Office,1964) p.15.

2. Business and Defense Services Administration, U.S. Department of Commerce, Construction Review, September 1966 (Washington, D.C. : U.S. Government Printing Office, 1966) p.17.

3. Bureau of Domestic Commerce, U.S. Department of Commerce, Construction Review, January 1972 (Washington, D.C. : U.S. Government Printing Office, 1972) p.23.

FIGURE 2.8 [WHAT REGION?]

Housing Starts By Regions (In thousands of units)

Year	Totals	North East	North Central	South	West	Accumulated Totals North East	Accumulated Totals North Central	Accumulated Totals South	Accumulated Totals West
1959	1,554	279.9 [1]	374.8 [1]	521.3 [1]	377.2 [1]	279.9	654.7	1,176.0	1,554
1960	1,296	236.5 [2]	303.7 [2]	441.3 [2]	314.5 [2]	236.5	546.2	981.5	1,296
1961	1,365	265.1	289.0	487.6	323.3	265.1	554.1	1,041.7	1,365
1962	1,492	273.7	295.0	541.2	382.5	273.7	568.7	1,109.9	1,492
1963	1,641	271.3	333.8	600.0	435.9	271.3	605.1	1,205.1	1,641
1964	1,591	266.8	351.4	602.2	370.3	266.8	618.2	1,220.4	1,591
1965	1,543	289.8 [3]	376.9 [3]	594.6 [3]	281.4 [3]	289.8	666.7	1,261.3	1,543
1966	1,196	215.7	297.2	482.9	200.1	215.7	512.9	995.8	1,196
1967	1,322	223.5	343.9	531.5	223.0	223.5	567.4	1,098.9	1,322
1968	1,546	236.4	377.1	633.7	298.2	236.4	613.5	1,247.2	1,546
1969	1,500	213.0	356.6	602.9	327.2	213.0	569.1	1,172.0	1,500
1970	1,469	224.1	301.4	628.9	314.5	224.1	525.5	1,154.4	1,469
1971	2,081	270.6	437.2	884.7	488.0	270.6	707.8	1,592.5	2,081

FIGURE 2.9 /WHAT REGION?/

Housing Starts By Regions (In Percent)

Year	North East	North Central	South	West	Accumulated Totals North East	North Central	South	West
1959	18.0	24.1	33.6	24.3	18.0	42.1	75.7	100
1960	18.3	23.4	34.0	24.3	18.3	41.7	75.7	100
1961	19.4	21.2	35.7	23.7	19.4	40.6	76.3	100
1962	18.3	19.8	36.2	25.7	18.3	38.1	74.3	100
1963	16.5	20.3	36.6	26.6	16.5	36.8	73.4	100
1964	16.8	22.0	37.8	23.4	16.8	38.8	76.2	100
1965	18.7	24.5	38.6	18.2	18.7	43.2	81.8	100
1966	18.0	24.9	40.3	16.8	18.0	42.9	83.2	100
1967	17.0	26.0	40.1	16.9	17.0	43.0	83.1	100
1968	15.3	24.4	41.0	19.3	15.3	39.7	80.7	100
1969	14.2	23.8	40.2	21.8	14.2	38.0	78.2	100
1970	15.3	20.5	42.8	21.4	15.3	35.8	78.6	100
1971	13.0	21.0	42.5	23.5	13.0	34.0	76.5	100

Sources for Figures 2.8 & 2.9

1. Business and Defense Service Administration, U.S. Department of Commerce, October-November 1964 (Washington, D.C. : U.S. Government Printing Office) p.15.

2. Business and Defense Services Administration, U.S. Department of Commerce, Construction Review, September 1966 (Washington, D.C. : U.S. Government Printing Office) p.23.

3. Bureau of Domestic Commerce, U.S. Department of Commerce, Construction Review, January 1972 (Washington, D.C. : U.S. Government Printing Office) p.23.