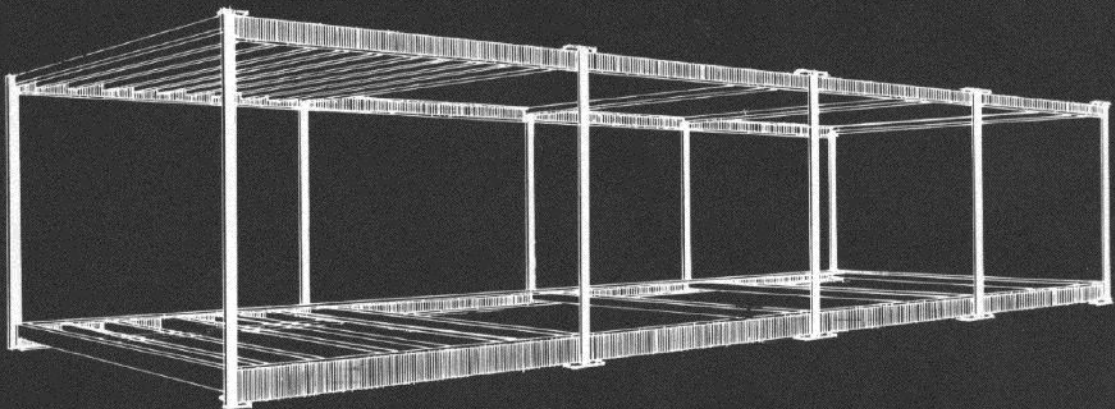


**RESTON
LOW INCOME
HOUSING
DEMONSTRATION
PROGRAM**



REPORT

VA-LIHD-1

RESTON LOW INCOME HOUSING

DEMONSTRATION PROGRAM

APRIL 1969

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This report was written by Norman Rowland, Principal Investigator for Reston, with the special assistance of Margaret Drury, Housing Analyst, from research conducted by Reston and Divco-Wayne Industries, Inc. Editor was Carol Wallers.

The Reston Foundation was represented by Jane G. Wilhelm, Executive Director, and John C. Linsenmeyer, Chairman of the Executive Committee, both of whom provided guidance and assistance. Monitor for HUD was Francis M. Crompton.

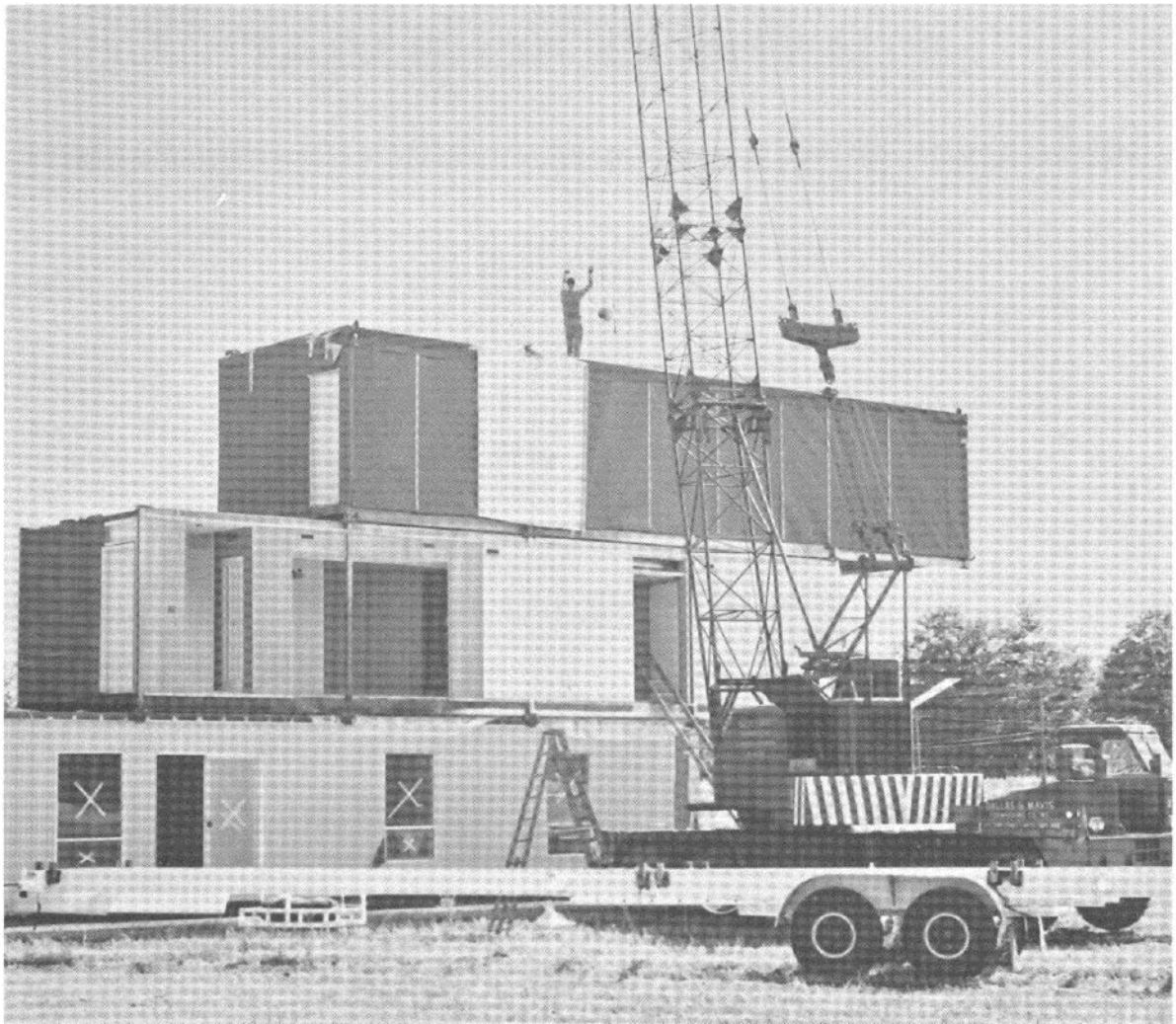
The contents include writing originated by various consultants for which credit is given in the body of the report as applicable. The survey of housing preferences was administered by Carolyn Frazier and analyzed and reported by Kathryn H. Stone of the Washington Center for Metropolitan Studies. Technical assistance was provided by many materials manufacturers with major contributions from United States Gypsum Company and United States Steel Corp.

The program is indebted to Hans J. Schultz, who directed the first phase and continued his interest and assistance, and to Edward L. Keating, Architect and Urban Planner.

Any errors are my own.

Norman Rowland

To the late Bernard T. Craun, Director of Low Income Housing Demonstration Programs for the Department of Housing and Urban Development, in recognition of his dedication to the cause of reducing housing costs for lower income persons.



**A REPORT ON FACTORY PRODUCED
MULTI-FAMILY HOUSING UTILIZING
LIGHT-GAGE STEEL FRAME MODULES**

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ABSTRACT

The Department of Housing and Urban Development funded a research program at Reston, Virginia, with a Low Income Housing Demonstration Grant to investigate new ways to reduce housing costs. The program was conducted by Gulf Reston and Divco-Wayne Industries, a major mobile home manufacturer. All identifiable sociological and technical constraints were observed. A new construction system which is both simple and flexible was developed utilizing a light-gage steel frame module. Construction of three prototype modules provided exact material and labor inputs as well as an understanding of the complexity of mass factory production. The new system can rapidly increase the production of housing at substantial cost savings. This report contains the plan.

SUMMARY

The planners of the New Town of Reston set a goal to house all income levels. As construction began and progressed, it became evident that high quality conventional housing at a sales price below \$22,000 could not be provided. The master planners consulted a mobile home manufacturer about the feasibility of producing fixed site housing at low cost. They then presented Reston with a plan to investigate the concept of factory produced housing modules. The Reston Foundation for Community Programs applied to the Department of Housing and Urban Development for research assistance and was awarded a Low Income Housing Demonstration Grant.

The two major goals of the Reston Low Income Housing Demonstration program were:

- 1) To demonstrate how to integrate low income housing into a New Town;
- 2) To make use of advanced techniques in determining how best to provide housing for New Towns in such a way that minimum costs are involved.

Indications of income ranges and characteristics of future users of housing in Reston were established by a market study of the Washington, D.C. Area. A survey was also taken of current Reston employees to obtain an indication of their housing requirements and preferences. Housing authorities were consulted in order to determine user needs, and the assimilation of the future residents into the community's recreational, cultural and social structures was considered.

The mobile home industry's production processes, costs and product were thoroughly investigated and detailed in order that its advantages of production could best be utilized. The production process of the mobile home was found to be more efficient than conventional construction methods. The indirect and direct labor costs are significantly lower for each unit of output. Use and flow of materials is more strictly controlled in the mobile home plant, and larger scale buying reduces cost.

Design schemes using modular components were developed for one and two story lineal clusters, one story semi-detached clusters, duplexes and three story garden apartments. Code and safety requirements and manufacturers' reviews and suggestions for feasibility of production and marketing were basic to final selection of a scheme. The three story garden apartment scheme used for research and mock-up construction was chosen primarily because of its simplicity. Revisions to the mobile home component were necessary in order to make the modules structurally capable of safely achieving three stories. A light-gage steel frame made up of a system of columns offered interior and exterior flexibility of design by eliminating load bearing walls in the module.

Technical development of the light-gage steel frame module included compliance with building code requirements for fire resistance ratings and egress. The structural system was analyzed and revised where needed. Three mock-up modules were constructed to test the structural integrity and safety of the units when stacked. The modules were stacked three stories and were cantilevered in a variety of ways.

In the final report phase, modifications in materials and techniques were made, and alternate floor plans were developed for room mix. Social requirements for space, number of rooms, design, maintenance, efficiency, safety and privacy were considered in revising the floor plans.

A production process based on mobile home industry methods was simulated with a breakdown of factory organization and plant for producing light-gage steel frame modules. The economies of operation of the plant were outlined in detail, and labor costs and skill level requirements were calculated. The capital investment required to start a plant was determined, and cost projections and comparisons with conventional construction were made.

It was concluded that high value permanent housing can be volume produced using mobile home industry methods. This report identifies the basic elements of mobile home construction technology and prescribes for its application to safe, attractive fixed site housing in medium to high densities.

INTRODUCTION

RESTON, VIRGINIA

The new town concept is proposed as one solution to suburban sprawl and the overcrowding of the central city. Reston is the most advanced and observed new town in the United States. Combining to make it a measure for the success of similar developments are innovative planning and Reston's social goals of providing a place to live and work in beautiful surroundings, both structural and natural, with focus on the importance and dignity of the individual. The basic planning criterion for Reston was founder Robert Simon's philosophy that it should be possible for anyone to live in a single neighborhood throughout his life -- uprooting being neither inevitable nor always desirable. The fullest possible range of housing styles from high rise efficiencies to six bedroom townhouses and detached houses is provided so housing needs can be met at a variety of income levels and at different stages of family life as needs change. The second planning criterion was for usable open space and commercial, cultural and recreational facilities to be made available to the residents from the beginning of development -- not years later. The third consideration in the plan was that research, light industry and government centers be an integral part of the new town and they, together with the commercial centers, would provide economic viability and make Reston a free-standing community. A by-product of this philosophy is heterogeneity, which spells a lively and varied community.

HOUSING COSTS IN RESTON

First estimates for house prices in 1961 were from \$13,500 to \$18,400, expressing the desire for a democratic mix of incomes and housing types. By 1962, estimates were from \$16,000 to \$23,000. As planning became more definitive, prices continued to rise until actual offerings in 1964 were from \$24,000 to \$45,000, with an average of \$34,000. This was due to the high cost of construction and because prices had to include some share of the vast sum necessary to create an exceptional environment that could be expanded to provide all of the characteristics necessary for an economically independent new town. It was also necessary to begin with higher priced housing to establish the new town's style.

There was considerable early and continuing negotiation with the Housing and Home Finance Agency (predecessor of HUD) for involvement with more moderately priced housing; however, HHFA felt Reston would become another upper middle income class development without the ingredients for what HHFA considered its purpose -- the extension of housing availability to lower and middle income families.

But Reston as it exists today has not fulfilled the original planning goals of providing housing for a full variety of income levels. Housing priced below \$22,000 is not available. Lack of housing makes it difficult for lower income families to live or work in Reston. Labor for the basic and service industries already located there is not readily available, and the problem is compounded by continuing success in selling high priced housing and attracting more industries. Most of the people who provide services are unable to find a place to live either in or near Reston. To achieve balance, Reston needs housing for a wider income range. If population and commercial and industrial development projections are realized, 35,000 jobs will be created, and hopefully most of those employed could live in Reston. There is over one and a half billion dollars worth of construction work projected, which would provide the largest source of employment for the lower and moderate income resident.

CONVENTIONAL CONSTRUCTION COSTS

A contractor using conventional methods of construction can develop efficiencies and economies as the number of units increases. A single garden apartment building is a custom job built by craftsmen-mechanics. To build ten of the same buildings, the contractor begins to take advantage of discounts on materials purchased in large quantities and reduces costs by a finer division of labor. To build one hundred buildings, he can set up for maximum efficiency and materials can be purchased at carload discounts. As efficiency increases, the time required to complete individual units will decrease with the result that cost items which are a function of time will go down. However, the homebuilding market, with few exceptions, is dominated by small and medium sized construction firms. The large companies which do achieve lower cost through volume specialize in high priced housing on their own land. This problem relates directly to Reston's lack of lower priced housing.

One possibility for high volume production of low cost housing -- prefabrication -- has a long history of development. Although successful under certain socio-economic and technological conditions, the ability to apply mass produced prefabricated housing to an urban environment remains to be demonstrated. A fundamental reason is the emphasis placed upon a purely technical building solution as opposed to the elusive total environmental solution.

A GRANT FROM HUD

A new town venture offers an unusual opportunity to innovate, and Conklin and Rossant, the master planner of Reston, was asked to study possible ways to provide housing of high quality at low cost. They consulted with Redman Industries, a mobile home manufacturer who was planning to enter the fixed site housing field. Together they presented Reston with a plan to investigate the concept of factory produced housing modules. Reston in turn applied to the Department of Housing and Urban Development for assistance in carrying out the proposed research and was awarded a low income housing demonstration grant.

The two major goals of the Reston Low Income Housing Demonstration project were: 1) To demonstrate how to integrate into a New Town, such as Reston, Virginia, low income housing, and 2) to make use of advanced techniques in determining how best to provide housing for New Towns in such a way that minimum costs are involved. Reston's first goal was a highly significant determinant of the many technological decisions necessary to satisfy the second goal. The first goal poses the many psycho-socio-economic aspects of low income housing, whereas the second aims for an immediate solution compatible with the constraints of current technology. The approach to the second goal was to use existing or modified mobile home technology to build unitized modules in a plant; ship the modules to the desired location, and stack them into a building configuration on site.

The building system presented here was designed under a \$200,000 grant from the Department of Housing and Urban Development to the Reston Virginia Foundation for Community Programs, which contributed an additional \$23,000. Funds amounting to \$45,000 for construction of three mock-up modules were later provided by the government. The system was developed after an extensive study of the methods and economics of the mobile home industry and designed for construction in a

Some of the larger manufacturers, particularly those who have branched into sectionalized housing such as Magnolia and Ritzcraft, indicated they would like to bid on the results of the research. Both manufacturers provided advice and tours through their plants, contributing to the education of the research team. Several discussions were held with DMH Corporation, then planning a new division for diversified housing products. They provided technical assistance and the opportunity for extensive research of manufacturing methods. Magnolia Homes was starting an FHA project for Redella in Vicksburg, Mississippi, and displayed the broadest range of activity yet encountered. Meetings were also held with Divco-Wayne Industries, Inc. They had recently completed a vacation house prototype which, according to the president, Newton Glekel, could not be manufactured in any Divco-Wayne plant. Mr. Glekel was afraid the same thing would be the outcome of this experiment. The vacation home related to traditional housing forms and was considered transitional to fixed-site housing; however, its success was confined to the shows, which added to the reluctance of the manufacturers to try something new.

As may be anticipated in a first attempt at research of this magnitude, it proved impossible to keep the original time schedule. The tasks facing the program were not straightforward, and although problem areas were readily identifiable, further breakdown into operational parameters and assignments became difficult. Changes in administration and unforeseeable events during the research tended to complicate and extend the process of development and added to the number of participants. A list of all participants who were consulted or who contributed to the project is shown in Appendix E.