A PREFABRICATED DWELLING FOR RURAL FARM OCCUPANCY

Submitted in partial fulfillment of the requirements for the degree Master of Architecture at the Massachusetts Institute of Technology

August 1951

by

Bachelor of Architecture — University of Minnesota 1949
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The following study is an attempt to provide the professional architectural and engineering services of the industrial age to 2,270,000 rural farm families of the North Central Region of the United States.

It has been established that 1 out of every 8 families in this area intends to build a new home within the next five years. 280,000 families will design and build these houses with only a minimum knowledge of contemporary materials, methods and technical skills of the architect and engineer. Present day economic conditions in the field of rural farm house design and construction have prohibited both the architect and builder from providing their services to approximately half of the entire population of these twelve states.

Some of the feature points of the author's solution to the problem are as follows: The house may be produced without need of specially designed machinery or trained labor other than that found in the building industry today; delivery is by ordinary cargo trailer truck, river and lake boat or railroad; site erection is by three unskilled workers and will require no more than three days; the farmer-purchaser may finance the house through local cooperative loan associations.

Present day public acceptance and modest production techniques have influenced the aesthetic and structural design of the house, and a conservative and practical approach has resulted in what the author considers to be a simple and evolutionary solution of the problem.
Dear Sir:

I respectfully submit this thesis, "A Prefabricated House for Farm Families", in partial fulfillment of the requirements for the degree of Master of Architecture.

Very sincerely yours,

Kenneth H. Walijarvi
ACKNOWLEDGEMENTS

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M.I.T.
M.I.T.
M.I.T.
M.I.T.
M.I.T.
M.I.T.
M.I.T.
M.I.T.
Univ. of Minn.
Univ. of Minn.
Univ. of Nebr.
Minn. Assn. of Coop.
The "Farmer"
Minnesota State Fair
Acorn Houses
Student - M.I.T.
Student - M.I.T.
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GENERAL CHARACTERISTICS OF THE REGION

PART I
PHYSICAL CHARACTERISTICS

NORTH CENTRAL REGION

The states that comprize the North Central Region do not necessarily include the same states to various groups of people. It is not too difficult to understand that the politician and the agriculturalist would have specific reasons why each would choose a different boundry line to describe the region, but it is not easily understood why the agricultural services of the various states do not seem to agree as to which states make up the North Central Region. However, for purposes of this study in housing it seems logical to follow the selection made by the Agricultural Experiment Station of the Iowa State College in their study of "Farm Family Housing Needs and Preferences in the North Central Region". The twelve states included in this study are North Dakota, South Dakota, Minnesota, Wisconsin, Michigan (these states make up the northern section), Nebraska, Kansas, Iowa, Missouri, Illinois, Indiana and Ohio (the southern section). In all studies of the region these twelve states are consistently included.

The most ambitious agricultural service in this respect is the University of Illinois' Extension Service in Agriculture and Home Economics. They reach far south to include Arkansas and Oklahoma for a total of fourteen states. The University of Minnesota's Agricultural Experiment Station ignores these two states but includes Kentucky for a total of thirteen states. The U. S. Bureau of Census divides the North Central Region into East (Ohio, Indiana, Michigan, Illinois, Wisconsin) and West (Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska and Kansas).
NORTHEASTERN REGION
Climatic Conditions
The varying climatic conditions of the North Central states are probably familiar to most people and more effectively described in a non-technical manner.

Temperature
The variation in temperature is great. Probably the coldest region is along the Canadian and North Dakota - Minnesota border. Here it is not at all uncommon for the mercury to drop to 30 or 40 degrees below zero Fahrenheit and stay at that point for days. Every winter finds the inhabitants of this region contending with such extremities, loss of life, livestock and much of the wild game, and of course, extreme weathering of buildings and equipment. Whereas, during the summer months, the Iowa corn will grow rapidly at an astounding rate at temperatures ranging upwards of 100 degrees Fahrenheit.

Air Movement
At both extremeties in this temperature range the air movement is at a minimum. During the winter this is of course an advantage, but during the summer it works to a disadvantage for humanity and livestock if not the crops. Tornados, on the other hand, run rampant through a great wide belt of the region extending from Kansas, northeasterly up to the Lake Region. These summer storms are violent in a local area where they may occur. Almost all structures in the direct path of the funnel like swirling column of air are destroyed. Barns, houses, automobiles, trees and almost all
things, loose and secured in the ground, are in some cases hurled through the air over considerable distances. Only the most heavy masonry buildings survive the direct fury of a tornado.

High velocity winds over wide areas, such as a hurricane, are not as common nor as destructive as those along the Eastern Seaboard.

In general, it might be said that the prevailing warm summer winds are from a southwesterly direction over the entire area and the severe cold winds of winter are from a northwesterly direction from the Canadian Rocky Mountain region.

Percipitation

Rainfall in the North Central region varies from the extreme dry ranch areas in western Dakotas, Nebraska and Kansas, where little vegetation, with the exception of tough prairie grass, is able to survive to the wooded areas of the Mississippi and Ohio river valleys and the Lake Region. The heart of the famous "dust bowl" of the "30's" was in Oklahoma and Kansas. Many of the old trees of the prairie states dried and have since disappeared. Although some trees do survive in these states, they are generally smaller trees in gorges and others that are planted and cared for by the inhabitants. It is not uncommon in the general area of the lower Missouri valley to have flash floods that recede as quickly as they appear leaving behind basements and ground floors of buildings saturated with a fine mud silt percii-
pitted in the stillled flood waters. The land generally is flat and low precipitation is carried off in the shallow streams or absorbed in the top soil, but a sudden heavy rain soon saturates the top soil and is not absorbed by the clay sub soil. Soon every field discharges a great deal of water into the streams and erosion ditches which rapidly fill the rivers to flood stage since the land is flat and the streams flow slowly. After flood stage is exceeded, a great acreage of country side becomes inundated before most of the inhabitants can prepare for the catastrophe.

Precipitation in the other states, however, is generally more heavy and regular. Flash floods are uncommon since drainage is good and absorption into the sub soil is better. The spring thaws do overload the streams and rivers and spring floods are not uncommon to the peoples in the Missouri, Mississippi and Ohio river valleys.

The heaviest snowfalls occur in the northern parts of North Dakota, Minnesota, Wisconsin and Michigan. Here snow drifts will isolate farms for days, but modern and numerous pieces of snow fighting equipment have roads opened for travel within two or three days of a heavy snowfall.1 However, heavy snowfalls do create a real problem for housing. Structurally, houses must be sound to carry heavy loads of wet snow for long periods under strong winds. Low windows,

1"A Basis for Rural Community Planning with Special Application to a Typical North Dakota Community." Thesis - Master of City Planning by Mathew Platt. Cambridge: Massachusetts Institute of Technology. p.48
sky lights and such must be used with discretion. Entry ways and porches cannot be handled without practical thinking. It is not uncommon for snows to drift high against buildings so that one must shovel a deep trench before access to and from buildings is normal. The snow drifts may not necessarily disappear quickly, but rather will stay on and accumulate during long periods of freezing weather when the only visible disappearance is by wind evaporation.

The other states of the region are frequently without lasting snow during the entire winter or experience very little which rapidly disappears. However, here too, a ravaging snow storm will for a short time, simulate conditions of the Northern States.

Sleet storms are common as well in these states. Immediate destruction is more limited to electrical utility lines, trees, livestock and highway traffic than it is to buildings. It is easy to understand, however, that time will tell what depreciation costs are for buildings that are coated with ice during the winter, bathed in warm dry sunshine during the summer and drenched by heavy rainfalls in the spring.

Topography

Prairies

The Prairie country of the North Central States predominate much of Kansas, Nebraska, North Dakota and South Dakota. The western edges of Minnesota and Iowa are flat and otherwise similar in character to the prairies except
that the soil is much more fertile. As mentioned earlier, the prairie lands support very little vegetation. Coarse grasses are about all that the thin top soil and sparse rainfall can support furthest west. However, toward the eastern ends of these states, one finds vast wheat farms in Kansas and the Dakotas with both wheat and a great deal of corn in Nebraska. Here the value of the farms are not estimated by the buildings but rather by the expansive tracts of land that represent a greater proportion of the real estate value of the farm. The same is true of the cattle and sheep ranches in the western parts of these states.

**Fertile Black Earth Lands**

Iowa, Illinois, Indiana, Ohio and parts of Minnesota, Wisconsin and Missouri are representative of this type of land. The farms market a great variety of goods such as dairy products, poultry and eggs, beef, small grains and vegetables. Different areas tend to specialize with greater production of one product because of favorable soil conditions or market value, but generally one finds the farms in these areas with a great many service buildings and much equipment. The investment in land equals the investment in buildings. Investments in machinery being about half of this and in livestock approximately one-third of this. These are the general farms of the U.S. and are located in what is commonly referred to as the "bread basket of the U.S." These too are the type of farms most people have in mind when referring to farming.
The following table illustrates the capital investment needed for a typical 120 acre northern general type of farm.

TABLE I

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land - 120 acres @ $55</td>
<td>$6,600</td>
</tr>
<tr>
<td>Buildings</td>
<td></td>
</tr>
<tr>
<td>House</td>
<td>$2,500</td>
</tr>
<tr>
<td>Dairy Barn</td>
<td>2,500</td>
</tr>
<tr>
<td>Corn Crib and Granary</td>
<td>400</td>
</tr>
<tr>
<td>Hog House</td>
<td>200</td>
</tr>
<tr>
<td>Poultry House</td>
<td>300</td>
</tr>
<tr>
<td>Machine Shed and Garage</td>
<td>400</td>
</tr>
<tr>
<td>Milk House</td>
<td>100</td>
</tr>
<tr>
<td>Fences</td>
<td>200</td>
</tr>
<tr>
<td>Total Buildings</td>
<td>6,600</td>
</tr>
<tr>
<td>Machinery and Equipment</td>
<td>3,157</td>
</tr>
<tr>
<td>Livestock</td>
<td>1,935</td>
</tr>
<tr>
<td>Feeds and Crops</td>
<td>998</td>
</tr>
<tr>
<td>Cash for Operating</td>
<td>500</td>
</tr>
<tr>
<td>TOTAL INVESTMENT</td>
<td>$19,790</td>
</tr>
</tbody>
</table>

Rolling Hill Lands

The low rolling hills and valleys of Wisconsin form the setting of Frank Lloyd Wright's Taliesin East. This type of land extends through much of Minnesota, Wisconsin, Michigan and Missouri with somewhat more subtle but comparable terrain in scattered parts of Iowa, Illinois, Indiana and Ohio. Here the valleys are fertile and a great deal of general farming is done but with less cultivated land and more grazing land for dairy cattle and hay crops. One finds

1University of Minnesota, "Capital Needed to Farm in the Midwest." Agricultural Experiment Station - North Central Regional Publication No. 5, Bulletin 389, Minneapolis: University of Minnesota, August 1947. p.17
in travel through such country that many of the crests of the knolls are rapidly being deprived of their fertile top soil and the light tan of sandy clay is beginning to show through. Much of this kind of terrain was created during the different glacial ages when the ice advanced and retreated several times. After each advance, the earth's crust was worn more smooth until the final melting of the glacial ice left its deposit of glacial drift in long meandering moraines and isolated hills of rock, gravel and sand. The melting ice filled many of the pockets in the earth and created the thousands of lakes that are scattered throughout Minnesota, Wisconsin and Michigan.

A great deal of vegetation exists in hardwood forests, underbrush, wild berries, flowers and grasses. Wild life is abundant.

Rocky - Forest Lands

The northern parts of Minnesota, Wisconsin and the peninsula of Michigan are alike in their topography. Here one finds the rocky ridges of the rich copper and iron ore country, with the great open pit mines of the iron ranges of Minnesota. One does not find the large well equipped and maintained farm that is a familiar sight in the southern parts of these states. The rural farm people do many things such as cut and sell a great deal of pulp wood to the paper mills in the Duluth-Superior area and saw logs for the many small local sawmills. It is not at all uncommon that these northern peoples should use local materials for their struc-
AWAITING THE SPRING THAW, LITTLE FORK RIVER

WHITE PINE LOGS ON LITTLE ROCK RIVER
tures. They have been accustomed to building with these materials, and they shall probably continue to do so. Highly organized lumber manufacturers recognise this competition from local sawmills.¹

Farm production is generally limited because of the shorter growing season and the difficulty of clearing forest and rocky land. Dairy cattle are kept and some small grains are raised. A great deal of hay is marketed. Trees and wild life flourish almost unmolested by humanity in the many and vast parts of this northern region.

MINNESOTA²

Area

"The state of Minnesota lies in the center of the North American Continent and includes the most northerly projection of the United States. In spite of the fact that most of its boundaries follow water courses, Minnesota's shape is fairly rectangular. It is 406 miles long from north to south, and although 357 miles from east to west along the northern border, its average width is only 240 miles. Within its area of 84,682 square miles originate three great river systems; the Red River, which flows north to the Hudson Bay; the Minnesota and St. Croix, which join the Mississippi and flow to the Gulf of Mexico; the St. Louis and other North Shore

streams that find their way to the Gulf of St. Lawrence through the Great Lakes.

**Topography**

"Although water flows away from the state in all directions, the altitude is relatively low, reaching an extreme slightly above 2000 feet only in the occasional hills of the rocky ridges north of Lake Superior. The Red River leaves the state at an elevation of 750 feet, the Mississippi has a fall of 620 feet to the Gulf and Lake Superior lies only 602 feet above sea level.

"The surface of the State presents a great variety of topographic features. To the upper west are the flat prairies, merging into the rolling hills and valleys of the forest and lake region which attain, in the upper northeast, the semblance of mountain ridges; in the southeast the closed valleys and lakes are replaced by the unglaciated hills and deep cuts made by swift flowing streams.

"The types of hills are many and varied. There are hills formed by running water, others have been left by glacial deposits; some were made by an irresistible shove of the glacial ice; others whose outlines are constantly changing, have been piled up by the persistent sand moving powers of the wind; while earth movements or volcanic expulsions have forced up the rougher elevations.

"The floral covering these hills varies from southwest to northeast. Most of the western area, with the exception of the narrow, wooded margin along the Red River, is a tree-
less prairie, sometimes flat, often rolling, with acres of grain displacing the original prairie grass. This broad sweep is separated from the great coniferous forest of the upper east by a wide belt of deciduous hardwoods.

Climate

"The areas of greater rainfall conform roughly with these forested areas. Along the eastern boundary the rainfall reaches an average of 32 inches; in the northwest it may not exceed 20 inches.

"Minnesota's temperature is likewise varied. Lacking the tempering effect of ocean bodies it is subject to great fluctuations. The State lies in the path of the low-pressure areas that move across the continent from west to east at an average speed of 600 miles in 24 hours. The average frequency of these cyclonic air movements is twice a week. They are characterized by fair weather and warm temperatures followed by periods of rainy and cooler weather. The average annual temperature is about 41 degrees. The winters are severe and reach extremes far below zero. The summers are characterized by rapid changes and occasional intense heat waves.

"Temperatures in many counties range from 40 degrees below zero to 100 degrees Fahrenheit. Frost, although rare from the last half of May to the first half of September, has been recorded for every month of the year. The longest growing season, 160 days, occurs in the region between the Twin Cities and Winona; in the north it is considerably shorter, in some places less than 90 days. Near Lake Superior, the temperature
is influenced in all seasons by the lake, but is consistently cooler than in the Twin Cities area. The prevailing winds are northwest for most of the State.

"The average relative humidity at 7 a.m. is 83 percent; at 7 p.m. it is 72 percent. The largest number of rainy days (132) in one year was recorded at Duluth; Lyon County has had as few as 64. The sunshine averages between 43 and 53 percent. The long hours of summer daylight in the northern counties help to compensate for the short growing season."
INHABITANTS

NORTH CENTRAL REGION

Population

The North Central Region contains a total population of 44,229,763 people. The breakdown into urban and rural population is shown in table II.

TABLE II\(^1\)

Population of the U.S. and North Central Region

<table>
<thead>
<tr>
<th>Area</th>
<th>Total</th>
<th>Urban</th>
<th>Rural</th>
<th>% Urban</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S.A.</td>
<td>149,855,592</td>
<td>95,891,539</td>
<td>53,964,053</td>
<td>64.0</td>
</tr>
<tr>
<td>North Central Region</td>
<td>44,229,763</td>
<td>28,352,507</td>
<td>15,877,256</td>
<td>64.1</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>3,421,316</td>
<td>1,978,087</td>
<td>1,443,229</td>
<td>57.8</td>
</tr>
<tr>
<td>Ohio</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indiana</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illinois</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Michigan</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minnesota</td>
<td>2,968,135</td>
<td>1,613,037</td>
<td>1,355,098</td>
<td>54.3</td>
</tr>
<tr>
<td>Iowa</td>
<td>2,612,598</td>
<td>1,246,040</td>
<td>1,366,558</td>
<td>47.7</td>
</tr>
<tr>
<td>No. Dakota</td>
<td>617,965</td>
<td>165,636</td>
<td>452,329</td>
<td>26.8</td>
</tr>
<tr>
<td>So. Dakota</td>
<td>650,029</td>
<td>215,572</td>
<td>434,457</td>
<td>33.2</td>
</tr>
<tr>
<td>Missouri</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kansas</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

When one considers that the proportion on a national basis of urban to rural population is 95,891,539 to 53,964,053 or 2/3s and 1/3\(^2\), it is quickly recognized that the North


\(^2\)Ibid. p.1
Central States are well represented by the farmer. A total of 2,270,000 farm families reside in the North Central Region.

**Family Composition**

In a recent survey of the households and families of the North Central region, it can be estimated on the basis of 884 households interviewed that about two thirds of all the open-country households had fewer than five members.

About: 25% had one or two members  
25% had three members  
20% had four members  
15% had five members  
15% had 6 or more members

About 60% of the families included children under 19. In about one-third of these families, all of the children were under nine years of age; in the other two-thirds, some or all of the children were nine years or older.¹

**Farm Legislation**

Such organizations as the Grange, founded in 1867² and officially titled the Patrons of Husbandry, have found widespread popularity among the farmers. "Through these Granges, the farmer could not only air his grievances, but by the endorsement of Granger candidates, he was able to carry his discontent to the legislature."³ In 1918⁴ the Farmer-Labor

¹Iowa State College, "Farm Family Housing Needs and Preferences in the North Central Region". North Central Regional Publication No. 20, Bulletin 378, Ames: Iowa State College, February 1951. p.16
²Works Project Administration. Op cit. p.57
³Ibid. p.5-7
⁴Ibid. p.62
party name was adopted in order that the Grange organization might endorse an independent candidate for Governor. In recent years the Farmer-Labor party is well represented in both state and federal offices and the voice and demands of the farmer in Minnesota and a good many of the north central states is well aired.

MINNESOTA

Population

As stated previously\(^1\) Minnesota has a total population of 2,968,135 people of which 1,613,037 are in urban areas and 1,355,098 are in rural farm areas. Percentagewise, Minnesota's population is 46% rural farm. Another way of bringing home the fact that this region is essentially a rural one is to realize that 2 1/2 times as many upper midwest people live in farm homes as reside in the large metropolitan cities of Minneapolis, St. Paul and Duluth combined.\(^2\)

History

"Although the drama of Minnesota spans three centuries, the actual transition from wilderness to Commonwealth has been crowded into less than a hundred years. Two and a half million people today spend their lives in the State, and few recall the aborigines and pioneer settlements. Yet the grandfathers of these few were of the generation that

\(^1\)Table II p.14

shot buffalo and built stockades, and the fathers were of the time that brought forth homesteads and towns. The shadow of a priest in his martyrdom seems hardly to have melted away before the figures of miners, loggers, artisans and farmers strained across the land. The tumult of construction had scarcely been stilled before the baton rap of a symphony conductor brought an audience to attention in Minneapolis.¹

The first wave of settlers swept over the state with the first land sale in 1848. They were mostly land-hungry and adventure seeking easterners from New York, Pennsylvania and New England.

In 1850 there were 5,354 settlers. The population grew so quickly that eight years later the population trebled. In 1860 the census showed the population to have risen to 780,773 of which 71 percent were Europeans of the first and second generations. All through the 80's the stream of immigrants flowed across the Atlantic. In 1890 the immigration tide reached its height. 1900 still saw the need of immigrants but now the need was for cheap labor rather than to open the land until in 1920 immigration virtually ceased and since that date the trend has been toward a smaller percentage of foreign born - but still there is a vast group only little removed from Old World influences.²

¹Works Project Administration. Op cit. p.42
²Ibid. pp. 49-63
LUMBER CAMP

FISH NETS, TWO HARBORS
Racial Groups

Of the different racial groups represented in Minnesota, the Swedes are probably the most prominent in numbers. During the 80's the combined numbers of Swedes, Norwegians and Danes made up half of the 71 percent of foreign born population in the State. Today, with the proportion of foreign born reduced to 15 percent, almost half of that number continues to be Scandinavian.

The influx of Swedes began in 1846 and with their love of rural life they soon established many farms. The Norwegians were great favorites of the lumbering regions, while the arrival of the Danes, after the Civil War, brought a knowledge of dairying unknown to America.

In 1890 and 1900 the German immigration began with concentrated settlements of neatly laid out farms in the southern parts of Minnesota where they have left a deep imprint on the cultural and professional standards of the area and many cities including St. Paul and New Ulm.

The recent arrival of the Finns no doubt accounts for their clinging tenaciously to Old World traditions. Deeply suspicious of all imposed government, they have bent their energies to building up their own co-operatives, and with the Danes are responsible for Minnesota's outstanding success in this social experiment. They were first drawn to the lumbering and mining industries but later migrated to the many small farms of the northern cut over area.

Poles and Czechs arrived around 1900 and settled prim-
arily in the industrial areas of the Twin Cities. Since the end of the First World War, and the establishment of Poland as a nation, they have made a courageous effort to retain their national heritage.

Other groups include Italians, Irish, Slavs, Mexicans, negroes and a few Asiatics. But with immigration practically at a standstill, and the birth rate apparently becoming stabilized, the varied national colors have largely merged.¹

The Twin Cities

The Twin Cities of Minneapolis and St. Paul have long been the center of activity for the rural people of Minnesota. It is here that farmer ships his cattle to the South St. Paul Stockyards and grain to the Pillsbury and General Mills elevators of Minneapolis. Also the Twin Cities are the home of such varied activities as the Minneapolis Moline farm implement industries, the mammoth Sears and Roebuck² and Montgomery Ward mailorder houses, and the lesser known rural retail stores of Gamble-Skogmo.

Farm publications such as "The Farmer" are printed in St. Paul and distributed to 260,000 Upper Midwest farm houses. The cultural attraction of the State University in Minneapolis, with its fine school of agriculture on the outskirts of St. Paul and the State Capitol and State Fair of St. Paul are educational and political meccas of every farmer. Here too is the headquarters of the world famous cooperatives of Minnesota - the Minnesota Assn. of Cooperatives in St. Paul.

¹Works Project Administration. Op cit. pp. 74-80
²Sears and Roebuck Company began in Redwood Falls, Minn.
ARCHITECTURAL CONSIDERATIONS

PART II
HOUSING CONDITIONS

PAST

Housing in the North Central Region during the years of pioneer settlements were varied and oftentimes wholly unsatisfactory. The early settlers built crude log houses in those areas of forests. Here particularly the early farmers chose to farm, preferring the hard labor of clearing the land of trees, underbrush and stone, to living on the prairies where they thought the land was not as productive and prairie fires were numerous.

After the opening of land offices by the federal government, many eastern speculators crowded into these areas to erect shanties and lean tos on small clearings, selling these as improved farms to immigrants and migrators from the east. Land purchased from the government at $1.25 per acre was often sold for $5.00 per acre after the "improvements" were made.¹

As the lumber companies moved through the forest lands of the Midwest, on their way to new stands of virgin forests of the Pacific Northwest, light wood frame houses soon began to replace the earlier log cabins, shanties and sod huts. The people slowly began to realize their mistake that the prairie lands were not productive. Early settlers in the Dakotas, Kansas, Nebraska and Western Minnesota reaped great profits from cash grain crops. A great many

¹Works Project Administration. Op cit. p.52
built the famous sod houses which are still legendary in these areas. The latter, rammed earth house is built today in some parts of these states.

The coming of the railroad to the prairies and through to the west similarly replaced these structures with the wood frame houses one finds there today. 93.4 percent of the rural dwellings in Minnesota today are of frame lumber construction.¹

Farm construction did not end until after the First World War when high prices for farm products induced many veterans and others to purchase land. (See Figure 1) Shortly after the war, most of the tillable land of the U.S. was occupied and a nation had settled one phase of its expansion program. Much toward this end had been accomplished by such empire builders as James J. Hill, boss of the Northern Pacific and Great Northern Railways. Many individuals as well as the Federal Government encouraged settlement of the west by talks throughout the territory and the east, stimulating propaganda in Europe by use of pamphlets and emissaries proclaiming a land of Marco Polo where fortunes were in the reach of every immigrant boy.

The occupation of most of the tillable soil after World War I and the following decade of boom years came to a bitter end with the fall of land prices and farm produce in the early 30's. The devastating drought augmented greater hard-

¹ Davies, Vernon, "Farm Housing Needs". Agricultural Experiment Station Bulletin 393, Minneapolis: University of Minnesota, August 1947. p.4
GROSS FARM INCOME
ships on the farmer until 1937.¹ New construction and maintenance of existing structures had virtually stopped.

With increasing prices and more favorable crops, the farmer began to slowly recover. However, he was not prone to rebuild or to maintain his structures. The high production and labor saving devices of a mechanized farm had induced him to change his methods from a horse powered farm to one of machine power. Forty years ago, horsepower was used to 100 percent in farm production, now there are less than 10 percent who could use horsepower for farm production if the need arose. It is a simple fact that the existing farm buildings were designed for the horse and not for the tractor.²

The later war years and the recent period of farm prosperity have done much to improve the financial status of the farmer. It has enabled many of the farmers to pay off their mortgages and others to change their status from tenant to owner. The 1940 census showed approximately 62% owner occupied and 34% tenant occupied. The 1950 census shows 79% owner occupied and 21% tenant occupied.³ He has also acquired a great many labor saving devices which he was unable to

¹Works Project Administration. Op cit. p.63
²"A Proposed Farm Plan for North-Eastern Nebraska". Thesis - Bachelor of Art of Architecture by Keith H. Christensen, Lincoln: University of Nebraska, Department of Architecture, May, 1950
³Davies, Vernon. Op cit. p.5
obtain during the war emergency. As never before, he is being a shrewd business man. He has learned the hard lesson of over expansion and depression of the preceding years, so that he now prefers to pay off old debts and purchase equipment before over-expanding and building at high prices.

In addition, prohibitive building restrictions during the last war and the construction costs of post war years have not improved the condition of his structures, many of which are of flimsy hurried construction of the early World War I boom days.

Substantiating facts for the redesign of the rural physical plant are these: "The average farm was using five times as much machinery and power equipment of all kinds in 1945 as in 1870. Farms are now turning out twice as much per worker as in 1910. Farm output in 1945 was nearly four and one-half times the volume in 1870. Meat production went up 70 percent from 1910 to 1949, and milk volume doubled."¹

¹"A Proposed Farm Plan for North-Eastern Nebraska". Op cit.
<table>
<thead>
<tr>
<th>Service</th>
<th>Farm (Per Cent)</th>
<th>City (Per Cent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Running Water</td>
<td>12.2</td>
<td>91.7</td>
</tr>
<tr>
<td>Flush Toilet</td>
<td>7.9</td>
<td>92.2</td>
</tr>
<tr>
<td>Central Heating</td>
<td>19.4</td>
<td>74.9</td>
</tr>
<tr>
<td>Electricity</td>
<td>29.9</td>
<td>98.8</td>
</tr>
<tr>
<td>Radio</td>
<td>85.3</td>
<td>95.8</td>
</tr>
<tr>
<td>Mechanical Refrigeration</td>
<td>9.6</td>
<td>51.8</td>
</tr>
<tr>
<td>Needing Major Repairs</td>
<td>26.6</td>
<td>10.0</td>
</tr>
<tr>
<td>1.5 or More Persons Per Room</td>
<td>8.9</td>
<td>4.9</td>
</tr>
</tbody>
</table>

Each symbol = 10 per cent
and dramatized by novelists. Yet there is a great deal of truth here too. Many of the city cousins of the farmer are shaken by the thoughts of spending a winter night on the farm where there is no central heating systems, one bathes in a washtub on the kitchen floor, if he bathes at all, and uses an outdoor privy in the dead of night. These conditions would make the most hardy of the city dwellers shrink from such thoughts.

From a recent report on farm construction needs, it could be stated that approximately 30 percent of the farm houses could be rated acceptable, 30 percent repairable and 40 percent non-repairable as of 1940.¹

Other statistics show that of the total number of farms in the U. S., 6,485,000, about 47 percent had running water, 27 percent had toilets and 30 percent had bath tubs.²

One could speculate further as to how many of the farms that do have running water and plumbing facilities have them of a standard that might be termed efficient and acceptable; or of those who had electricity, how many merely have a socket and bulb suspended from the center of the ceiling in a few rooms; or the condition and character of the central heating system.

As stated previously, "Less than a century ago the landscape of Minnesota was dotted with log cabins and sod huts. These were replaced by wooden frame structures when lumber became available. The use of lumber as the principle construction material has persisted in large part to the present time, as 93.5 percent of Minnesota farm houses in 1940 were of traditional frame construction with wood exteriors.

"If we regard as pioneer farm houses all houses built before 1890, then there were 29,011 such structures remaining, and in large part occupied, in 1940. Nearly 41 percent of the 1940 Minnesota farm homes were erected between 1900 and 1920,¹ as shown in Table III. Agricultural prices had a generally favorable relation to industrial prices during this time, particularly during the period of World War I.

From 1920 to 1930 there was a slump in farm home construction that was undoubtedly related to the unfavorable relation of farm prices to other prices during most of the decade. About 13,000 less houses were constructed during the 1920's as compared with the preceding 10 year period. This slump continued on through much of the 1930 decade. There was considerable increase in construction activity of farms from 1939 to 1943 which was followed by another recession resulting from World War II.²

¹ The large volume of farm construction coincides with the vast influx of immigrants during the early 1900's and 90's as well as the last land rush to purchase remaining Government land.
² Davies, Vernon Op cit. p.4
CONSTRUCTION OF DWELLING UNITS IN MINNESOTA
TABLE III
Age of Minnesota Farm Homes - 1940

<table>
<thead>
<tr>
<th>Year Built</th>
<th>Age in 1940</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1935-1939</td>
<td>5 years or less</td>
<td>16,059</td>
<td>7.3</td>
</tr>
<tr>
<td>1930-1934</td>
<td>6 to 10 years</td>
<td>12,406</td>
<td>5.7</td>
</tr>
<tr>
<td>1925-1929</td>
<td>11 to 15 years</td>
<td>12,815</td>
<td>5.9</td>
</tr>
<tr>
<td>1920-1924</td>
<td>16 to 20 years</td>
<td>18,089</td>
<td>8.3</td>
</tr>
<tr>
<td>1910-1919</td>
<td>21 to 30 years</td>
<td>44,076</td>
<td>20.2</td>
</tr>
<tr>
<td>1900-1909</td>
<td>31 to 40 years</td>
<td>44,111</td>
<td>20.2</td>
</tr>
<tr>
<td>1890-1899</td>
<td>41 to 50 years</td>
<td>35,571</td>
<td>16.3</td>
</tr>
<tr>
<td>1880-1889</td>
<td>51 to 60 years</td>
<td>19,284</td>
<td>8.8</td>
</tr>
<tr>
<td>1860-1879</td>
<td>61 to 80 years</td>
<td>8,851</td>
<td>4.0</td>
</tr>
<tr>
<td>1859 or before</td>
<td>80 or over</td>
<td>876</td>
<td>0.4</td>
</tr>
<tr>
<td>Not reporting year built</td>
<td>6,442</td>
<td>2.9</td>
<td></td>
</tr>
</tbody>
</table>

TOTAL | 218,580 | 100.0

PROSPECTIVE FARM CONSTRUCTION

When the U.S. Senate appointed a special committee to study Problems of American Small Business, they made a separate study of farm construction for reasons that farm construction represents approximately 5 percent of all construction and is made up of small jobs for individual farms, not subject to urban building codes and zoning controls or to rules of organized labor.¹

They found that: "The prospects for farm construction in the postwar years are the best since World War I. This is explained by a combination of such factors as an accumulation of deferred maintenance, a healthy agricultural balance sheet, a high level of income and a growing appreciation for higher standards of farm buildings. It is estimated that expenditures for maintenance of the farm plant (new construc-

¹Hallauer, Frank J. Op cit. p.1
tion and repairs), should average close to a billion dollars annually for the next 5 years. This compares with previous periods as follows:

Estimated Average Annual Expenditures for Farm Construction

<table>
<thead>
<tr>
<th>Period</th>
<th>Current Prices</th>
<th>1939 Prices</th>
</tr>
</thead>
<tbody>
<tr>
<td>1920 - 29</td>
<td>$600,000,000</td>
<td>$485,000,000</td>
</tr>
<tr>
<td>1930 - 39</td>
<td>350,000,000</td>
<td>350,000,000</td>
</tr>
<tr>
<td>1940 - 45</td>
<td>585,000,000</td>
<td>455,000,000</td>
</tr>
<tr>
<td>1946 - 50</td>
<td>940,000,000</td>
<td>690,000,000</td>
</tr>
</tbody>
</table>

"For the entire period of 26 years, 1920 to 1945 inclusive, expenditures total something like one and one-half billion dollars less than depreciation."

Accumulated cash farm reserves are high - $16,000,000,000 in bank deposits, U.S. savings bonds and warehouse receipts.

The gross income of the farmer has risen from 11 billion dollars in 1940 to 24 billion for 1945 while production expenditures have not risen as fast nor have cash outlays offset incomes, because of the scarcity of goods.

The farm mortgage debt is favorable. In 1945 it was $5,271,000,000 compared with $6,586,000,000 five years earlier, and $7,137,000,000 at the end of World War I. Mortgage debt has been decreased $1,315,000,000 during this war in contrast to an increase of $2,100,000,000 during the first World War, while interest rates have decreased as well from 6.1 percent in 1919 to 6 percent in 1930 compared with 4.6 percent in 1940 and 4.8 percent in 1945.¹

¹Hallauer, Frank J. Op cit. p.2
On the basis of the 1940 census data, it is estimated that 40 percent of all farm dwellings, or 2,800,000 are so poor as not to justify their repair. Perhaps 500,000 will be eliminated by abandonment. Most, but not all, or the 2,300,000 remainder are occupied by families in the lower income class. Normally anticipated replacement over a ten year period would be about 1,600,000 farm dwellings. This would have to be increased to 2,300,000 if all dwellings below desirable standards were to be replaced over a ten year period.

Added annual replacements might be distributed something as follows:\(^1\)

<table>
<thead>
<tr>
<th>Dwellings per Year</th>
<th>Average Value</th>
<th>Total Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>55,000</td>
<td>$1,400</td>
<td>$77,000,000</td>
</tr>
<tr>
<td>15,000</td>
<td>2,500</td>
<td>32,500,000</td>
</tr>
<tr>
<td>70,000</td>
<td>1,564</td>
<td>109,500,000</td>
</tr>
</tbody>
</table>

PROSPECTIVE FARM CONSTRUCTION - NORTH CENTRAL REGION

A sample survey of nearly 900 households, made in the spring of 1948, provides a basis for making a reliable estimate of the housing needs and preferences of the 2,270,000 households in the open country portion of the North Central region. One out of every eight families interviewed said they planned to build houses for themselves in the next five years or 12.5% of the total 2,270,000 families. 280,000 families are planning to build an average of 56,000 houses a year for five years.

\(^1\)Hallauer, Frank J. Op cit. p.7
"Minnesota, in common with other sections of the nation, is facing a serious housing problem. Particular attention has been focused on the situation in the larger cities and town of the state where families have had to adjust themselves to overcrowding, makeshift quarters and evictions. What is not so well known is that thousands of farm families are living in substandard dwellings and are doing without conveniences that have long been regarded as necessities by the average city dweller. Many of these dwellings were constructed hurriedly during the expansion of the west and without the aid of sound construction techniques or knowledge."

1 Iowa State College, "Farm Family Housing Needs and Preferences in the North Central Region". North Central Regional Publication No. 20, Bulletin 578, Ames: Iowa State College, February 1951. p.9

2 Davies, Vernon Op cit. p.3
DISCLAIMER

MISSING PAGE(S)

31
PROBLEM

STATEMENT

"Under present methods of merchandising, the farmer does not buy buildings complete and ready for operation as he buys other equipment. He buys partially fabricated materials or builds from materials on his own farm. In either case skillful handling on the part of the purchaser is required. As construction specialists are not usually available, the buildings usually are unsuited for their intended use and are not constructed in a way that will tend to reduce depreciation and repair costs to a minimum. The situation is altogether different from that in the cities where buildings are generally planned by trained architects, built by experienced contractors and checked by building inspectors.

"Proper construction of buildings necessitates a careful study of building methods. The requirements as to space and sanitation, and the conditions of air temperature, relative humidity, and rate of air movement, must be known before buildings can be well designed, and in meeting these requirements materials and labor must be used economically. New materials should be adapted to farm uses. Development of standard practices and simplification of construction methods would aid materially in securing better buildings. Much of the data now available for the design of farm buildings are based on tradition and probably are inaccurate.

1"Research in Farm Structures" Henry Giese, "The Architectural Record", Vol. 75, No. 4, April, 1934. p. 308
"The architectural profession in general has not yet shown interest in developing farm structures. The small scattered units have not proved profitable from a professional standpoint, and the architect has not seen the necessity of specific training in the design of farm buildings. The farmer usually does not employ professional service, because he does not appreciate the importance of scientific design and is not convinced of the value of assistance for which a professional charge is made. On the other hand he may be reluctant to accept recommendations from organizations that give free assistance in planning but that expect eventually to sell enough merchandise to cover their service costs. There is then a real need for constructive effort in research."

DESIGN PROBLEM

The problem of a design for a farm dwelling is unique. One must keep in mind many factors that are seemingly far afield but do have their immediate effect on the actual farm structure.

The farmer is king of his property. He will decide on the design and style (?) of his buildings. In a recent survey¹ it was established that almost three-fourths of all farmers in the study were influenced in their planning by seeing other houses or by talking to neighbors, relatives or friends. The fact that 60 percent secured ideas from exist-

¹ "The Role of Social Research in Housing Design." Social Science Research Council, Committee on Housing, Ann Arbor: University of Michigan, May 24 - 26, 1951. p.6
ing houses illustrates the influence of established patterns of design. See Table IV.

**TABLE IV**

Types of Sources of Ideas Used by Farmers in Farmhouse Plans

<table>
<thead>
<tr>
<th>Types of Sources</th>
<th>% of Farmers Mentioning each type of source*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Specialized Sources</strong></td>
<td></td>
</tr>
<tr>
<td>Consulting with professional persons or agencies</td>
<td>(44.4)</td>
</tr>
<tr>
<td>Builders (contractors, carpenters, etc.)</td>
<td>38.3</td>
</tr>
<tr>
<td>Farm and home extension agencies</td>
<td>3.0</td>
</tr>
<tr>
<td>Professional designers</td>
<td>2.3</td>
</tr>
<tr>
<td>Vocational agricultural teachers and government agencies</td>
<td>2.3</td>
</tr>
<tr>
<td>Reading mass media</td>
<td>(36.1)</td>
</tr>
<tr>
<td>Standard plan booklets</td>
<td>25.6</td>
</tr>
<tr>
<td>Magazines</td>
<td>15.8</td>
</tr>
<tr>
<td>Newspapers and books</td>
<td>3.7</td>
</tr>
<tr>
<td><strong>Informal Sources</strong></td>
<td></td>
</tr>
<tr>
<td>Observing existing houses</td>
<td>(60.2)</td>
</tr>
<tr>
<td>Outside the community</td>
<td>38.7</td>
</tr>
<tr>
<td>Location unspecified</td>
<td>32.3</td>
</tr>
<tr>
<td>Owner's former residence</td>
<td>9.4</td>
</tr>
<tr>
<td>Consulting with non-specialized persons</td>
<td>(29.7)</td>
</tr>
<tr>
<td>Neighbors</td>
<td>23.7</td>
</tr>
<tr>
<td>Relatives and friends</td>
<td>7.5</td>
</tr>
<tr>
<td><strong>Total number of sources mentioned</strong></td>
<td>541</td>
</tr>
<tr>
<td><strong>Total number of farmers mentioning sources</strong></td>
<td>266</td>
</tr>
</tbody>
</table>

*Note that the total exceeds 100% since many farmers gave more than one source.*

1 "The Role of Social Research in Housing Design". Social Science Research Council, Committee on Housing, Ann Arbor: University of Michigan, May 24 - 26, 1951. p. 7
This data indicates that more than a third of the farmers were not directly influenced by any of the persons, agencies or mass media which have a professional interest in the transmission of building plans and ideas. Among professional persons and agencies, the only one of importance is the local builder. Most of these builders are carpenters or other skilled workmen personally known to the farmer.

"Mass media of one or more types were used by only a third of the farmers. The most important source in this group was the booklets of floor plans and retouched photos which are prepared by several firms and distributed largely by building materials dealers."

Who Drafted the Plans

"More than one in five (21.1 percent) farmer-builders used no written plans. Of the remaining 210 plans, 192 were drawn up by one person while 18 were the joint product of two person's efforts. The types of persons or agencies who participated in the drafting of plans is shown in Table V.1

TABLE V

Types of Persons or Agencies Participating in the Drafting of Farmhouse Plans

<table>
<thead>
<tr>
<th>Type of Person or Agency</th>
<th>Percentage of Plans Participated in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of plans drafted - 210</td>
<td>100 %</td>
</tr>
<tr>
<td>Local builder or carpenter</td>
<td>35.7</td>
</tr>
<tr>
<td>Farmer-builder</td>
<td>34.8</td>
</tr>
<tr>
<td>Standard plan</td>
<td>16.7</td>
</tr>
<tr>
<td>Relative (exclusive of builder or carpenter)</td>
<td>11.9</td>
</tr>
<tr>
<td>Architect</td>
<td>4.8</td>
</tr>
<tr>
<td>Others</td>
<td>4.8</td>
</tr>
</tbody>
</table>

1 "The Role of Social Research in Housing Design" Op cit. p.11
The prominent place of the local builder or skilled workman in the planning was again demonstrated by his participation in drafting the farm house plans. Not only was he the source of ideas for a third of those buildings but he was directly responsible for the plans of most of them.

"When the 56 who used no written plans are added to the 58 who drew up their plans without assistance, the sum represents 42.1 percent of all those in the sample; four out of ten farmers felt competent to do their own planning. In spite of the non-community influences mentioned above, it is evident that the farmer still relies largely on his own judgement and on those of persons he knows intimately to assist him."

It is highly questionable if this works to the advantage of the farmer for when one considers the following data taken from the same survey, it becomes obvious that this practice of independence upon the part of the farmer is a costly one. One might question further to find how many farmers were dissatisfied with their new dwelling upon completion and would have made further changes had this been economically feasible.

In any case, "the independence of thought and action of the farmer as a builder is further shown by the large number who made major changes in the plan of construction during the actual building. Of the 210 who used written plans, 40.5 percent altered them after construction was underway. The types of alterations and the percentage of farmers using..."
written plans who made each type is shown in Table VI.¹

TABLE VI

Types of Important Changes in Plans Made After Beginning Construction

<table>
<thead>
<tr>
<th>Types of Changes</th>
<th>Percentage of Farmers Making Each Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of farmers using written plans - 210</td>
<td>100.00 %</td>
</tr>
<tr>
<td>Changes in the arrangement of rooms or in individual room sizes</td>
<td>15.2</td>
</tr>
<tr>
<td>Changes in total floor space</td>
<td>11.0</td>
</tr>
<tr>
<td>Changes in doors and windows</td>
<td>11.0</td>
</tr>
<tr>
<td>Changes in porches</td>
<td>4.8</td>
</tr>
<tr>
<td>Changes in building materials</td>
<td>3.8</td>
</tr>
<tr>
<td>Other changes (in roof, chimney, etc.)</td>
<td>7.1</td>
</tr>
</tbody>
</table>

When one considers that 56 had no plans, 58 drew their own plans and 85 made major changes in written plans after construction got under way, a total of close to 75% of the new farm homes considered in the survey were not the direct result of a preconceived or well thought out scheme. This tends to indicate the dire need of a professional study of house design for rural peoples. Many have been influenced by urban dwellings and have attempted to simulate these ideas in their new dwellings. Wholesale lumber agencies, finance corporations and such have sought long and hard to induce the farmer to build. They have provided much of the literature that has undoubtedly influenced design even more than the surveys indicate. Responsible agencies such as the different agricultural services have conducted many surveys

¹"The Role of Social Research in Housing Design" Op cit. p.11
and uncovered a wealth of material that would benefit farm
dwelling design, but the farmer as indicated is more sus-
ceptible to what merely looks good to him on other farms or
what he imagines his utopian dwelling to be. It is obvious
he has neither the training to interpret his desires in three
dimensional form, nor does he have the ability to coldly
rationalize his primary needs.

The first problem of design then is to interpret the
needs of the farmer as logically and enthusiastically as
possible without consideration of present day trends in
design or materials or the recommended minimum and maximums
of urban standards. As we shall see later, life in a farm
dwelling corresponds only in basic needs to the city dwelling.
The opportunity for unaffected original design is prevalent
here.

CONSTRUCTION - ERECTION PROBLEM

It has been difficult to obtain specific data as to the
number of farm dwellings that are constructed by the farmer
alone, the farmer and a local builder or carpenter, or by a
carpenter alone or a contractor. However, almost all of the
material indicates that the farmer should be credited for the
construction of a great percentage of the rural dwellings.
"Since the great majority of the farmers and their families
participated in the actual construction of the house (only
7.5 percent let a contract for the entire house), the length
of delay might have been reduced somewhat if less expensive,
more easily constructed, more adaptable designs had been
available to the prospective builder." (Data collected by intensive personal interviews from a stratified sample of farm families in North Carolina, using a carefully constructed interview guide. A total of 266 farmers were interviewed." -p. l)¹

Much of the literature pertaining to farm house design and construction is written in the first person. Much of it is fundamental in describing basic design and construction principles.²

The farmer has long had the native ability to build. Indeed, it is of prime importance in his business that he should have some knowledge of construction if only to maintain his structures. To be a successful farmer, he is called upon to be a first rate "Jack-of-all-trades". This was probably more true at the turn of the century than it is today. Nevertheless, much of the same is demanded of the farmer today. In more recent years of relative rural prosperity, dating from 1937, the farmer has slowly begun to industrialize his techniques. As stated earlier, production in many fields has doubled, even trebled. His economic status has so improved that he has not only mechanized his techniques but has slowly begun the practice of purchasing prefabricated service buildings in preference to building these himself in order that he may divert more of his time and energies to profitable farm production.³

¹ "The Role of Social Research in Housing Design" Op cit. p. 4
² Note the pamphlets listed in the bibliography of this paper.
³ When 192 farm families were asked why they delayed building a new home when they had already planned such a venture 16.7% stated that they lacked the time because of farm operations or service in the armed forces. Ibid. p. 5
Prefabricated chicken brooders, silos, corn cribs and such are becoming a commonplace sight on more and more mid-west farms. The Weyerhauser Lumber Company provides their rural retail lumber dealers with plans and specifications for these structures.\(^1\) Sears-Roebuck and Montgomery-Ward have long advertised many such buildings to be purchased via the mail order houses. The prefabricated structural members of the large dairy barns of Minnesota, Wisconsin and other states have rapidly, of late, gained in popularity with the farmer.

In a recent issue of "The Farmer"\(^2\), there appeared no less than seven general and four classified advertisements proclaiming the advantages of prefabricated and precut buildings. Among the more prominent companies advertising were included Butler Manufacturing, Great Lakes Steel Corporation and Rilco Laminated Products. As will be pointed out later, Weyerhauser Lumber of St. Paul ran a trial advertisement heralding the advantages of prefabricated structures for a period of six months in 1941. Precutting and prefabricating of service buildings has initiated courage in some to extend this service to the marketing of houses. One independent northern Minnesota lumber company is currently advertising six different precut houses ranging in cost from $1,850 to $2,750 F.O.B. Wadena, Minnesota.

There can be no doubt that the farmer is slowly relinquishing this time consuming task of construction. He is rapidly mechanizing his next concern in farm production, that of better service buildings. True to popular opinion, as the situation seems to point today, the farmer will soon demand the standards, conveniences and finish of the urban dwelling for his home.

One reason for the farmers preference for Weyerhauser's famous "4 - Square, lumber cut to exact lengths, squared on ends and edges, smoothly surfaced and thoroughly seasoned" is illustrated humorously by a local rural lumber dealers remark: "Farmer's saws are poor. Can nail 4-Square together for hog feeders, for example, almost water-tight."[1]

The second problem may now be stated. That is to bring the most contemporary knowledge of building materials and methods to rural farm people so as to raise the standards of farm life and lower the costs of construction in time and cash outlay.

By way of review, the problem may be stated simply in two broad statements as follows:

A. Provide the professional services of the architect and engineer to rural peoples who, under present day economic structure, cannot obtain in the far scattered areas of the open country the high standards of dwellings common in urban areas.

B. Provide the most contemporary building materials

1"The Farmer". Op cit.
and methods and finishes in the form of a price tagged finished product, ready for occupancy without calling too heavily upon the questionable skills and limited time of the farmer purchaser.
DESIGN RECOMMENDATIONS

INTRODUCTION

One might readily debate the theory of creating a dwelling of one design type for mass consumption. As stated recently during a forum\(^1\) which culminated the study of a plan of redevelopment for a large part of South Chicago at the Graduate School of Design, Harvard University, Prof. Emeritus Otto Wagner expounded his philosophy toward the statistical comparison of individuals by whom he termed "Intellectual Architects". His viewpoint was in effect that a worker in Cleveland and a worker in Chicago cannot represent equal entities, even though they are the same figure or numeral on a statistical balance sheet. In other words, Worker A, in Cleveland, can never be made to equal Worker B, in Chicago, and to classify different personalities into groups for purposes of design needs will never satisfy individual personalities.

This, without doubt, is a very truthful statement and probably one of the best in retaliation against mass production of houses. For urban people, this is particularly true. A bank employee does not have the same demands of a house as does the filling station employee. Their lives are basically different in many respects.

However, one might rationalize as to the demands of these people for housing if it would be an economic possibility

\(^1\)Forum held in Hunt Hall, June 7, 1951.
of discovering the needs of each type of individual, say the
bank employee, and designing as nearly as possible the most
satisfactory house that would fit the typical characteristics
of this type of worker. For any prefabricator to do this
kind of investigation and proceed to actually produce for
these people today would be an impossibility. However, the
logic does seem good from purely a speculative viewpoint.

On the other hand, the opportunity is not so unreal or
hopelessly uneconomical for farm dwelling design and produc-
tion of a standardized type. It is true here as well, that
Farmer A, near Fargo, North Dakota, will never be equal to
Farmer B, near Cleveland, Ohio. However, they do have one
basic thing in common. They are farmers. Their farms may
differ materially but chances are that they have a great deal
in common in the manner in which they work, play and relax
within their dwellings. Whereas the wife of a city dweller
may or may not bake, sew or preserve foods, it is common
knowledge that the farm woman does these things almost
universally and without exception. Also, the urban man may
or may not desire a den to do some of his work at home,
depending upon whether he is a young lawyer or a grocery
store clerk. Here again, all farmers need desk space and a
place for preliminary cleaning and dressing (mud room) since
he is a business man of a particular type. As will be
illustrated in this part of this paper, there are many such
similarities by which one might attempt to design a dwelling
which could very readily satisfy a great number of rural farm
people.
The following viewpoints of design recommendations, except where noted, were obtained from on-the-spot interviews made by the cooperative efforts of the state universities of the North Central region and published by the University of Iowa, with approximately 900 persons living in such areas over the North Central states as to give a comprehensive and accurate study of what farm people would most desire in the way of design, comfort and livability from their dwellings. Further inquiries were made of all of their possessions, such as kitchen equipment, furniture, laundry facilities, linens, personal clothing, etc. These findings, however, are too great in content to be presented in this paper but they are available, free to all who wish them, by contacting the Agricultural Extension Service of the University of Iowa.¹

SUMMARY OF FINDINGS

The summary of these findings are of primary importance and are presented first - after which a more precise interpretation will be attempted. Last, a key of definite design recommendations is presented, upon which, it is felt by the author, real reliability may be placed as comprehensive design requirements for rural farm dwellings in the North Central region of the United States.

ILLNESS CHART

bed cases per 1000 population

female
male

age (years)
annual incidence of illness from all causes
Characteristics and features that farm families would like to have if they were building new houses:

About 70% would like to have houses of 5, 6 or 7 rooms, the preference being divided as follows:

About: 20% would like to have 5 rooms
30% would like to have 6 rooms
20% would like to have 7 rooms

About: 65% would like a one-story house. Of those preferring more than one story:

About: 85% would like to have one or more bedrooms downstairs
75% would like the bathroom downstairs if they had no lavatory

About: 95% would like to have
1. A sloping roof
2. Central heat
3. One or more porches
4. A spare bedroom
85% regard a basement or cellar as necessary
80% would like a separate clothes closet
75% would like
1. a separate dining room
2. plan to heat the whole house
60% would like
1. a first floor workroom
2. like to have the house and drive so planned that callers would come to the front door.

Selected activities that are related to housing needs of farm families:

Food preparation and meal service:

About: 90% have not more than two persons working in the kitchen for everyday tasks
95% do some baking
90% usually serve meals to not more than six persons
80% would like to be able to serve meals in the kitchen
60% would like to be able to serve more than six persons in the dining room.
Food preservation:

About: 95% can, freeze, dry or pickle some foods
90% would like to prepare food and process it in the same place
40% have round water bath canners to store in the house
70% make lard and store it
30% cut up meat in the farm house

Laundering:

About: 90% do all their laundry at home
60% would like to be able to dry laundry in the basement
50% would like to do washing in the basement

Sewing:

About: 75% do some sewing (more than hand mending) at home

Farm work:

About: 50% prepare eggs for market in the house
25% prepare some cream for market in the house
50% have milk pails, milk strainers or meat saws to store in the house
45% have churns or household scales to store in the house
25% store some seed in the house

Farm and home business:

About: 75% would like some space provided in the home for farm business
60% would be satisfied with a desk for that purpose; do not want separate room

Hospitality, leisure and play:

About: 65% entertain groups of some kind (half of those who entertain, entertain groups of 20 or more)
90% entertain overnight guests
95% want to be able to entertain overnight guests

Shortcomings of farmhouses in the North Central region in 1948

About: 75% lack bedrooms

47.
65% do not have both electricity and running water
60% lack running water
55% lack basements with finished walls and floors
65% have fewer than one clothes closet for each bedroom in the house
30% lack adequate number of bedrooms on the basis of household size and composition
30% lack electricity

STATISTICAL ANALYSIS OF FINDINGS

Size of Families

On the basis of the 884 households interviewed, it was estimated that about two-thirds of the families interviewed had fewer than five members.

About: 25% had one or two members
25% had three members
20% had four members
15% had five members
15% had six or more members

It would be well then that any design for these people should have at least three bedrooms. The even distribution as to the size of these farm families does suggest a highly flexible design to accommodate all types. Referring back to the summary as to the number of rooms preferred again indicates that the percentages are evenly distributed:

About: 20% would like 5 rooms
30% would like 6 rooms
20% would like 7 rooms

Among the 5, 6 and 7 room choices, leaving about 30% preferring less than 5 rooms or more than 7 rooms.

The first design recommendation might be stated: The design should be flexible as to floor area and number of rooms to satisfy the even spread of family choices and needs.
INCOME CHART

age (years)
annual earnings, according to age, corresponding to five maximum levels
Cost of Dwelling Unit

Farm incomes are a good indication of what the farm family can afford in the way of housing.

In the North Central region:

About: 30% of the farm families had net incomes under $1,500
35% of the farm families between $1,500 and $2,999
25% of the farm families between $3,000 and $4,999
10% of the farm families of $5,000 and over

40% had incomes under $5,000. It would be wise to assume then that the design must be of the most economical and functional of materials and methods.

The second design recommendation then is: The cost of the house package must not exceed $10,000 and ideally should be around $6,000. (This includes mechanical equipment and storage facilities, exclusive of stove, refrigerator, washing machine, movable tubs, sewing machine, freezer etc.)

Storage Space

Storage space was mentioned more often as the feature most wanted by farm homemakers than any other.

The third design recommendation is: Adequate storage facilities.

Number of Floors

"If people could have houses of the number of stories they prefer, two story houses would flatten out to one story houses all over the North Central States."

About: 65% of all the families in the open country in the North Central states wanted one story houses
25% actually had one story houses
15% wanted one-and-a-half story houses
25% had one-and-a-half story houses
20% wanted two story houses
40% had two story houses

From the figures presented of those that had one story and two story houses and what they would prefer, it is evident that the fourth design recommendation should be: The design should be of all rooms on one floor.

Roof Styles

Most of the farm families would prefer to have a sloping roof (or pitched) rather than a flat one on the house they build for themselves.

About:
- 90% preferred a sloping roof
- 5% preferred a flat roof
- 5% were undecided

This estimate must be considered in the light in which the farm people were asked to make their choice. They were shown sketches of two houses of the same size and general plan, one with a pitched roof and the other with a flat one. It is questionable as to the value of such a choice. However, when one considers the climatic conditions of the area in question as well as popular tastes (even though they may be steeped in tradition) it does seem that a pitched roof is the logical answer. It is a moot point as to the economies of a flat roof for this region - even though the popular architectural journals of late have been pointing out the savings here. The question is: Are these savings real ones to the owner who must maintain the structure over a long period of time or are they savings for the contractor? The integrity of this much
heralded economy of construction, for the particular area in question, is questionable in the mind of the author.

Therefore, the fifth design requirement is: The structure must have a pitched roof.

**Attic**

Less than one-half of the families would have an attic with a floor. About 90 percent of the families questioned who said they wanted an attic would use it for storage - and most of these for nothing but storage.

If adequate storage could be provided elsewhere, it is reasonable to assume that most would not care for an attic - since very good arguments can be illustrated by number of household accidents that occur on stairs, waste space, costly construction that might logically by supplemented by less costly construction serving the same purpose, etc.

The sixth design requirement is: No attic, adequate storage provided elsewhere.

**Basement**

"Between 80 and 90 percent considered a basement necessary. In the original question about preferences for basements, the homemakers were asked whether they believed a basement was so necessary that they would not build a house without one, whether they considered it nice to have but not necessary, or whether a basement was something for which they would not care to spend money. Their replies indicate that

About: 90% of those who had houses with basements, and 80% who did not, considered a basement necessary. 5% of those who had houses with basements, and
10% of those who did not, thought a basement would be nice to have, but not necessary. 5% who had houses with basements, and 10% of those who did not, would not want to spend the money on one.

"Many people named more than one use for a basement. Nearly every one who would plan to have a basement would use it for storage, and most of them for storing food. People would like to keep canned food and root vegetables there as well as freezers or lockers. A few women said they would store screens, storm windows or just "stuff" or "junk" in the basement. Others said they would use it for storage, but did not say what they would store in it.

"Farm families naturally think of a basement as the appropriate place for a furnace, water system and fuel. At least one of these uses was named by seven out of ten. Almost as numerous were the people who would wash, iron or dry clothes there. Other frequently named uses were: recreation; farm work, such as handling farm products like eggs, milk and cream, meat or seeds; work-bench space; wash-up area; and housework, including canning, churning, and washing the separator."

To the author, the question of whether or not to include a basement for this problem has been a bothersome one from the beginning. There are many arguments that can be raised pro and con and a few are as follows:

First of all, basements are costly for the amount and

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1 Many state and local regulations prohibit the preparation of dairy products in the house.
character of the space created. To make a basement free of dampness, through all seasons and the various soils one finds in the North Central region, is an expensive proposition and requires the best of materials and construction knowledge. Second, the value of a basement as the proper place for a furnace, water system and fuel is aptly negated in the proposed plans submitted with this paper. The total floor area occupied by these utilities (with the exception of fuel) plus the hot water heater is 10 square feet measuring 2 feet by 5 feet. The height necessary is from floor to ceiling.

Next, the advantage of a work bench in the basement is questionable. Farming requires a great deal of shop work and it does seem that the home should be spared of as many of the outside tasks as possible. It is not unreasonable to assume that in a properly designed farm plant one would locate a well equipped shop in a more related building, such as the machine shed. Here the farmer might readily work with everything, from repairing dresser drawers or making an end table to overhauling his tractor or making new doors for the barn. It does seem unreasonable to heap too great a burden on the house.

Recreation room in a basement has been greatly popularized of late. The question cannot be argued architecturally - it is one of a social nature. By way of speculation, it might be assumed that people will react in a recreation room much more freely than they would in the living room. Without doubt, the victorian idea of the "parlor", "sitting room" or
"front room" still exists in many localities and cannot be easily remedied by merely changing one or more individuals attitudes. The habit is so well established it cannot be corrected by anything less than time. However, in the consideration of this problem, the necessity of a basement merely for recreation would be out of the question economically.

A basement as a place for storage of root vegetables, canned food and freezers or lockers does have merit. Experience has proven that root vegetables do maintain much of their freshness and are retarded from further growing if the furnace room is properly insulated from the vegetable room so as not to dehumidify them. On the other hand, it is certainly not a convenience to force the housewife up and down stairs three or more times each day in order to prepare meals.

The other tasks, of preparing farm goods, wash-up area, canning, churning and washing the separator could more conveniently take place where the relative equipment and utensils are generally kept - the kitchen.

A great savings may be realized in both time and money if space were provided where all foods handled could be cleaned, cooked and canned, or otherwise prepared on one stove and with one set of utensils, both properly located.

The basement as a laundry area will later be shown not to be the preferred location for these facilities by a majority

of the farm women - contrary to the opinions expressed above. See page 64.

If one were to be coldly logical, then the only two valid uses of a basement would be for recreation and the storage of root vegetables. Both of these facilities by way of economy do not justify the construction of a basement. It might have been reasonable to feature a small stair leading down into a fruit cellar and such is illustrated with the drawings as one possibility. However, the author did not feel justified to carry the problem further. Perhaps the best answer would be a first floor storage area with the proper temperature and humidity controls. However, this seemed an unnecessary expense if vegetables might reasonably be stored in large quantities in an old fashioned independent vegetable cellar near the house.

A large basement is unnecessary - a small vegetable cellar would be advantageous.

Porches

"If farmhouses could be made to order, about 90 percent of those in the North Central Region would have a porch, and many would have more than one.

About: 60% of all the farm families wanted a front porch
60% wanted a back porch
15% wanted a side porch
35% wanted both a front and back porch
10% some other combination of two or three porches

"Homemakers would like about half their porches glassed in the winter and screened in the summer. They would have
about equal numbers of the remaining 50 percent screened, open or glassed, with more front porches than side or back porches left open.

"Farm families would use their porches in many different ways. Front porches would be used mainly for rest and recreation. Back porches would be used for storing all kinds of things from fuel and soiled clothes to the ice box and assorted food. The list of things that homemakers would plan to do on back porches suggests that for some families, at least, a back porch might serve as a work room or utility room. Washing and ironing, drying clothes, sewing and mending, cleaning fruit and vegetables, canning and serving meals were all included in the list. Back porches would also be used for men's wash-up areas, as well as for many other tasks."

Here one finds that much of the same tasks that householders said they would do in the basement they say they would like to do on a back porch. This is a good indication that the farmer has not the ability to rationalize his primary needs as was stated earlier when discussing the farmer as an architect builder. (See pages 36, 37, 38.) It is a further indication that many do regard a basement as only a place for storage and not a good work place.

The usefulness of an open porch for this region is questionable. Mr. H. E. Wichers denies its value by virtue of the fact that nocturnal insects are extremely annoying during the summer months.

The next design recommendation is: Provide a screened
"front" porch for rest and recreation and a screened and/or glassed "back" porch, for various household tasks and storage.

Room Combinations

The preferences of farm families for room combinations in various sized houses are offered here. This material illustrates those rooms people would like if their financial situation permitted, and those rooms people feel they could do without if their financial situation were limited. The true value of the material then is the information it gives the designer as to the adjunct facilities he should make an attempt to provide for by better organization and utilization of space.

Four Room House

About: 80% would want a kitchen, two bedrooms and either a living room or a combination living and dining room  
85% would want two bedrooms  
5% would want some other room

Five Room House

About: 32 to 38% want a kitchen, dining room, living room and two bedrooms  
59 to 65% would make no provision for a dining room  
59 to 65% would want two bedrooms (most of the others would have three)  
25 to 31% would include some other room

Workrooms were most frequently named other rooms; dens, sewing rooms, recreation rooms and sun porches were also named by substantial numbers.

Six Room House

About: 95% wanted a separate living room - 5% combined living room and dining room  
75% wanted a separate dining room  
70% wanted 3 bedrooms  
25% wanted 2 bedrooms
45% would have some "other" room
30% wanted a work room
5% wanted a den or study

Seven Room House

About: 65% would want a kitchen, dining room, living room, two or three bedrooms and some other room or rooms
20% would want a kitchen, dining room, living room and four bed rooms
85% would have a separate dining room
70% would have three bedrooms
45% would have a work room
15% would have a den
15% would have a sewing room

Eight Room House

Nearly everyone would have a kitchen and a living room.

About: 85% would have a dining room
55% would have four bedrooms
35% would have three bedrooms
60% would include workrooms

Dens and sewing rooms were the next most wanted "other" rooms.

If all the farm families could have their choice of room combinations, they would want a separate living and a separate dining room and three or four bedrooms. The extremely high percentage who would have this combination in the eight, seven and six room house seems to indicate this to be true. The only other most frequently desired room was the work room.

The next design recommendation is: Provide a kitchen, a separate living room, a separate dining room, three bedrooms and a workroom. The third or preferably a fourth bedroom should be so placed and designed as to be readily converted into some "other" room, such as a sewing room, den, study or recreation room.
Men's Wash-Up Area

<table>
<thead>
<tr>
<th>Location</th>
<th>Percentage of families preferring stated location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bathroom (No separate wash-up area)</td>
<td>29.2 %</td>
</tr>
<tr>
<td>Basement</td>
<td>24.3 %</td>
</tr>
<tr>
<td>Utility or workroom</td>
<td>16.4 %</td>
</tr>
<tr>
<td>Back porch or &quot;other&quot; place</td>
<td>11.9 %</td>
</tr>
<tr>
<td>Washroom or lavatory</td>
<td>11.2 %</td>
</tr>
<tr>
<td>Kitchen</td>
<td>5.4 %</td>
</tr>
<tr>
<td>Outside</td>
<td>0.6 %</td>
</tr>
<tr>
<td>No information</td>
<td>1.0 %</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100.0 %</strong></td>
</tr>
</tbody>
</table>

If the total percentage of those families preferring a first floor location (including those who would have no other facilities than a bathroom) were added, almost 75 percent would prefer wash-up facilities in or near the kitchen-workroom area.

Almost 65 percent would locate the wash-up area in some "other" room, other than the kitchen or bathroom and close to 50 percent would locate it in other than the kitchen, bathroom or basement.

The next design recommendation is: Provide a separate men's wash-up area in some other area, on the first floor, other than the kitchen or bathroom.

Guest Entrance

About: 25% of the homemakers wanted to have guests use the back door
60% wanted them to use the front door
15% wanted them to use the side door

Coat Closet

About: 80% wanted a separate coat closet for "town" coats, with equal preference of location at or near the front or back doors
Less than 50% would want a coat closet for guests

Pantries

Pantries were not considered necessary by most families.
Fireplaces

About: 35 to 45% of the farm families would want a fireplace.

View from Kitchen Window

About: 25% would like to see the farm buildings
20% would like to see the road
10% would like to see the drive

"The age of the homemaker was significantly related to the door to be used by guests and for the view from the kitchen window. A larger percentage of the homemakers of 45 or more years than those under 45 were satisfied to have guests come to the back door, and preferred to be able to look out on farm buildings or on more than one view from the kitchen window rather than on the drive or the road."

Type of Fuel

About: 45% prefer to burn oil
20% prefer to burn soft coal
10% prefer to burn gas

"Oil was preferred by a larger percentage in the northern than in the southern part of the region, and by a larger percentage middle states than either the eastern or western areas.

"The preference for soft coal stronger in the southern than in the northern area and stronger still in the eastern section.

"Preference for gas and wood were about equal in the northern and middle areas, but gas was preferred by a larger percentage in the southern, eastern and western section."

Northern group: Minnesota, Michigan, North Dakota, South Dakota, Wisconsin
Southern group: Illinois, Indiana, Iowa, Kansas, Missouri, Nebraska, Ohio
Eastern group: Indiana, Ohio, Michigan
Middle group: Illinois, Iowa, Minnesota, Missouri, Wisconsin
Western group: Kansas, Nebraska, North Dakota, South Dakota

The next design recommendation is: The heating system should be designed for oil consumption, but flexibility and discretion must be shown for other preferences of fuel that are economically more feasible in "border" states of the North Central region.

Rooms to be Heated
About: 75 % would heat the whole house
15 % would heat only the kitchen and one or two other rooms

Storage Space
In order to emphasize the need of storage space, it should be pointed out that after the homemakers were asked about the foregoing more common and popular features, they were requested to name any other feature that was so important to them that they felt they could not do without. "The one thing named by person after person was 'storage space'. The need was revealed again and again. Some homemakers specified built-in-cupboards, or cedar closets, or a place for large toys or for men's work clothes. Many of them simply said they wanted more storage space.

Design recommendation: A variety of storage space for small and large items and for specific atmospheric conditions.
FAMILY ACTIVITIES

"Homemakers were asked about the most important activity that influences housing needs: (1) food preparation and meal service; (2) food preservation; (3) laundering; (4) sewing; (5) farm and home business, including the handling of produce for market, and (6) hospitality, leisure and play."

In order to be more brief, only the highlights are presented here. The material is presented in far greater detail in the reference already mentioned.

Food Preparation and Meal Service

About: 60% of the farm families said everyday cooking, dishwashing and canning were one person jobs
90% said they were not done by more than two
30% had more than two in the kitchen when company were entertained

Baking

About: 90% baked pies - 75% four or more times a month
90% baked cakes- 70% " " " " " " " " "
85% baked cookies or doughnuts-50% " " " " " "
80% baked quick bread -60% " " " " " " "
65% baked yeast rolls -40% " " " " " "
55% baked yeast bread -45% " " " " " "

"Baking is not a lost art in farm kitchens."

Meal Service

About: 50% wanted to serve meals in both a kitchen and dining room
30% would be satisfied to serve all meals to company and family in the kitchen
30% regularly served meals to more than four
10% need space to serve meals for more than six

Food Preservation (Canning, freezing, drying, pickling)

About: 90% preserved fruit
90% preserved vegetables
90% preserved both vegetables and fruit
50% preserved meat
50% preserved fruit, vegetables and meat
25% preserved poultry

About: 15% required less than 14 square feet of counter and/or table space
25% required less than 18 square feet
55% " " 22 " "
75% " " 26 " "

About: 90% prepared food for preservation in the kitchen
85% processed it there
90% would like to do both in one place
40% would like to center all activities in the kitchen
30% would prefer the basement
20% would prefer the workroom
70% now store canned food in the basement
85% would like to store it there

Meat Cutting and Lard Making

About: 33% cut up some meat for preservation in their houses
33% would want to do it there
50% worked with fewer than 400 pounds at one time. The amount varied from a few pounds to 1500 pounds.
For some this suggests a separate meat house.

Food Processing Equipment Stored

About: 50% had meat saws, household scales, water bath containers, milk strainers, milk pails or churns to store.

Preferred Location for Washing

About: 40% do their washing in the kitchen, but less than 50% would choose to do it there. Instead, 55% would prefer to wash in the basement
30% would use a workroom

Preferred Location for Ironing

About: 65% ironed in the kitchen
15% " " dining room
10% " " living room
About: 40% would prefer to iron in the kitchen
25% " " " " " " workroom
20% " " " " " " basement
5% " " " " " " dining room
No one " " " " " " living room

Laundry Center

About: 60% did not want to do ironing and washing in the same place
35% wanted a laundry center
5% wanted to wash and iron in the kitchen

About: 20% of those who wanted a laundry center would locate it in the workroom
15% would locate it in the basement

"The centering of laundering activities was desired more by those who would prefer houses of six or more rooms than by those with more modest preferences. Less than one-third of those who preferred four roomhouses, but nearly half of those preferring eight room houses, would have a laundry center. The location of laundry centers also seemed to relate to the size of the house wanted. The basement was most preferred among people planning four and five room houses; of those who would like six room houses, about equal numbers preferred basement and workroom, but a work room was the choice of a larger percentage of those preferring houses with more than six rooms."

The data indicates that many or almost all would abandon the basement for washing and ironing if an economical arrangement of space would allow these activities to be done in a first floor workroom. The mass preference is only logical since it is unreasonable that heavy baskets of wet clothes and other washing supplies should first be carried down into the basement and carried up to dry, then carried down again to be
ironed and finally carried up again to be stored. It is possible to assume too that the housewife must undoubtedly make additional trips up and down to tend to other household tasks, cooking, child care, visitors, etc. while a large washing or ironing is in process.

About: 15% had used built in ironing boards
45% of those women preferred the built-in-kind
85% had not used built-in boards
30% of those, thought they would like them

Preferred Locations for Sewing

About: 20% sewed in the dining room
15% " " bedroom
30% " " living room
Less than 5% used a sewing room

About: 40% were content with their sewing quarters
35% would like a sewing room
15% would like to use a bedroom
10% would like to use the dining room

Preferred Location for Cutting-out Garments

About: 30% used the dining table
30% used the kitchen
5% used the floor or "other" place, but

About: 15% would like to cut out garments in a sewing room
25% would use the dining table
15% would use the kitchen table

Sewing Equipment to be Stored

About: 25% did not have sewing machines
66% of those who did - prefer to leave them open

Only a few had so many patterns they needed special storage areas and less had dress forms or large quilts, rugs or garments in the making that these storage problems cannot be made a design standard.

Market Goods Handled in the House

About: 45% handled no eggs in the house
30% handled 1 to 5 dozen eggs each day
15% " 6 to 10 " " " "

65.
10% handled 10 dozen or more

About: 75% of those who handled eggs in the house would prefer to do it in the basement

About: 75% handled no cream in the house
15% handled one gallon or less per day
5% handled 2 to 5 gallons per day

*The many state and local regulations of the preparation and sale of dairy products are related to this situation.

About: 25% stored seed in the house
15% stored less than 10 bushels
10% stored more than 10 bushels

About: 30% started plants in the house (northern states)
10% " " " " (southern states)

Farm and Home Business

About: 75% would like some space for farm business

About: 60% wanted only a desk
15% wanted a separate room

About: 50% who wanted a desk wanted it in the living room
30% wanted it in the dining room

About: 80% were content to have no space for household business
5% would like a file drawer
5% would like a desk

Hospitality, Leisure and Play

About: 65% entertained groups of 20 persons

Family gatherings were most important, the church and neighborhood gatherings, birthday parties, social clubs, P.T.A., Grange, garden clubs, boy's clubs, Sunday school, 4-H Club and F.F.A.

About: 90% had overnight guests
95% and more would like to have them

About: 40% wanted to accommodate 1 or 2
40% " " " 3 or 4

About: 80% would like a spare room for company, if they were building houses
Hobbies did not seem an important function - only about 20% had hobbies, and these few were of a great variety and mostly of simple character.

The most popular place for books and magazines was the living room. Built-in cases elsewhere are not recommended.

Interviewers asked if the farm people preferred more than one place to entertain so that others in the family may retreat to another room if they desire privacy.

About: 55% would not want any special place
10% would like a recreation room
10% would like a den - the rest a variety of places.

The best way to provide extra sitting space is to arrange the kitchen, dining room and porches so that they can do double duty as sitting rooms.

About: 50% would like space for lying down during the day, other than bedrooms or living room
20% of those would like space on the porch
5% would like space in a den

A few remaining design recommendations that were not mentioned, or sufficiently emphasized, in the preceding reference are the central rear hall, mud room and work clothes closet.

As stated by Mr. H. E. Wichers,¹ "The central rear hall is probably the most important of the three special characteristics of the ideal farm house. In the most efficient plan, the central rear hall leads directly to every room in the house - - -".

¹Wichers, H. E., Op cit. p.19
This feature is further emphasized in a joking way by Prof. Linus Burr Smith\(^1\) when he wrote in a letter to the author as follows: "I may have told you that most farm divorces are caused by husbands who track their muddy boots through kitchens. The kitchen on a farm house is like the pilot house on a steam ship - -".

The importance of a central rear hall, mud room and work clothes closet cannot be over emphasized. The farmer cannot at times keep himself from getting "dirty". During the spring he must walk in muddy fields, become drenched in downpours, etc. In the winter his outer clothing may be covered with snow and ice. At all times his clothes may smell of the barn, perspiration and gasoline.

It is imperative that a farm house be so designed as to allow the farm worker to enter the house and hang his outer garments (hat, gloves, coat, overalls and over shoes) in a closet provided with complete ventilation to the outside and a drain to the sewer. This area next to a rear entrance should have a floor and drain so that mud tracked into the house can be easily washed away. From this "mud room", next to a rear entrance, the farmer should have access to all other parts of the house without crossing through any one room. Probably first, he should have access to the bath, dining area, then probably the work room, kitchen and finally

\(^1\)Prof. Linus Burr Smith, Chairman, Department of Architecture, University of Nebraska Lincoln, Nebraska. Letter of June 18, 1951
the living room and bedrooms.

An interesting design feature that merits attention is that made by the well known Mrs. Maud Wilson of the Agricultural Experiment Station, Oregon State College of Agriculture and of late, the United States Department of Agriculture.

"The problem of heat conservation is of very great importance in connection with provisions for sleeping and dressing. The rooms are not used a great deal during the day except as a place in which to dress, and most farmers prefer sleeping in cool rooms. Hence, in most cases, only enough heat needs to be furnished to keep beds dried out and to make the rooms comfortable for use while dressing."¹

A great many people, including urban dwellers, prefer sleeping in cooler temperatures than they normally prefer for other parts of the house. It would seem therefore, that this might have a noticeable effect on room layout and massing of the building in general.

By way of review and simplification, without further justification, the design recommendations may be stated simply as follows:

1. The design should be flexible so as to satisfy the wide variety of preferences.

2. The cost of the house package should not exceed $10,000 nor be less than $3,000.

3. Adequate storage space is of prime importance
4. There should be no more than one floor
5. The structure must have a pitched roof
6. An attic is unnecessary
7. A full basement is unnecessary - a small vegetable cellar would be advantageous
8. Provide a screened front porch and a screened and/or glassed back porch
9. Provide a kitchen, separate dining room, living room, three, or preferably four bedrooms, with one bedroom flexible so that it may be used as a guest room, sewing room, den or sitting room or a room to rest in.
10. Temperatures for bedrooms may be lower than those of other rooms
11. Provide a men's wash-up area on the first floor, other than in the bath or kitchen
12. Provide a rear central hall
13. Provide a bathroom and other utilities
14. Provide a mud room with a closet for work clothes
15. Provide a coat closet for town coats
16. Provide a coat closet for guest coats
17. Provide facilities for an oil furnace with possibilities of installing most any other type
18. Provide heat to the entire house
19. Provide storage space for large and small articles and for articles demanding specific atmospheric conditions
20. The kitchen need not be designed for more than two workers
21. Provide facilities for a great deal of baking
22. Provide dining facilities in both the kitchen and a dining room
23. Provide work space for all kinds and large quantities of food processing and preservation
24. Provide laundering facilities in a workroom
25. Provide space for ironing in either the workroom or kitchen
26. Do not provide a laundry center, as such
27. Provide space for drying clothes indoors
28. Provide facilities for portable laundry tubs
29. Provide space for a sewing machine in a bedroom, dining room, kitchen or workroom
30. Make only minor provisions for handling eggs in the house
31. Make only minor provisions for handling cream in the house
32. Provide desk space for farm business, no desk space for household business
33. Provide space for entertaining 20 guests
TOWARD A SOLUTION

PART III
INTRODUCTION

"We should carefully consider that there was a lot more in getting a useful product in use than nice designs. He was not against design advance, but if that was going to get full attention, the whole business (prefabrication) would be a failure. Some know-how was needed, and this was more fundamental. The more difficult job was the point beyond the design stage — beyond just knowing that it was possible to get something done — a knowledge of practical possibilities of a particular product."¹

This type of thinking, more than any other, has tended to influence the direction taken in the study and presentation of this thesis by the author. The foregoing analysis of "General Characteristics" and "Architectural Considerations" were conducted from the viewpoint that the area and the people are deeply entrenched in their present day way of life. No attempt was made to hypothesize as to how the area could be made more adaptable to living by suggestions of better facilities for communications, social readjustments, etc. But rather, an attempt was made to present the living conditions and social standard of these people as is known today.

By other standards, the following analysis "Toward a Solution" could be thought of as archaic.

The methods of transportation, procurement of materials, factory type, etc. do not seem as well developed in advanced theory as they might have been. However, it is a firm conviction of the author that the success of a prefabricated house is not assured by revolution. Revolutionary designs and ideas are certainly advanced during periods of emergency but hardly accepted even then, in their original concept.

The following proposals are made then in the hopes that they are based on firm ground and could be realized at the present time.
POSSIBILITIES OF A PREFABRICATED HOUSE

There are several valid reasons why a prefabricated house for farm families might succeed. They are as follows:

1. Building codes are non-existant in rural America. The farmer is the sole judge as to what he feels is necessary for the safety, health and welfare of his family.

2. Organized labor does not offer extreme opposition in the scattered rural areas.

3. The native ability of the farmer to build and to exchange labor with his neighbors encourages and lightens the site assembly problem.

4. The low standard of living and the present day trend toward a higher standard of living by the farmer cannot be economically obtained in rural areas under present day building operations.

5. The great number of families of the North Central region that intend to build indicates a sizeable market for a prefabricated dwelling.

6. The farmer's familiarity with prefabricated service buildings, silos, brooder houses, corn cribs, etc. indicate his willingness to accept a prefabricated structure.

7. The farmer's tendency toward greater farm production with less manual labor indicates that he will follow this policy in home production.

8. The financial status of the farmer is higher and more soundly established than ever before in American history.
9. The prospects of high prices for farm produce indicate prolonged prosperity for farm families.

10. Competition in the form and finish of the prefabricated dwelling is favorable when compared with the form and finish obtained from questionable skills familiar to the rural areas.
FACTORY TYPE

The factory necessary for production of a farm dwelling, it is felt, cannot be an expensive operation in the beginning. The many failures of prefabricating companies in the last few decades is evidence that the changing from creating a house on site to one in a factory is not one of revolution. It is hardly conceivable that the huge factories of the Ford Motor Company throughout the world could have been established instantaneously as many seem to think a prefabricating factory for houses can be. The same may be said of the creation of industries producing radios, refrigerators, etc.

Even though the history of man seems to indicate the evolutionary period of these industries to be extremely short in comparison, it is highly impossible to conceive of the Wright Brothers flying a Strato-Jet the day following their initial flight at Kitty Hawk.

Just as it would have been impossible for the Germans to turn out the Stuka dive bomber during World War I, or for the Ford tri-motor passenger cargo plane not to have preceded the DC-4, so it is felt that in the creation of a prefabricated dwelling, it is futile to dream of a factory completely equipped and free of all inconsistencies of production, ready to spew forth the answer to all man's dreams.

Therefore, the factory type that is contemplated for the production of the proposed dwelling is of the most modest
proportions. The design of the dwelling itself is such that it is comparable in many respects to the conventional dwelling. It is hoped through this kind of familiarity with design, structure and materials, that a real production of a flawless prefabricated dwelling will result. It can be assumed that the factory employee will not need to be trained for his job, nor will there be a need for expensive machinery or particular machines necessary for the production of any part.

The first few houses may well be hand-made custom built houses and the cost may be the same or perhaps a little more than that of a comparable conventionally constructed house, but the cost of the first house will not be measured in five, six or eight figures. It will be of a price that perhaps a few people might purchase, purely for the social aspect of being different. Then it is conceivable that the demand will grow until experience and finances permit changes in factory methods that will increase production and permit greater savings. The whole of this scheme is based upon this conservative theory.
PROCUREMENT OF MATERIALS

In these precarious times of world unrest, procurement of materials is probably the most important aspect in all manufacturing. A dwelling, as essential as it may be to the success of any war emergency, is soon limited to the kind of materials that are available for construction. It is not unfamiliar to any, the heavy tax a war program creates on the demand for metals and plastics. The production of cement for masonry construction is geared to either war or peace operations but not both. Labor necessary to work these materials disappears rapidly to the places of greater demand as do the materials themselves.

Wood was selected as the material least likely to be effected by greater demand elsewhere. The adaptability of the design to the use of wood waste boards works to a great advantage in any emergency, whether it be that of war, depression or high costs of a dwindling supply.

The location of the mother plant, in Minnesota (Twin City area) facilitates easy procurement of almost any wood product. Plywood is obtained inexpensively from the Pacific Northwest via railroad. A great deal of good native lumber, both hardwood and softwood is available from northern Minnesota, Wisconsin, Michigan and Canada. Wood for waste board production (the patent for masonite has or will shortly

1 Distribution of western lumber meets with stiff competition in these areas. "Analysis of Farm Paper Advertising" Op cit.
Tensile strength relationships between woods and hardboard, and between woods, hardboard and metals, calculated on basis of specific gravity of wood substances, e.g. strength to weight ratio.
expire)\(^1\) is available from many saw mills in the north, wood working factories within the Twin City area and almost every farm wood lot. The conscientious efforts of men concerned with forest conservation throughout the world have notably increased efforts toward greater utilization of wood. Many experiments have already established the feasibility of the production of wood waste board, and it is not unreasonable to predict a near future production of an inexpensive large supply of sturdy boards of unpredictable dimensions.

The basis for a definite market volume is based upon a statement referred to earlier; that is, of the 2,270,000 farm families located in the open country of the North Central states, one out of eight intend to build a new home within the next five years of the time of the survey.¹

By simple calculation and a trust that an average may represent a fairly accurate estimate, some confidence may be shown the following figures.

Total number of families - 2,270,000

About: 283,000 intend to build in five years
57,000 intend to build each year
5,000 families intend to build each year in each of the twelve states

If it may be assumed that a prefabricating plant can transport efficiently over a distance of 400 miles radius, then the Twin Cities are within the area of six states. (See Figure No. 2.) This would place the Twin Cities in position to provide a prefabricated dwelling to one half the farm families who intend to build, or approximately 30,000 families. If one of every one hundred families could be sold a prefabricated dwelling - from all aspects this is not too difficult to imagine - then the annual market volume could be estimated at 300 houses per year. This would be the production of one house each working day. It

is doubtful that at the end of the first year that volume could be realized, but as an indication of market volume, it is a figure to be strived for.

As referred to several times in other parts of this paper, the farmer's desire toward more efficiency in farm work and higher standards as well as his financial status and familiarity with prefabricated service buildings all tend to indicate that the market may be established without too much difficulty.
SALES METHODS

A wonderful network of communicating systems was discovered in operation in the rural areas of the North Central States.

The local farm papers are read almost universally throughout the region. (See Figure 2.) They are published twice each month and contain items and news of interest for every member of the family.

"The Farmer" published in St. Paul is read in 260,000, or about 90 percent, of the farm homes of Minnesota and parts of the surrounding states.

Farm radio programs throughout the area are special features on most broadcasting stations at different times during the day - particularly early each morning and at noon. Almost every large city has at least one station that features throughout the day, programs, news and advertisements of interest to rural families.

The Minnesota State Fair is an exceptional attraction to all from the entire area. The fair is of interest primarily to rural people. The average attendance during Fair Week for the last four years has been 872,000.

In a letter written to the author by Mr. Harry J. Frost, it was stated "- - - we could place this exhibit on three lots, frontage of which would be 75 feet, depth of 135 feet

1See page 93 for additional theories.
2Mr. Harry J. Frost, Superintendent, Space Rentals Department, Minnesota State Fair. Letter received July 11, 1951.
DISTRIBUTION of POPULATION
in the Upper Midwest

Merchants in all towns in the Upper Midwest, outside of Minneapolis, St. Paul and Duluth, depend upon farm families for from 40 percent to 95 percent of their business.

They stock the goods that farm people buy, and farm people naturally buy brands they know.

Your rural display window is THE FARMER, which reaches more than a quarter million farm homes.

STUDY the chart above. It shows graphically why an advertising campaign in the Upper Midwest, to be 100 percent effective, should include adequate space in THE FARMER.

Merchants serving groups 1, 2 and 3, which represent 65.1 percent of all the people in the Upper Midwest, do from 65 percent to 95 percent of their business with farm people.

Merchants serving groups 4 and 5, which represent an additional 17.0 percent, do from 40 percent to 50 percent of their business with farm folks.

THE FARMER
SAINT PAUL 2, MINNESOTA
and rental of $75.00 or $1.00 per front foot." This was complete charge for the week of the fair.

This suggests that the most effective and inexpensive method of advertising a prefabricated house for farm families would be an exhibition at the various state and county fairs throughout the region. The great variation of dates that the different counties have established as their fair week would allow a prefabricator to exhibit his building in all parts of the state from June 30 until September 23.¹

Not to be ignored are the position of the farm youth organizations. Many commercial products of real value to the farmer are known and, in effect, sponsored by these groups. The local co-op store plays an important role as a gathering place and in the advertising of new products with notices tacked on a bulletin board or the lowly post. The old fashioned party line telephone as well is a much used source of news in many localities.

The farmer, even though he may not contact as great a number of people during each week as does the urban man, does have quick and concentrated communicating systems. This can be utilized to a great advantage in the sales of any product.

Future sales technique is discussed on page 93 under Distribution Methods.

OWNER-FINANCING

Owner-financing of the farm dwelling enjoys relative freedom today. The debt-paying ability of the farmer has improved since post World War I days. (See page 28.)

Gross income to persons living on farms has risen without a corresponding rise in farm operating costs. (See page 28.) Not only has farm mortgage debt been reduced, but mortgage interest rates are lower. The average for the country is estimated at 4.8 percent as of January 1, 1945, 4.6 percent in 1940 as compared with 6 percent in 1930 and 6.1 percent in 1919. (See page 28.)

In a survey conducted in 1941 by "The Farmer" the following data was uncovered from replies made by local rural Weyerhauser lumber retailors as to the question:

"If an installment selling program could be developed which would enable farmers to buy homes, farm buildings, or major repairs on an installment basis, would it be helpful in closing more sales?"

The answers were as follows:

- Yes - - - - 25
- No - - - - 22
- No answer - 2
- Might - - - 1

Total 50 replies

Approximately 47% of the dealers did not think an installment program would help. A comment very often noted

1"Analysis of Farm Paper Advertising" Op cit.
WHOLESALE PRICES IN THE U.S.
was: "Farmers mostly pay cash!" One dealer commented: "Farmers do not like the red tape of installment plans."
And another said, "Extend credit notes, barns are cash from $1,000 to $1,500."

To recall again that this survey was conducted in the era just prior to World War II cannot be over-emphasized. Since that time the farmer has had a period of unprecedented prosperity. (See Figure 3.) Also, he has not been able to purchase many necessities during the war, or at least during half of the years since the survey was conducted.

There are many local rural finance agencies, banks and loan associations that have long extended credit to the farmer without a guaranties. The rapid rate of decline in farm debt and the vast accumulated cash reserves tend to indicate the farmer to be a good financial risk.

His position is totally different from that of the urban man. He has an average property investment in real estate, cattle and equipment of $19,790.1 (By all indications this is debt free.) He also has the property on which to place the new dwelling, and the ability to devote part of his own labor, materials and equipment to the erection of the house.2

The last two items enable the farmer to realize a cash savings of $500 to $600 and would divert this amount (10% of final costs) toward a down payment for a loan. This is

1See page 8.
2Sand, gravel, stones, power equipment, hoists, block and tackle as well as landscaping material and equipment for site improvements.
arrived at by estimating the cost of land and improvements to be 7 percent of the total cost ($6,000) of the house package and adding to this the savings of not having to pay for 100 hours of site labor at an average of $1.50 per hour.

The author, in an attempt to find an existing loan agency that would risk floating a loan on a prefabricated dwelling for farm families, contacted the Co-op Credit Union, a division of the Minnesota Association of Cooperatives. The result was as follows:

"As to Credit Union long-term loans on prefabricated houses I would say that probably Credit Unions could not handle such long-term credit. We are however, planning to establish a savings and loan association as a sister organization to the Credit Union, operating with the same board of directors. This Savings and Loan Association is authorized to specialize in long term loans. It will be possible for us to transfer funds from the Credit Union to the Savings and Loan Association or vice versa depending upon the requirements in the loan departments of each. Credit Unions are specifically designed for short-term loans. Savings and Loan Associations are specifically designed for long-term loans.2

It does seem reasonable to anticipate that popular demand would soon move other more conservative and reluctant

2Mr. Harry J. Peterson, Executive Secretary, Minnesota Association of Cooperatives - Letter received July 18, 1951
rural loan agencies and banks to enter into competition with this well organized and well represented popular rural association in Minnesota.

By all indications then, it seems that one might say that owner-financing conditions are favorable.
DISTRIBUTION METHODS

The modest factory out put proposed for early stages of production, dictated to a great extent the methods of distribution and transportation. At the beginning, it is felt that the manufacturer might well serve as the sole distributor and later call on well organized and established distribution systems to assume this task until again, when greater production and capital might warrant him to assume the responsibility.

Early in the stage of development of this study, the author discussed the problem of transportation with Mr. Bliss of the Fruehauf Trailer Company. It was learned that the Fruehauf people had for sale at their Detroit factories about 800 trailers designed specifically for the transportation of a prefabricated house. The trailers for various reasons were no longer required and the problem of what to do with them yet remains with the company.

It would seem wise to avoid this kind of extreme specialization. In an effort to base the system of transportation on simplicity, it was reasoned that there are a great number and variety of trailer trucks operating to all areas of the United States - all having in common the maximum allowable width. The Federal Government has established the maximum width of every vehicle on U.S. highways at 8'-0".1

1 It allows the states to control the height, length and axel loads.
**Aluminum Open Top Van**

Model FCALO GT5532
Length, 32 ft., Tandem Axles; 10.00/20 Tires; Vacuum Brakes; Aluminum Crossmembers, Supports, Wheels, Tarp Bows and Ridge Pole.

Deliver the goods at a maximum profit! Increase your payload weight... cut your loading and unloading time with this tough-skinned aluminum open top Van that’s built to take punishment from load, road and elements.

ALUMINUM SUPPORTS, well braced, with large drum-type double wheels and full width axle, give adequate strength and support to load.

REAR DOOR HEADER, (steel, removable) multiple tarp bows, wide steel cap rail and strong side posts provide extra load protection and then some!

**SPECIFICATIONS — Model FCALO**

<table>
<thead>
<tr>
<th>CAPACITIES (maximum gross axle load)</th>
<th>Model 5 single axle, 20,000 lbs.; Model GT55 tandem axle, 18,000 lbs. per axle</th>
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<tbody>
<tr>
<td>DOORS</td>
<td>rear, full length</td>
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<tr>
<td>FLOOR</td>
<td>11/2&quot; tongue and groove magnesium (as available)</td>
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<tr>
<td>FRAME</td>
<td>intermediate crossmembers and sub-frame, aluminum</td>
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<tr>
<td>HEIGHT</td>
<td>overall (10.00/20 tires; 70&quot; body height) 124 1/4&quot; to ridge pole; inside: 60&quot;, 66&quot;, 70&quot;</td>
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<tr>
<td>WIDTH</td>
<td>inside, 911/2&quot;; overall, 96&quot;</td>
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<tr>
<td>KING PIN LOCATION</td>
<td>20&quot;</td>
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<tr>
<td>LIGHTS</td>
<td>I.C.C. including turn signals, 3 red on a strip and dual stop and tail light</td>
</tr>
<tr>
<td>LINING</td>
<td>plywood</td>
</tr>
</tbody>
</table>

PAINT  
carbon steel parts painted aluminum, entire unit one coat clear lacquer

PANELS   
aluminum

TARPAULIN BOWS  
aluminum (removable)

TARPAULIN TIE ROD  
24" up from hub rail

BRAKES  vacuum (also optional at extra cost)  Model 5, 16 1/2 x 7" for 20" base tires; 18 x 7" for 22" and 24" base tires; Model GT55, 16 1/2 x 6" for all tire sizes

TIRE SIZE (maximum)  
Model 5, 11.00/24; Model GT55: 11.00/22

WHEELS  
hub integral-forged aluminum on 20" and 22" base tires, cast steel for 24" base tires

SUPPORTS  
aluminum vertical, 2-speed mechanical

UNDERCONSTRUCTIONS  
Models 5 and GT55 in section 1 near front of book
It was further learned that the combined thickness of side panels was invariably no greater than seven inches.\(^1\)

Here then was a reliable standard upon which could be based a module for all parts of a prefabricated house with the assurance that the manufacturer could obtain transportation rates on a competitive basis with other products. It is necessary, of course, to design the prefabricated house so that there will be full utilization in the factory of the standard 4 x 8 foot building material.\(^2\)

The advantages of ordinary trailer truck transportation are evident. Competition necessarily establishes rates at a minimum. The product may be shipped by railroad or water and picked up and delivered the remaining distance by any truck. The consumer may find it to his advantage to provide his own transportation and purchase the house at a factory price; the initial investment of the manufacturer is reduced considerably; the speed, efficiency and familiarity of locale is necessary for the successful operation of a trucking agency, etc.

Early wishful thinking had led the author to believe that the 2,000 livestock trucks operated throughout the state by the Co-op might be utilized for the transportation of the house. It was reasoned that if the trucks could carry a pay load on the return trip, a substantial savings might be realized. However, this arrangement proved to be impossible. In a letter to the author, it was stated that:

\(^1\)"Fruehauf Trailers." Pamphlet Order No. 120, Detroit: Fruehauf Trailer Company.

\(^2\)The proposed scheme observes this contingency.
"Very few of our cattle trucks are authorized to carry back-hauls. In spite of this some of them do, but they do it either in violation of the Railroad and Warehouse Commission rulings or it is possible that they may haul their own material, bought for their own account on a back-haul. The cattle truck back-haul is not a practical approach to the problem. There are cooperative transportation associations, and there are, of course, the commercial transportation agents. The figures I will quote you, attached to this letter, is a schedule of rates for one of our cooperative trucking associations authorized to carry material under a permit from the Railroad and Warehouse Commission. They carry merchandise for cooperatives both ways.  

The rates quoted proved to be standard rates as they are authorized by government regulation. They are the same rates that are made by interstate transportation companies specializing in prefabricated houses.  

However, some savings in transportation costs may be realized by the consumer if he is a member of the co-op and utilizes co-op trucking service much as he does for many of his purchases.

The employment of the cooperative trucking system has other advantages. There are a considerable number of trucks owned and operated by the many scattered rural associations.

1 Harry J. Peterson Op cit.
The small localized and almost family operation and ownership that characterizes the individual trucking systems would facilitate delivery of the house to even the more remote sections and farms of the state.

Other methods of transportation were considered, and found that transportation by water could be utilized. It was concluded that if the house were designed as stated above, the parts could be transported by either rail or water. Although it was not investigated, it is hoped that lower transportation rates via Great Lakes cargo ships and Mississippi river boats might significantly increase the area of operations in these directions from a factory located within the Twin City area. Transportation west into the prairie countries would be lowered from truck rates by use of the railroads.

The answer to a method of distribution for latter stages of increased production was not so unsuccessful as the unique livestock-house transportation system that was anticipated.

Again, Mr. Harry J. Peterson stated in a letter:
"-- this is to advise you that the Minnesota Association of Cooperatives is a trade association representing some 350 cooperatives in Minnesota in the field of education, public relations, research and legislative relations. Within our membership there are three wholesale cooperative organizations which would have the capacity to handle this prefabricated house which you propose to design as a graduate problem in connection with your study at the Institute.
"The organizations I have in mind include Midland Cooperative Wholesale, Minneapolis, Minnesota; Central Cooperative Wholesale, Superior, Wisconsin; and Farmer's Union Central Exchange, South St. Paul, Minnesota. These organizations handle farm supplies and equipment and would be the logical channel through which distribution of prefabricated farm houses might well be handled."

The purchases made annually by the coop associations are of considerable magnitude. The kind of purchases, as well, often range large in volume, i.e. tractors, threshing machines, prefabricated farm service buildings, etc.

This then suggests that the distribution of the house might well be accomplished through these well established associations. Indeed, full responsibility in the fields of education, public relations, research, legislative relations, consumer financing transportation, etc. as relate to the sales methods, distribution, purchase and erection of the house by the farmer might be absorbed by the Cooperative Association and lighten the burden of the manufacturer.

Although it has not been investigated because of insufficient time, the author anticipates that the cooperative association, acting as the distributor, does have the facilities for storage of the house. It is not too difficult to imagine that scattered storage facilities might be found and utilized in the three large distribution areas along with additional storage at the factory. It is...
conceivable that a definite production rate might easily be maintained throughout all seasons. Another advantage for the manufacturer.

A final thought toward encouragement of off season purchase of the house might be a sales technique advising the farmer to purchase his house in the winter to avoid the spring building rush and store the parts or entire package intact in buildings on the farm. There could logically be many that might be persuaded to do this since the barn hay loft empties rapidly toward spring and a system of loading is provided for many of the panels. The core could be stored in a machinery shed if some of the farm machines might be stored elsewhere on the property or neighboring farms. Provisions for movement of the core in the spring would easily be accomplished by utilization of the farm tractor, etc.
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A PREFABRICATED HOUSE FOR FARM FAMILIES OF THE NORTH CENTRAL REGION

A GRADUATE THESIS
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
SCHOOL OF ARCHITECTURE
SUBMITTED AUGUST 1951
KENNETH HAROLD WALIJARVI

DISTRIBUTION AREA 1
UTILITY ADDITION
PLAN 4 BEDROOM UNIT
PLAN 3 BEDROOM UNIT
1. SINGLE LAPPED MINERAL SURFACE ROOFING.
2. ROOF COVER PANEL - FLYWOOD, MAJORITE OR OTHER HARDBOARD.
3. WEB MEMBERS - plywood.
4. GYPSUM - plywood.
5. FASCI - SOLID WOOD OR FLYWOOD.
6. CEILING PANEL - FLYWOOD, POSSIBLY & PREPAREDLY MAJORITE.
7. REINFORCEMENT MEMBERS - SOLID WOOD.
8. CONNECTORS - STANDARD 1/8" IRON BOLTS THROUGHOUT.
9. PANEL ALIGNMENT - 1/8" SPLIT-RING CONNECTORS MAY BE USED THROUGHOUT.
10. RIDGE - TARRED, CORK BLEDGED OR COPPER & ROOFING (SITE OPERATION).
11. FLASHING - COPPER.
12. EXPOSED JOINTS - V CUT, CORNER MOULDS MAY BE USED.
13. INSULATION - Batts, blankets, full or part reflective.
14. FINISH - NATURAL, STAINED, VARNISHED, PAINTED, PAPERED, PLASTIC (K-NORMA), ETC.
15. JOINT SEAL - IMPREGNATED FELT.
16. GLUE BLOCK - SOLID WOOD ON ALL WEB MEMBERS.
1. FLOORING - LINOLEUM, RUBBER OR ASPHALT TILE, CORE, WOOD BLOCK.
2. STRUCTURE - SIMILAR TO ROOF PANEL.
3. VENT & ACCESS OPENINGS - CIRCULAR, LOCATED APPROXIMATELY AS ILLUSTRATED.
4. SILL - COPPER SCREEN & HEAVY MESH REINFORCING STRANDS SECURED WITH WOOD BLOCK AT SILL, ANCHORED IN SOIL.
5. ALL MOLDINGS OPTIONAL THROUGHOUT.

FLOOR PANEL & DETAILS 11
1. Exterior Facing — T & G Vertical Boards, Boards & Battens, Plywood, etc.
2. Sheathing — Masonite, or Various Papers.
3. Framing — Solid Wood.
5. Window Frames & Sash — Hardwood.

WALL PANELS & DETAILS 12
1. **FURNACE** — STANDARD INSTALLATION: HORIZONTAL SUSPENDED FORCED AIR OIL-FIRED.
   ALTERNATES: GAS, COAL, OR WOOD FIRED.
2. **SUPPLY** — METAL DUCTS IN UTILITY CORE; OTHER: PREFab PLUMBING SECTIONS, WITH REGISTERS,
   INSTALLED AFTER ERECTION OF HOUSE.
3. **RETURN** — BEDROOM CORRIDOR & BEAR CENTRAL HALL, AND RETURN AIR CHAMBERS; METAL DUCTS
   IN UTILITY CORE SHUT INTO RETURN FURNACE UNDER FURNACE.
4. **EXHAUST** — BATH & WOODSTOVE.
5. **CHIMNEY** — PREFAB ASPEROSITE PIPE SERVICES FURNACE, PHB HEATER & KITCHEN STOVE.

**HEATING & WIRING DIAGRAMS**

**PLUMBING DIAGRAM**

**UTILITY ISOMETRICS**