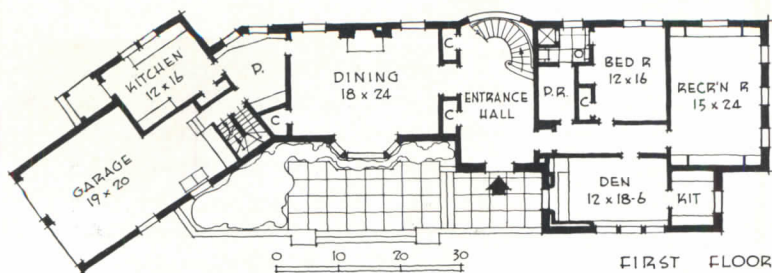
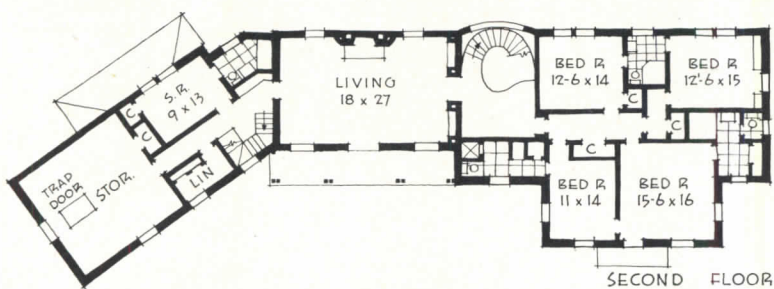




HOUSE FOR MR. AND MRS. C. P. CLARK, NASHVILLE, TENN.: EMMONS H. WOOLWINE and JOHN HARWOOD, Architects

## HOUSES

This month's group of houses, selected from widely separated regions of this country, vary in size (one to six bedrooms), style, and solution. The basic planning ideas have widespread potential application and adaptability to the fundamental problems of residential planning in any part of the country. As is pointed out many elements conform to the standards mentioned in "How Safe Is The House?" (p. 67).



## EMMONS H. WOOLWINE and JOHN HARWOOD, Architects

**REQUIRED FOR THE NASHVILLE, TENN.** residence of Mr. and Mrs. C. P. Clark was a ground floor suite for entertaining which would be independent of the main living and service areas. Hence the den, recreation room and kitchenette. The living room was placed on the second floor to take advantage of a fine view over the surrounding countryside. This location also simplified the framing. The room opens on a balcony, cantilevered from living room floor and additionally supported by tie rods from roof rafters. Since the owner preferred a storage room to attic space, such a room was provided over the garage. This arrangement has the additional advantage that by means of block and tackle immediately above a trap door lifting of heavy objects is facilitated.



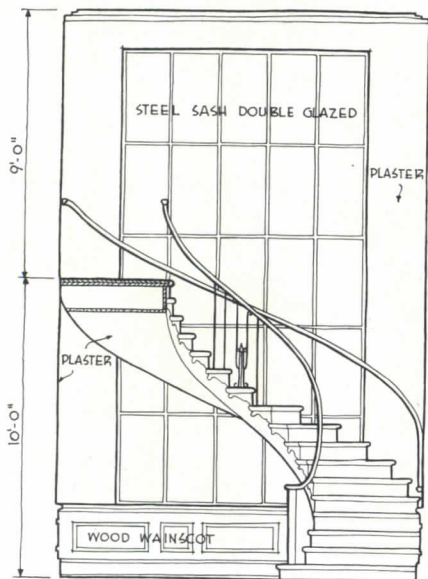
Photos by St. Thomas



TERRACE



DINING ROOM



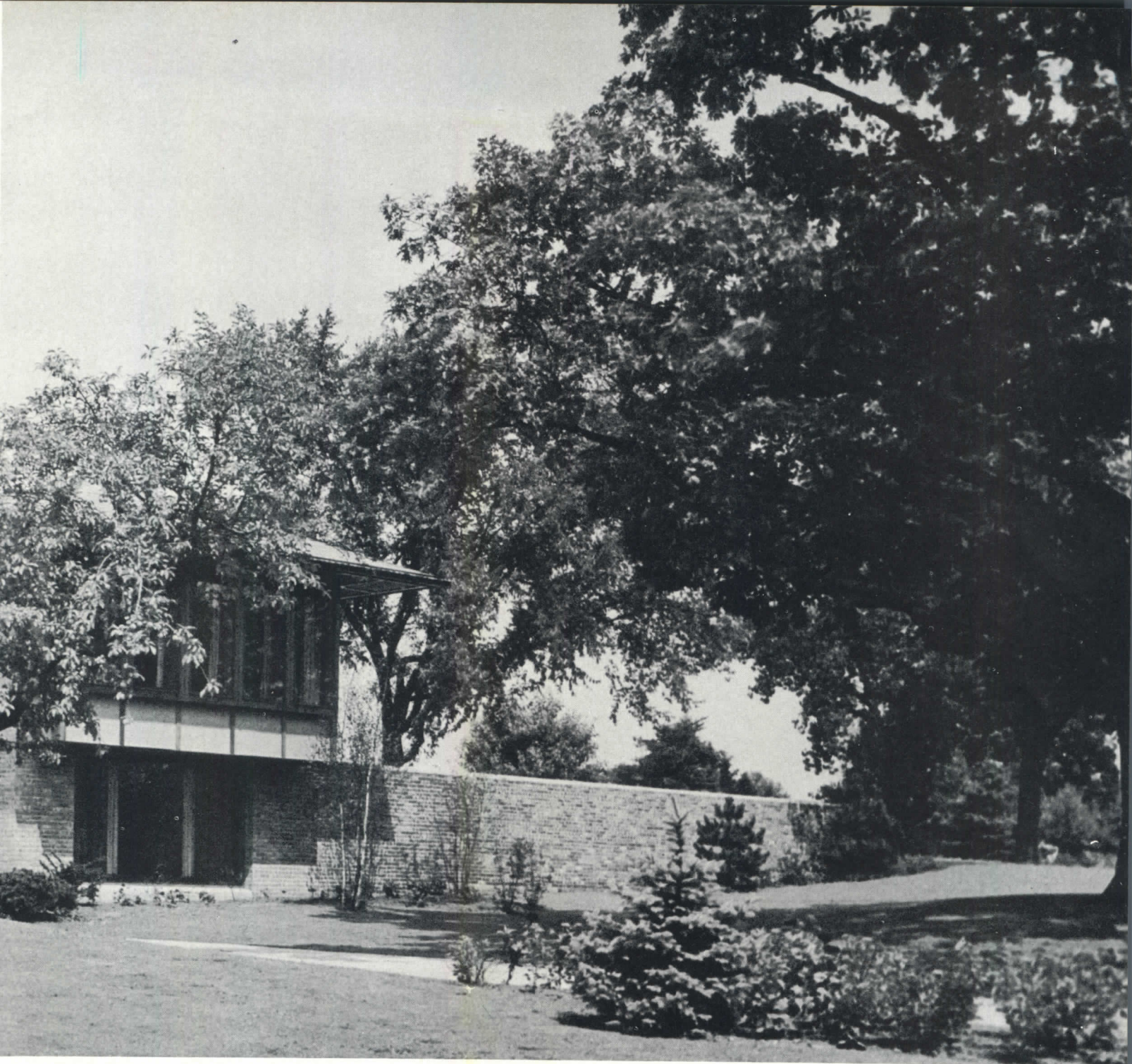
STAIR HALL



### ALDEN B. Dow, Architect

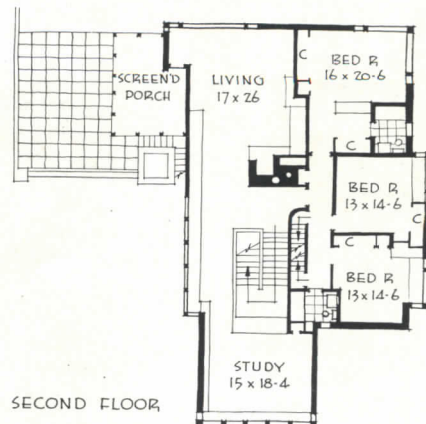
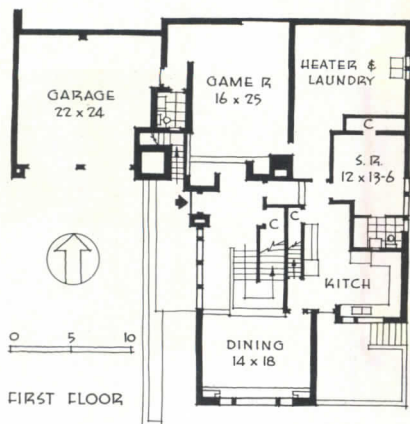
**THE PLAN OF THIS MIDLAND, MICH.** house was conditioned by the sloping lot, and by the view obtainable from second floor level. Thus living room and study on the second floor have the best outlook; rooms used either less frequently or for shorter periods of time are on the ground floor. Exterior walls are of light pink brick and turquoise blue building board, with varnished wood trim. Interior walls are of natural white plaster or brick; carpets are brilliant blue-green in color. Provision for light—both artificial and natural—is ample: note large glass areas (admitting plenty of daylight) and flush ceiling lights to complement the natural source. Circulation is provided for with little waste space; service stairs are located immediately behind the main stair, and are partitioned off for privacy. The plenitude of closets, cupboards and shelves provides for storage of all types, and is itself an excellent safety measure.

## HOUSES



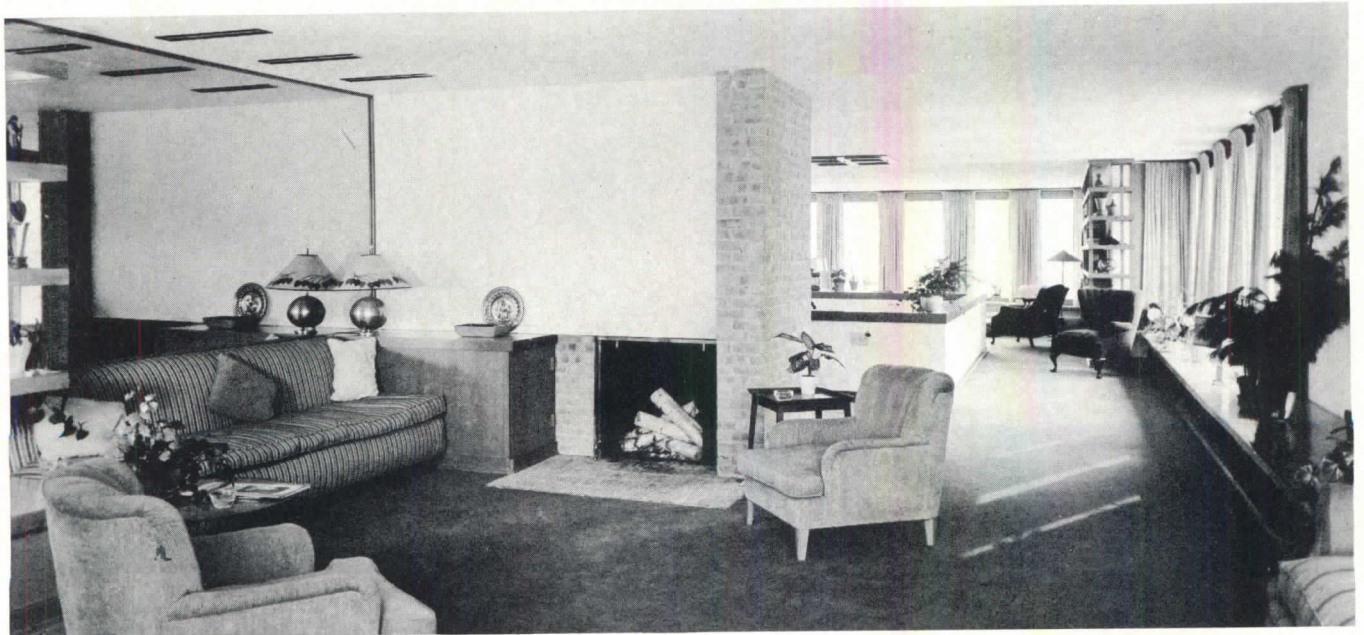
Photos by Elmer L. Astleford

Interiors overpage →

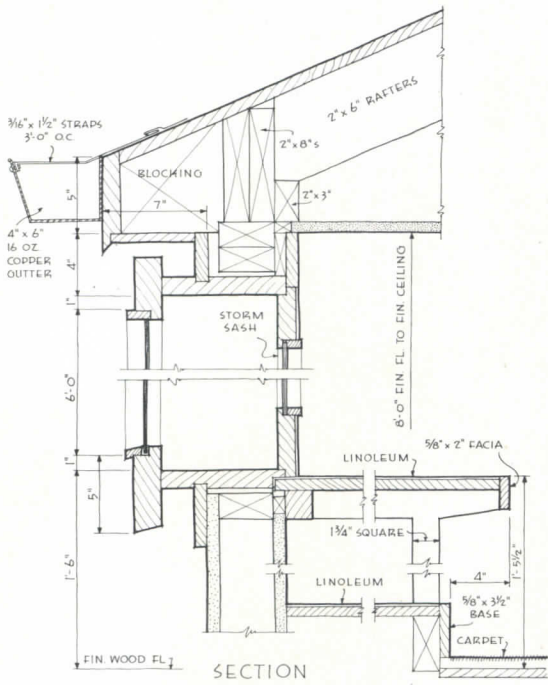




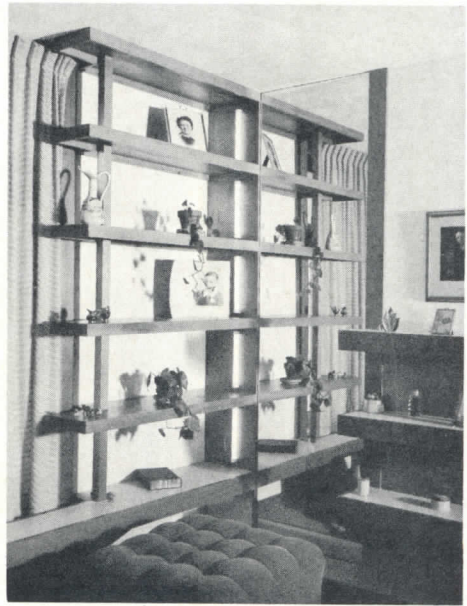
ENTRANCE HALL from stair landing



LIVING ROOM: View toward stair hall



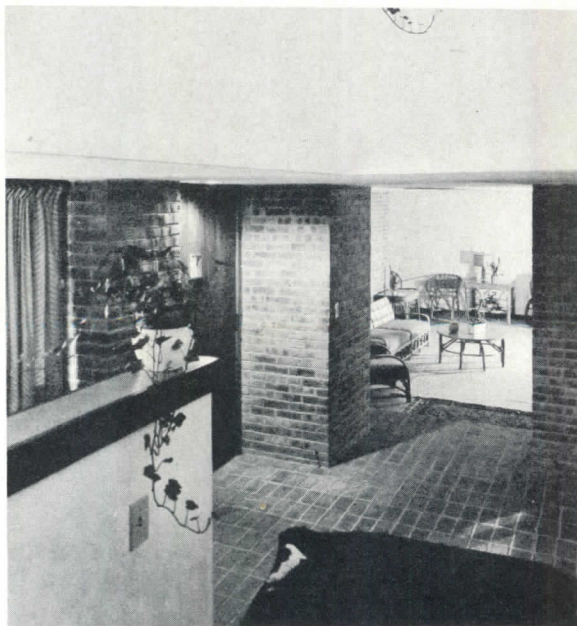
DETAIL OF WINDOWS in study, hall and bedrooms



DRESSING TABLE and shelves in bedroom



DINING ROOM

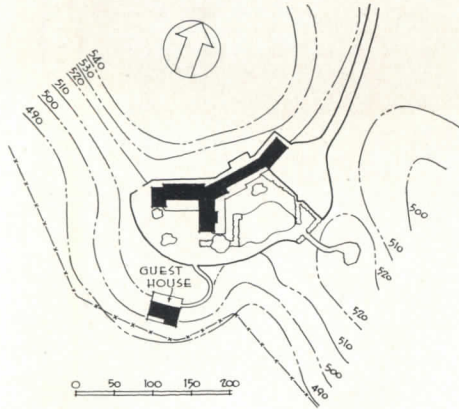


ENTRANCE HALL looking toward recreation room



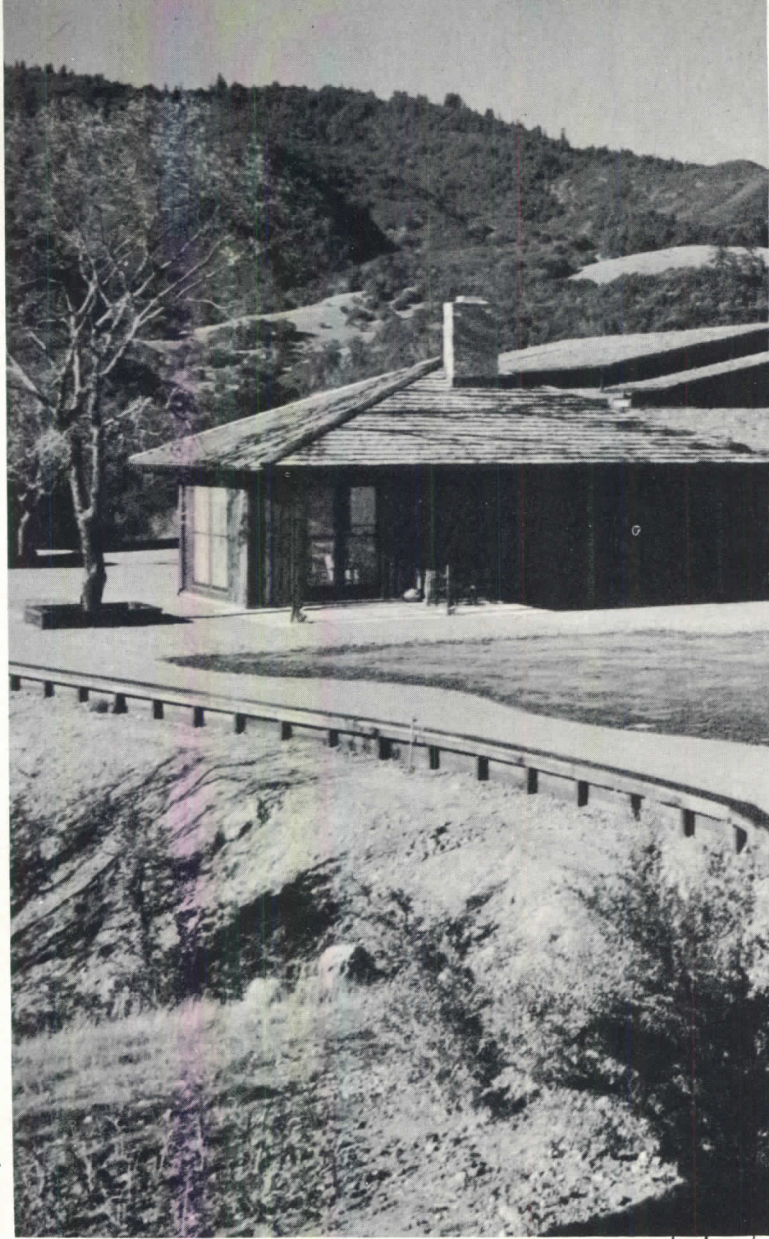
STAIR HALL

# HOUSES

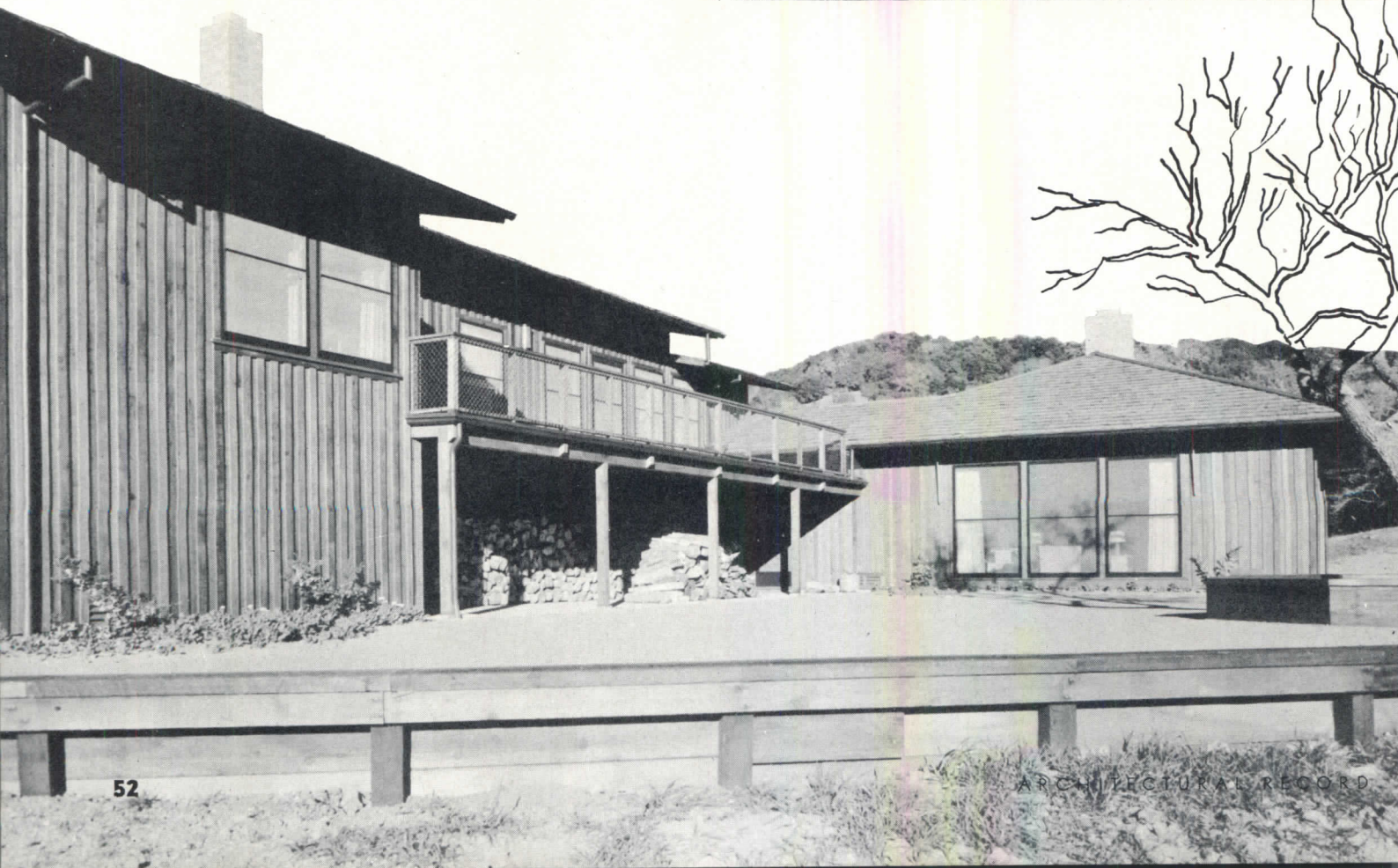


## WILLIAM WILSON WURSTER, Architect

**AN UNUSUAL FEATURE OF THIS HOUSE NEAR GILROY, CALIF.** for Mrs. A. G. Reynolds, is the use of ramps throughout instead of stairs. This device, long considered a safety measure, is practical in this instance since the spread-out plan accommodates the ramp without materially increasing the amount of walking necessary. Nowhere in the house or garden area are steps used for a change of level; terraces are flush with floor level. Pitch of the hipped roof is steeper than that of the shed over the rest of the house: the effect is that both slopes appear to be the same. Exterior siding is redwood boards and battens, with two coats of boiled linseed oil. Interior finish is Ponderosa pine; ceilings are of wall board.



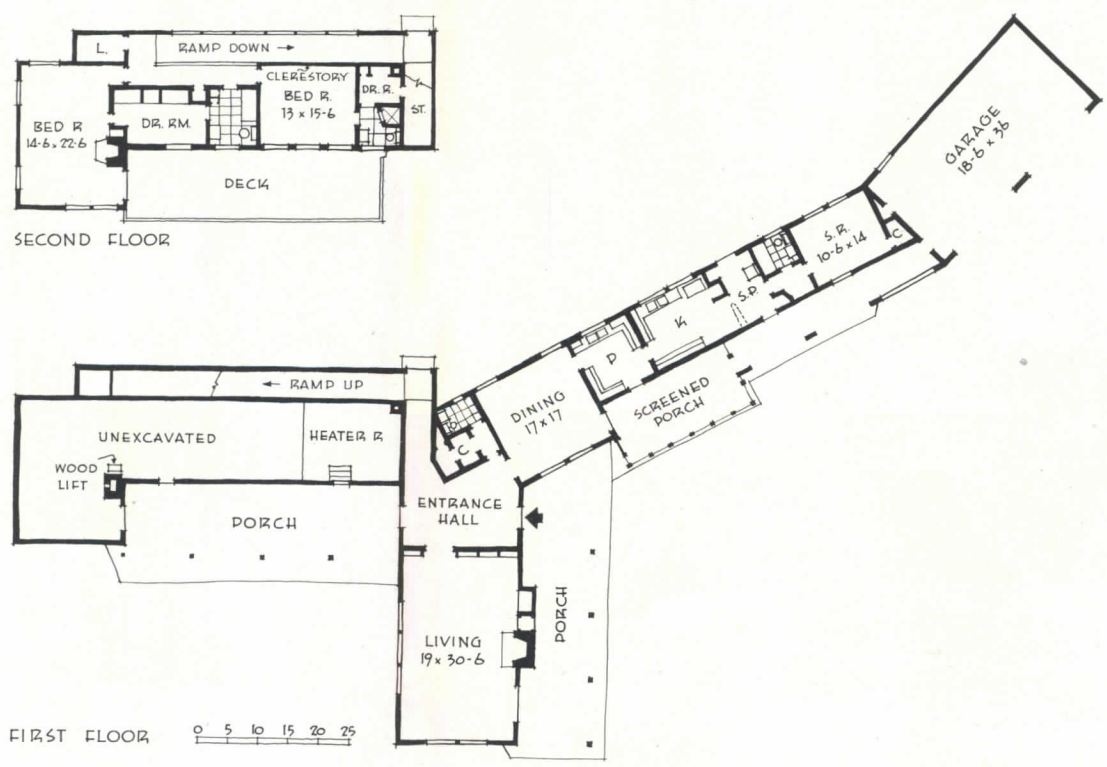
*Photos by Roger Sturtevant*

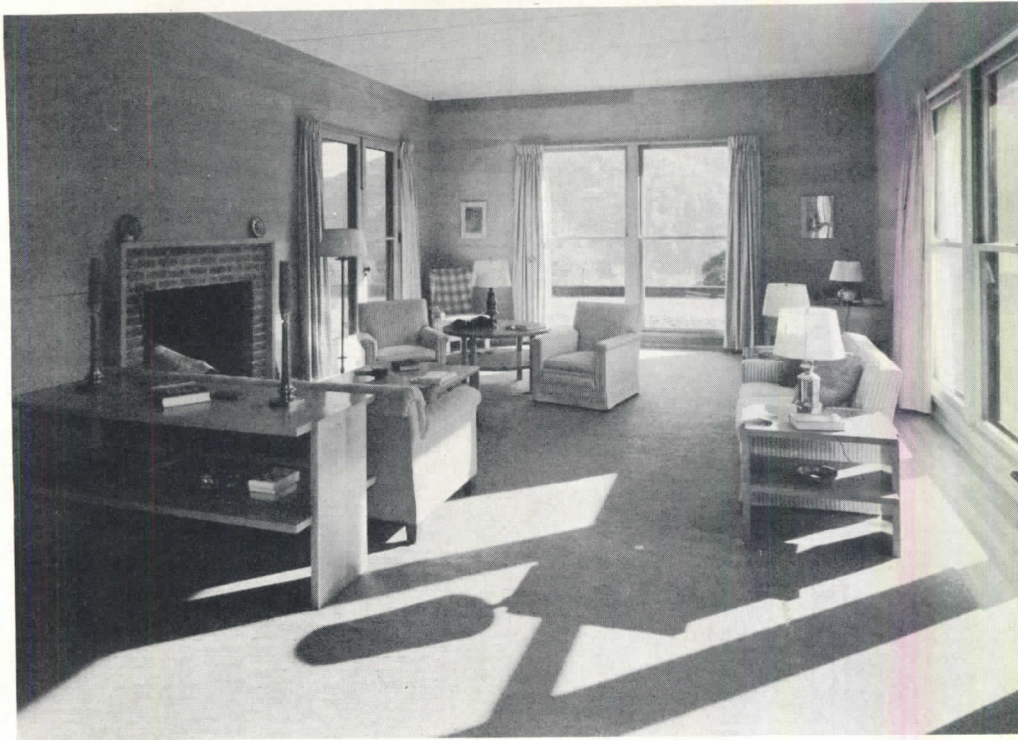




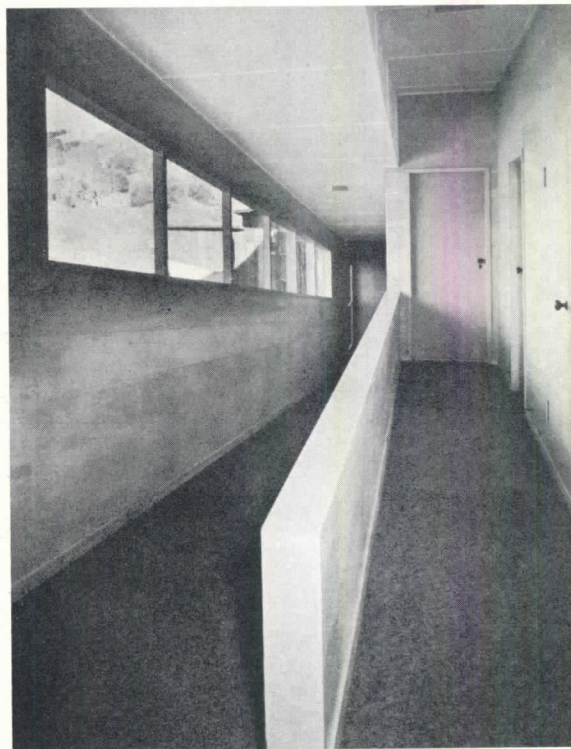


Interiors overpage →

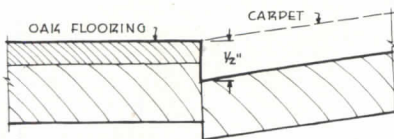




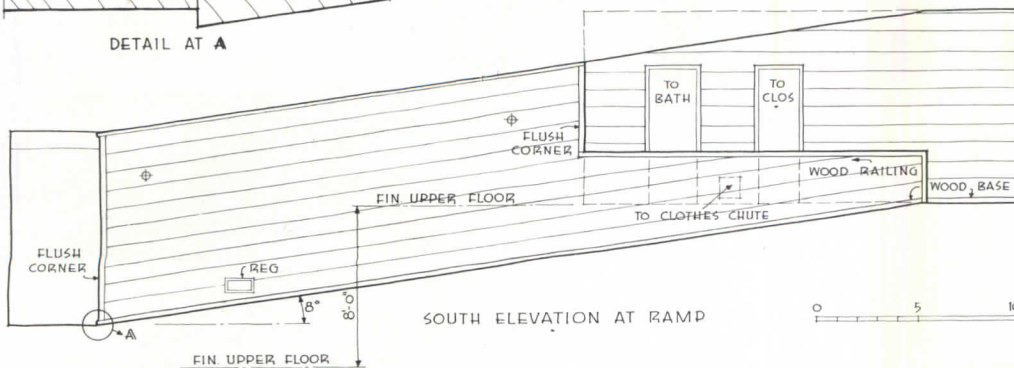
LIVING ROOM



RAMP from living area to sleeping quarters



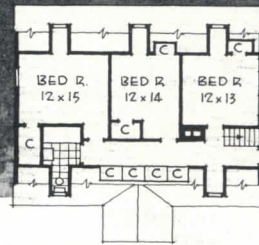
DETAIL AT A



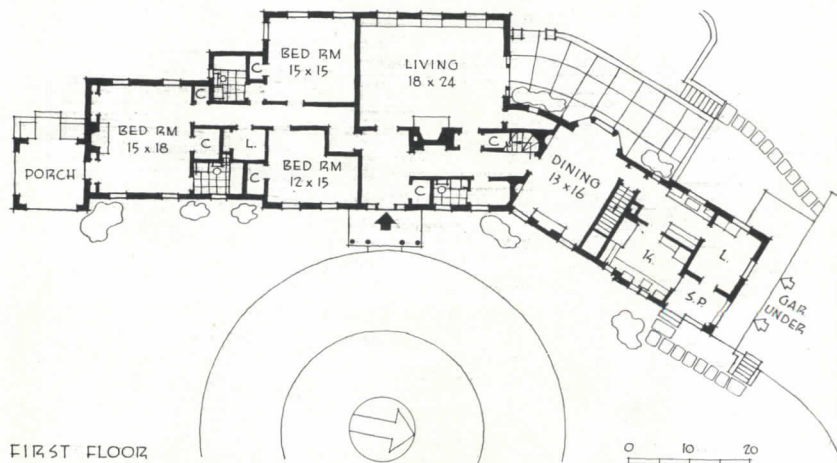
SOUTH ELEVATION AT RAMP



# HOUSES



SECOND FLOOR



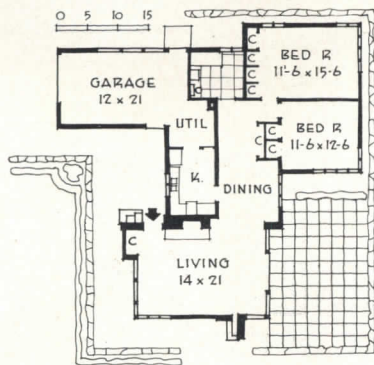
FIRST FLOOR

## FRANKLIN and BROWN, Architects

**ON A KNOLL IN SEWICKLEY, PA.** is the residence for Mrs. Margaret A. Campbell. The long, rather rambling plan recognizes the terrain, and makes possible location of bedrooms on the first floor, so that the house is essentially a one floor residence. The service area is located near the entrance road, convenient for deliveries. The laundry, on the same level with, and accessible from kitchen as well as from the service porch, involves no extra walking or climbing of stairs. Ample storage space is provided. A light standard at the entrance to the driveway reduces possibility of night accidents. Driveway markers are painted white for greater visibility.



# HOUSES

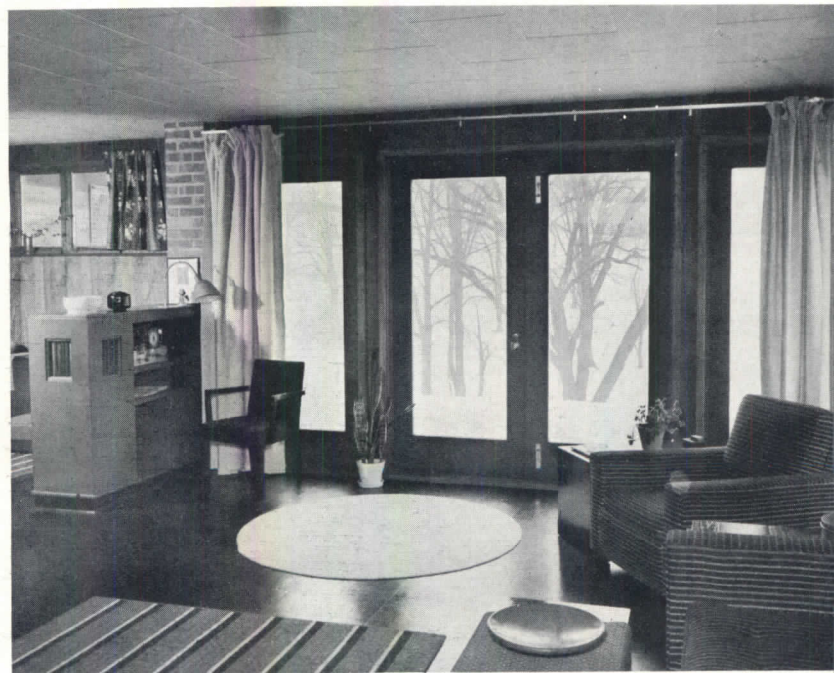


## FRASIER SMITH, Designer

**NEAR WHEELING, W. VA.** is the residence of Mr. and Mrs. Frasier Smith. The plan is so compact that an absolute minimum of hall space is necessary, but circulation is ingeniously provided for. The dining alcove is the means of access between living and sleeping areas; since its use is confined to specific times when circulation is unnecessary, use of the space for these two functions is logical. For so small a house there is an unusual amount of storage space. Another feature is the combination of kitchen, utility room and garage; these form one unit and have worked out satisfactorily, according to Mr. Smith. The house was planned for minimum upkeep and maintenance, and, except for the solid black floors which show dirt easily, has justified the owner's hopes. The exterior is of redwood siding, unfinished, with deep blue trim; interiors are finished in plywood, except for the kitchen and bath, where walls are of painted wall board. Ceilings throughout are of fibre board.



ENTRANCE DETAIL



LIVING ROOM looking toward dining alcove

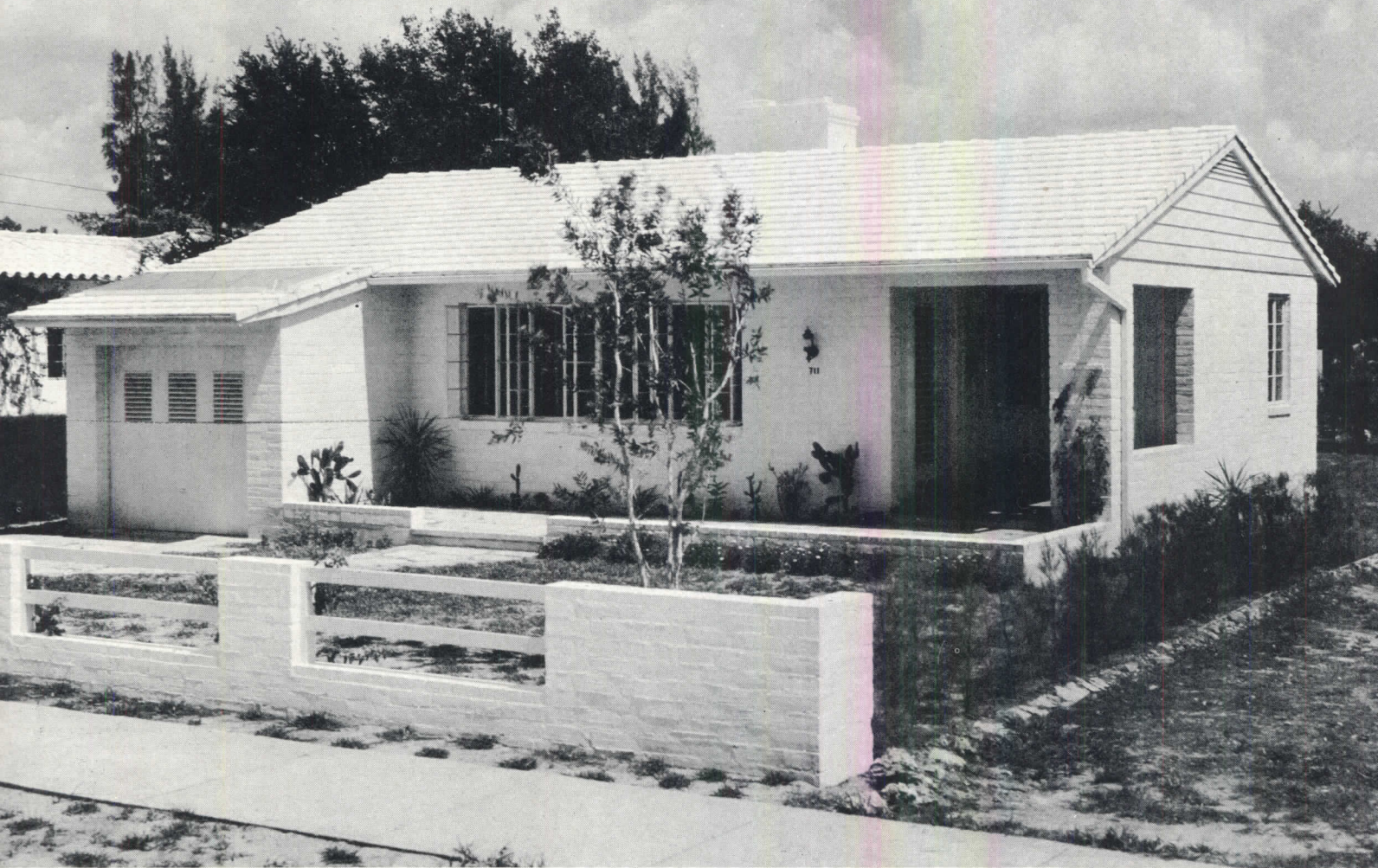


DINING ALCOVE and hall



KITCHEN: note lighting of work space

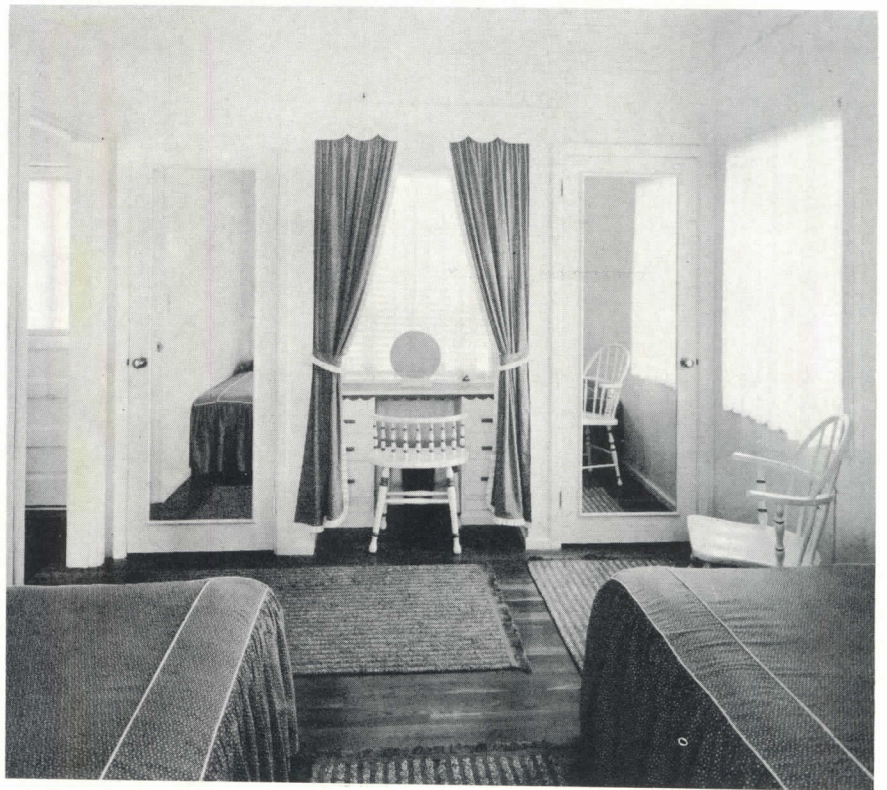
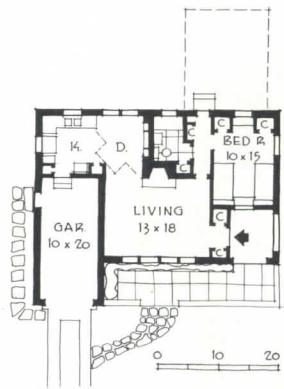
Photos by R. Luttrell; Gottscho.



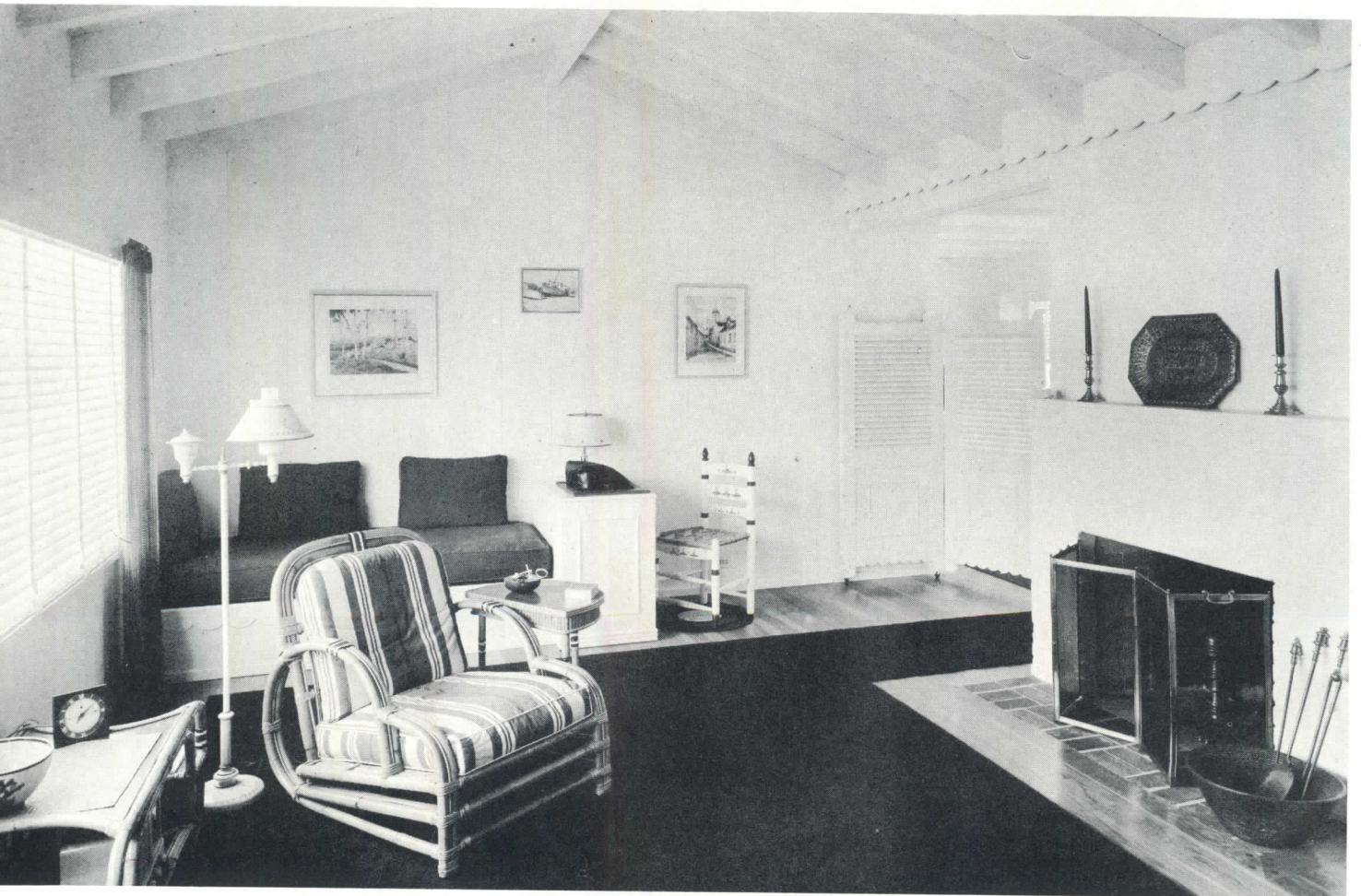
DINING ALCOVE

## L. R. PATTERSON, Architect

**THIS SMALL HOUSE IN MIAMI, FLA.** was designed by the architect as a winter home for himself and his wife. The organization of the plan is direct and compact; plenty of storage space is provided, and there is a minimum of hall area, but circulation is unhampered. Dining area is separated from the living room only by a movable screen. The exterior is of "adobe" cement brick; interior finish is western white pine, painted. The roof is of white cement shingle tile, a much used local material. The house is equipped with a solar water heater.



BEDROOM



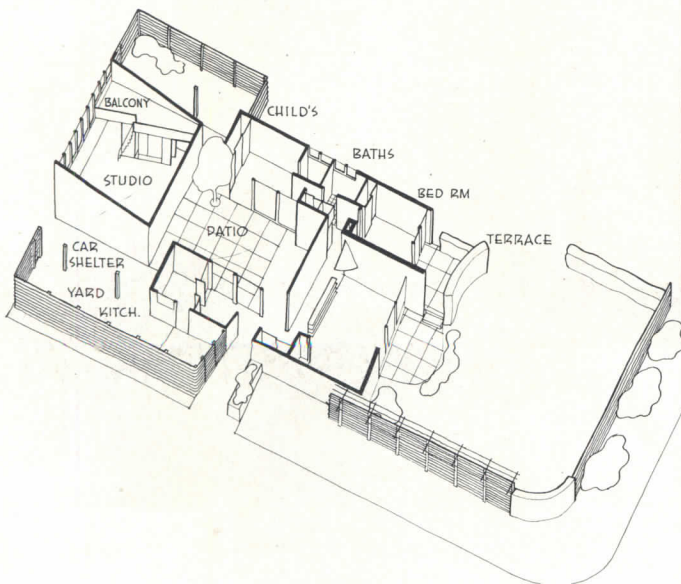
LIVING ROOM

# HOUSES



MAIN ENTRANCE is reached by a ramp; there are no changes in level throughout the house

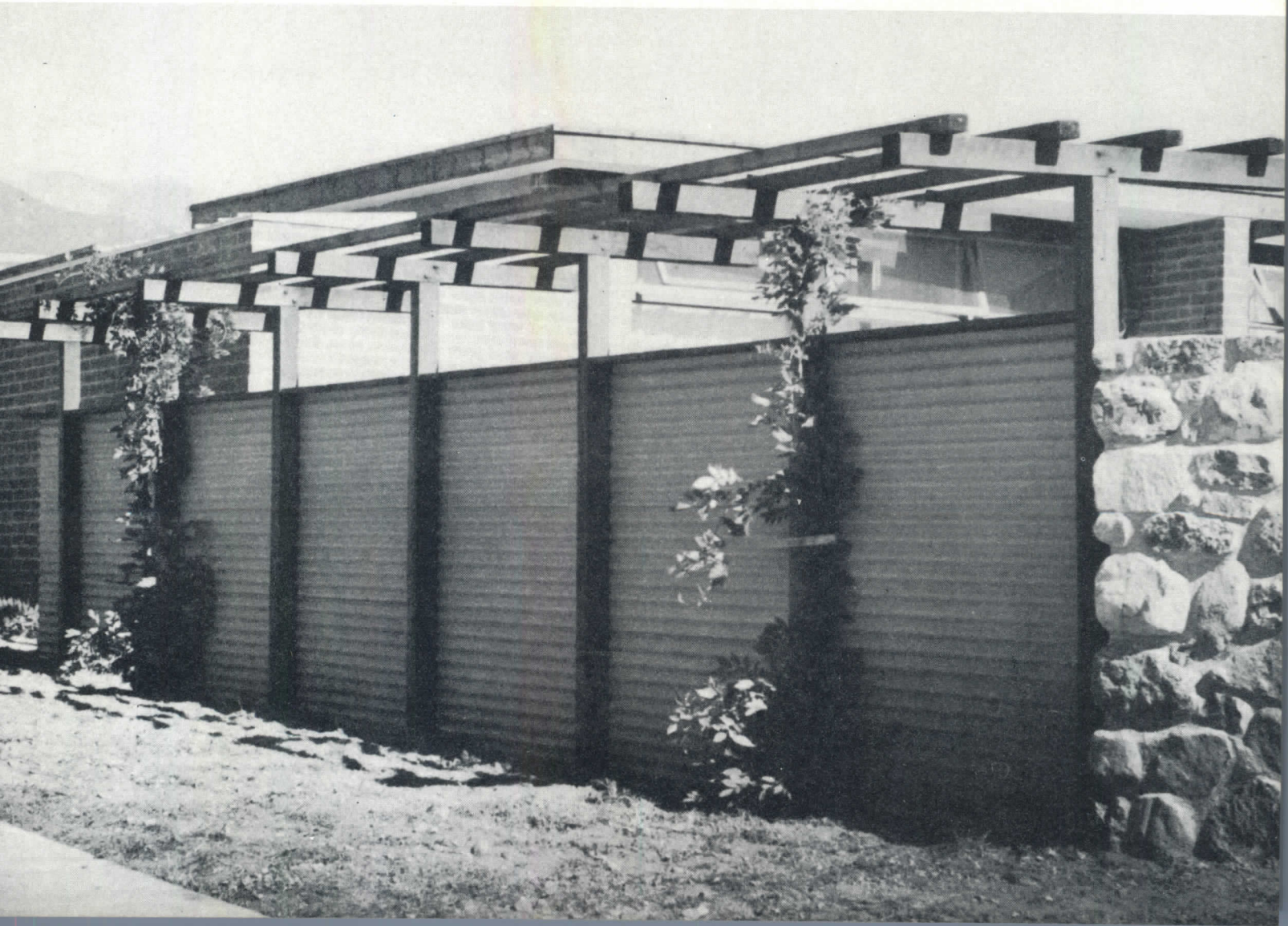
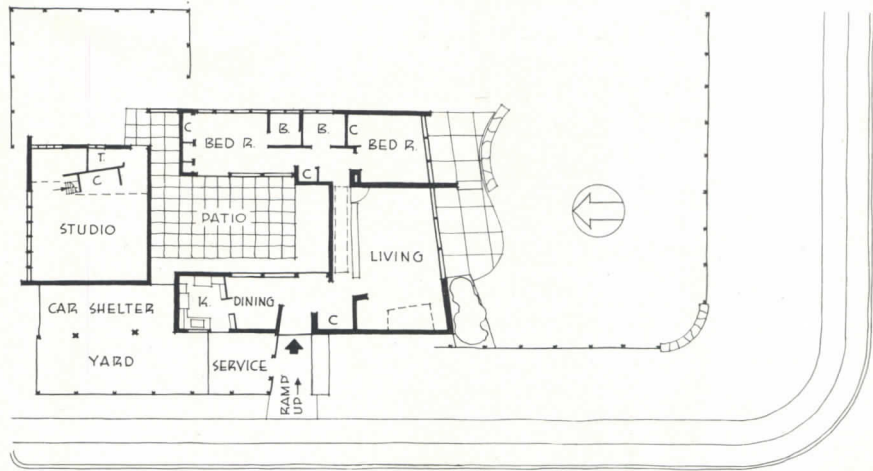
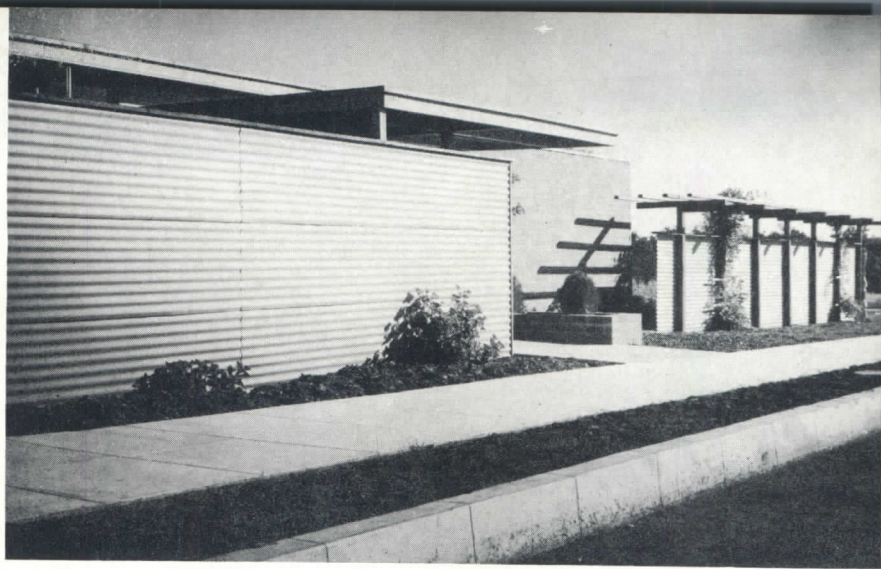
*Photos by Fred R. Dapprich*





## C. B. TROEDSSON, Architect

**THIS STUDIO-RESIDENCE IN CLAREMONT, CALIF.** for Mr. and Mrs. Milford Zornes provides privacy from the street and at the same time offers ample space for outdoor living. The studio is so located and equipped that it can be rented as a separate unit. Mr. Zornes, a painter, required wall space on which to hang his paintings; this is provided in the gallery (with skylight over), separated from living room by low bookshelves. Space for Mrs. Zornes' piano is provided at western end of living room, with skylight to left. Wall construction is stud with plaster or vertical shiplap redwood, and reinforced groutlock or brick construction. Roof ventilation is provided by continuous screen-covered openings under projecting eaves. Fence is of corrugated asbestos board, painted reddish brown.



C. B. TROEDSSON, ARCHITECT (continued)



TERRACE: looking from bedroom toward living room



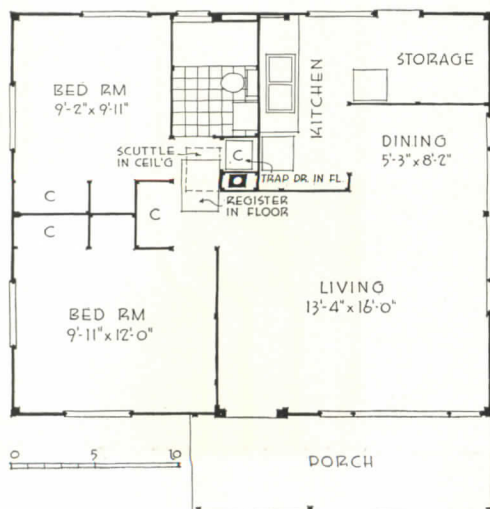
LIVING ROOM: A low bookcase partitions off the gallery where the owner shows his paintings. Note the flush skylight. At the right is a view of the opposite end of the room from which can be seen the terrace and garden





*Photo by Orville K. Blake*

**JOHN B. PIERCE FOUNDATION, Robert L. Davison, Director of Housing Research**  
**SKIDMORE, OWINGS & MERRILL, Consultant Architects**



MOST RECENT of the experimental, low-cost houses developed by the John B. Pierce Foundation is this "skeleton frame and curtain wall" house built by the Stansbury Corporation near Baltimore, Md. Two elements are of special news interest: 1. The structural system. 2. A rationalized construction procedure which assigns items to the shop or the field according to where they are most economically handled; yet which does not conflict with existing craft organizations. Such operations as sizing, notching, etc., are handled in the shop or mill; actual assembly of elements is made a field operation.

As in previous houses researched by the Pierce Foundation (AR 1/34; 8/35; 10/36 and 9/39), plan elements, materials and construction methods were determined only after exhaustive pre-analysis and test, with no interest in or bias in favor of any particular material, equipment or system per se.

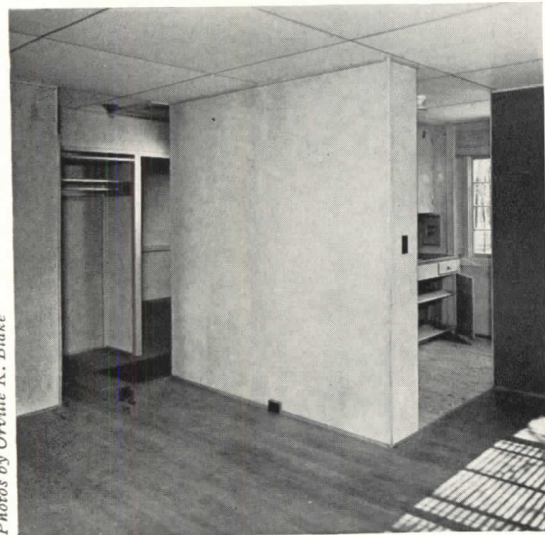
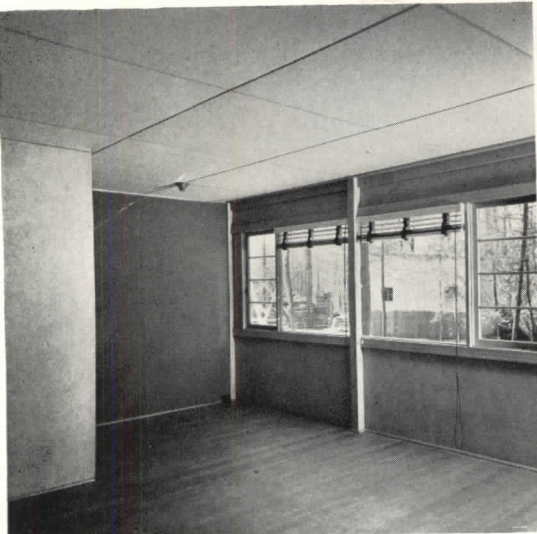
Detailing of the house for large-scale production required the development of an entire new type of drawing, combining architectural, structural and shop drawings, specifications and erection manual (see next page).

THE NEW HOUSE utilizes a skeleton frame to which a curtain wall is attached. Unlike a usual bearing wall of traditional materials, either shop or job assembled, or a heavy panel unit assembly requiring special means for support and attachment, the curtain wall in the Baltimore house is simply a material, as it comes from the factory. All necessary components—exterior weather surface, insulation, and interior finished wall surface—are integrated into this single structural board, which is made up of an insulation board core veneered in manufacture with a 1/8-in. sheet of asbestos-cement on both faces. For exterior walls, a board with a 1 1/2-in. insulation core is used; for interior partitions, the insulation core is 1/2 in. The use of this ready-made material instead of a curtain wall that must be assembled from a number of elements both materially reduces costs and overhead of a prefabricator, and simplifies and speeds erection.

Members of the frame—4-by-4-in. wood columns spaced 12 ft. on centers, built-up sills, and plywood girders—come from the mill pre-finished and pre-cut as to length, detail and profile. Sash and doors come from the manufacturer prefitted to frames for installation.

In arriving at the most economical use of materials, the Pierce Foundation concluded that the largest unit of a curtain wall material that is both convenient to use by hand labor at the site and that is generally commercially available is 4 by 12 ft. This explains both the 12-ft. centering of columns and the horizontal use of the board. Among advantages noted for the horizontal system:

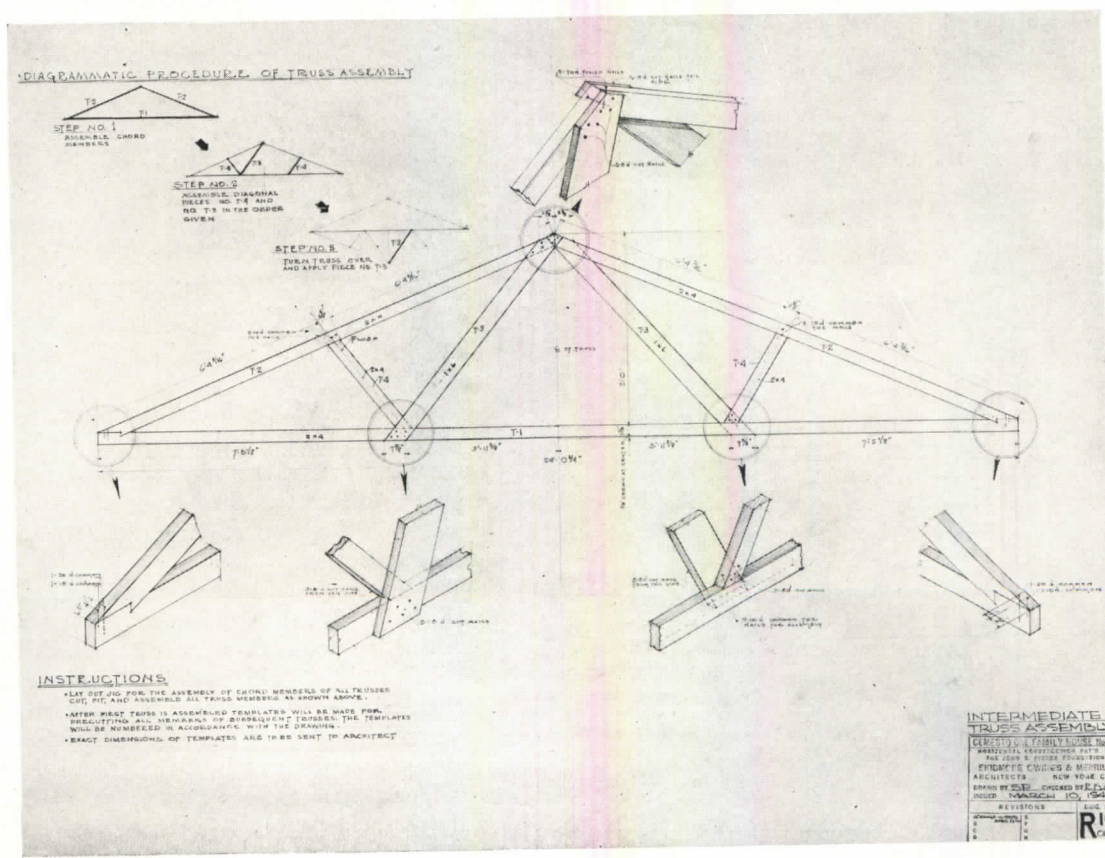
1. Use of maximum size of available curtain wall material in simple rectangular sizes; if used vertically, more cutting of odd shapes as well as greater number of joints would have been necessary.
2. The horizontal sill member in the frame allows the architect any width or arrangement of windows desired. Had the board been used vertically, window widths would be limited to multiples of the width of the material.

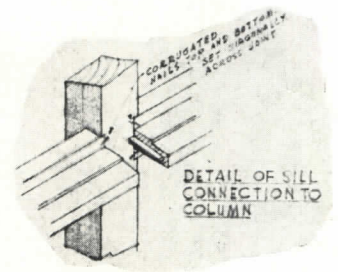
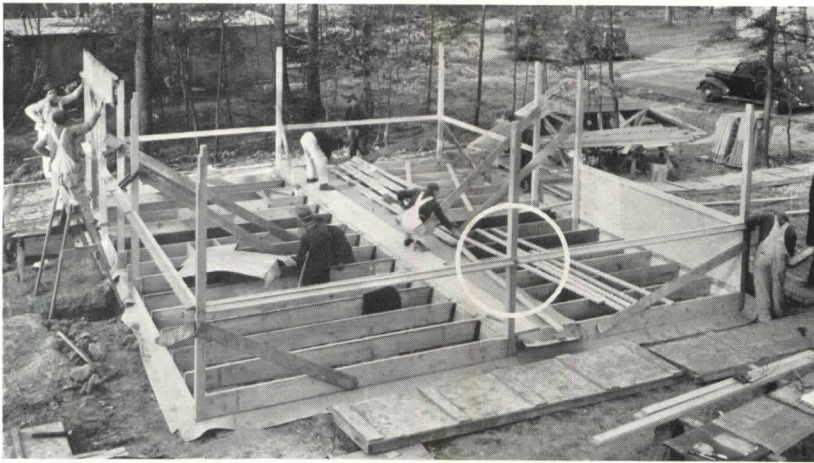


Photos by Orville K. Blake

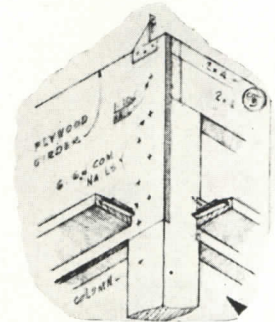
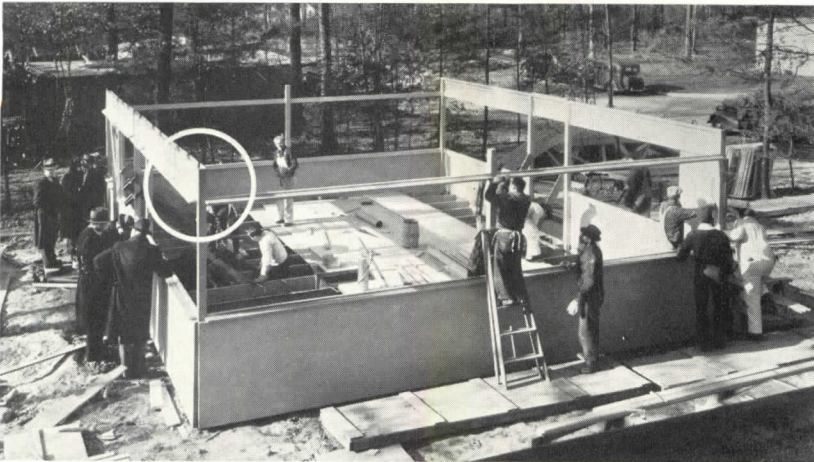
TYPICAL INTERIORS

TYPICAL ARCHITECT'S DRAWING — all details (many in isometric), assembly instructions and specifications are included on each sheet. Entire set of drawings—about 60 sheets—is divided into 7 sections: Foundation; Exterior erection; Interior erection; Rough lumber; Millwork; Shop details; and Contract drawings. Each section, printed in a different color, is used only by the trade or fabricator involved. All details shown on the two following pages are taken directly from the originals

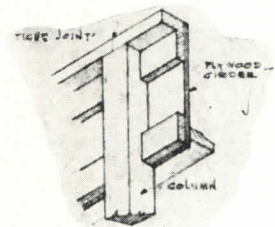
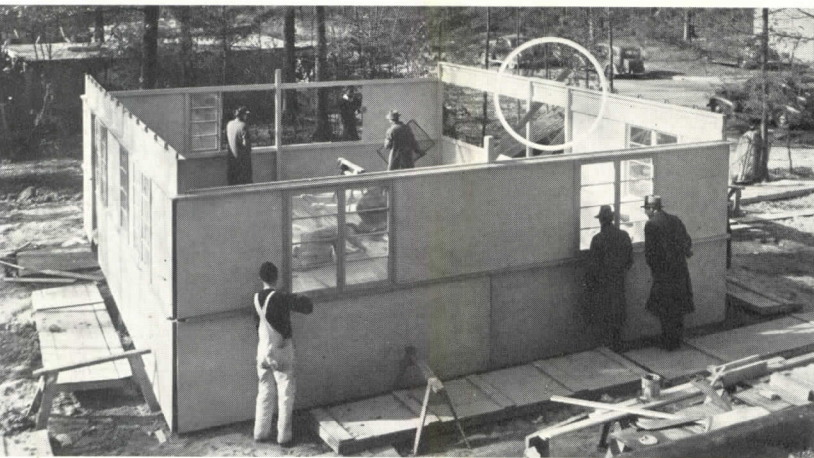




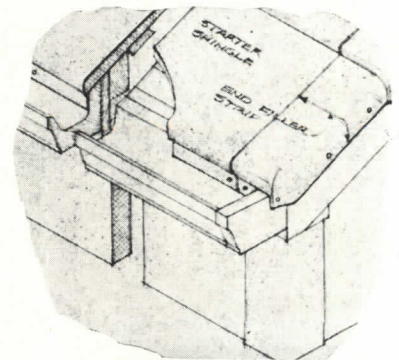
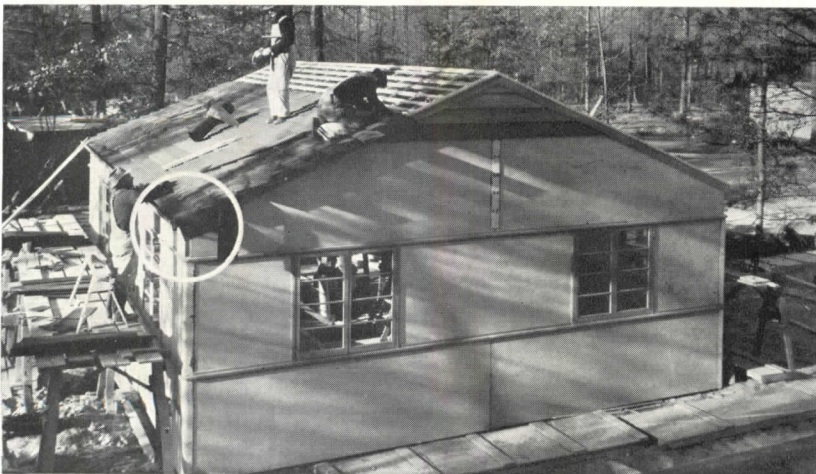
The skeleton frame is of 4-by-4-in. columns, sills and plywood girders



To this frame, the ready-made curtain wall material is attached

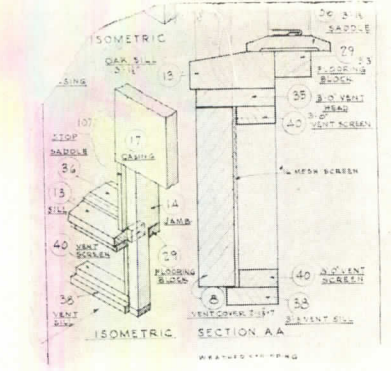


Sash and doors, prefitted to frames, are installed; joints are caulked

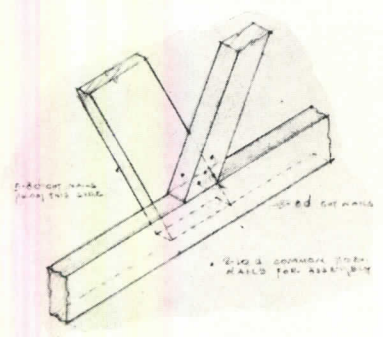
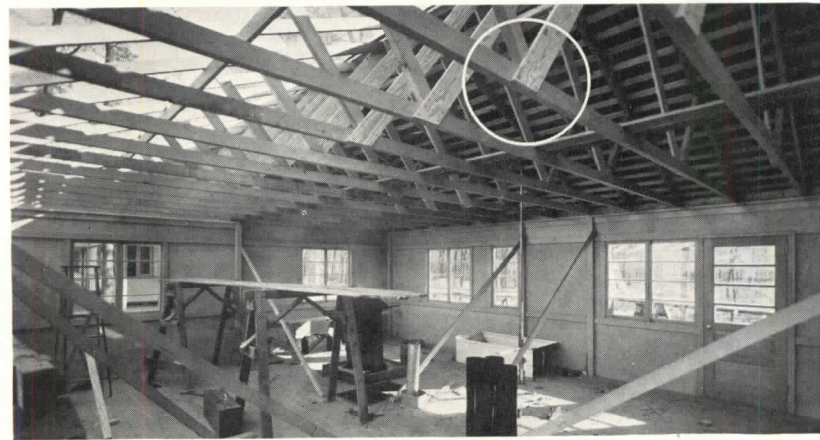


Wood trusses are erected. Heavy, asphalt-impregnated roofing, combining structural, insulation and waterproofing functions, applied on shingle strips. Gable end is a louvre vent

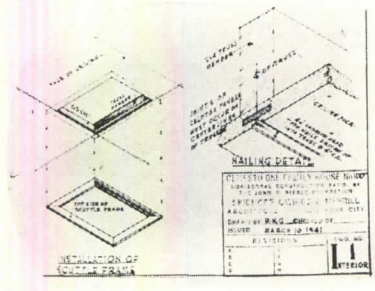
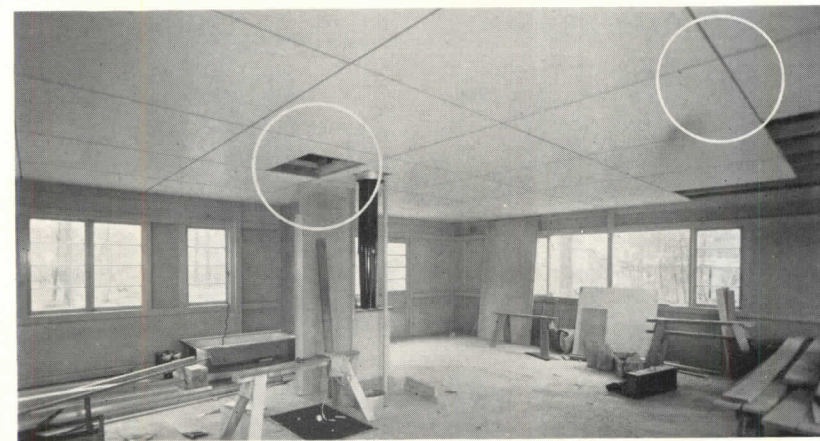
Photos by Eric J. Baker



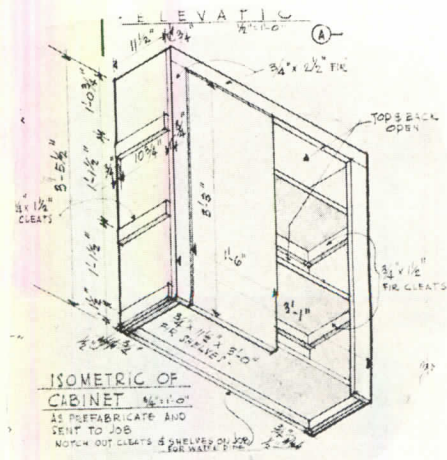
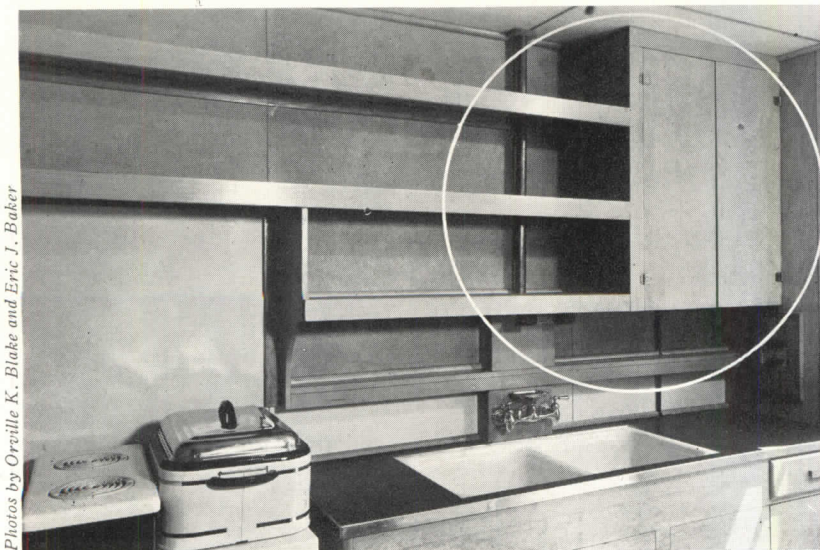
Interior view of wall elements in place



Attached to lower truss chords . . .



is a ceiling of insulation-board units



Cabinet work is precut for assembly

Photos by Oreville K. Blake and Eric J. Baker

# HOW SAFE IS THE HOME?

THE GENERALLY-ACCEPTED TRUISM that "home is the safest place" is nowadays cracking under an accumulating load of evidence to the contrary. Accidents in the home killed 32,000 people in 1939—a third of all accidental deaths, within 2 per cent of the number killed in motor accidents, and more than twice as many as were killed in industry. In addition, approximately 3,000,000 persons were injured in home accidents—about 375,000 of them suffering some permanent disability. Expressed in economic terms—wage loss, medical expenses, overhead cost of insurance—it is estimated that these accidents cost \$600,000,000; property loss in home fires amounted to an additional \$100,000,000. "As a cause of death and disability," says Dr. Donald B. Armstrong of the Metropolitan Life Insurance Co., "the home accident problem may significantly be compared with some of the hitherto major diseases of mankind, many of which have yielded to scientific control." Some idea of the epidemic proportions of the problem may be gathered from the fact that *home accidents are the eighth most important cause of death*—exceeded only by heart disease, cancer, cerebral hemorrhage, nephritis, pneumonia, tuberculosis and motor accidents!

## Human fallibility to blame?

What causes these accidents? How can they be reduced? For a clue to the answers to these questions the architect might turn to industry, where scientific research and control and preventive measures have resulted in a "69 per cent reduction in accident frequency and a 50 per cent reduction in accident severity in the period from 1926 to 1939 inclusive." Such facts indicate that the problem of home accidents can be objectively attacked and drastically reduced—but only from a similarly scientific point of view.

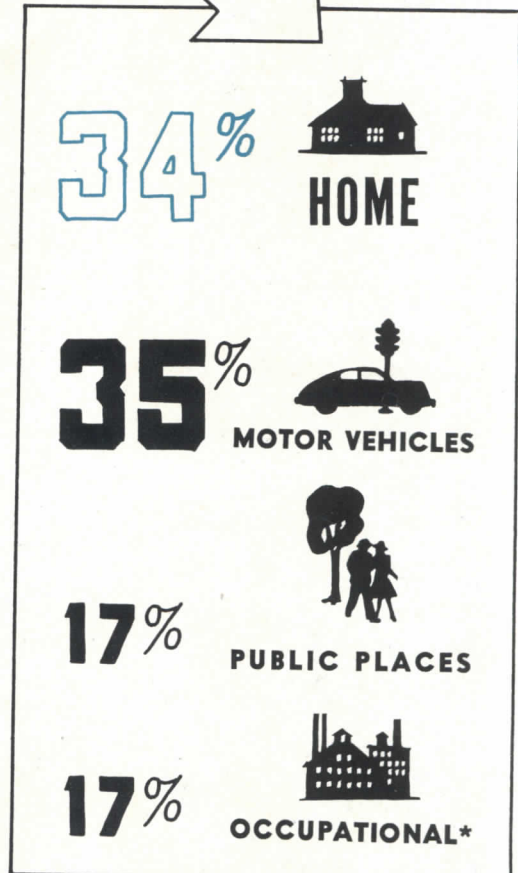
Naturally, no house can be 100 per cent accident-proof. The factor of human fallibility enters into the use of a house just as it does that of a motor car, so that intensive education of the home owner must parallel an increased safety factor in the design. But, in a statistical sense, the main burden of blame rests on the house, not the user. This is made clear by recent surveys (see charts, next page) which show that home accidents of a given type happen to people of given age and sex, while occupied with given tasks, at given places in the house.

There is, on the basis of available material, no way of telling whether the percentage of home accidents is higher in old houses than in new, or in non-architect designed houses than in those architect-designed. The chances are probably in favor of new, architect-designed structures. But even here the margin is not as large as might at first be expected. Figures seem to indicate that higher priced housing is only moderately less dangerous to users than the slums themselves (see next page).

## Safety is not accidental

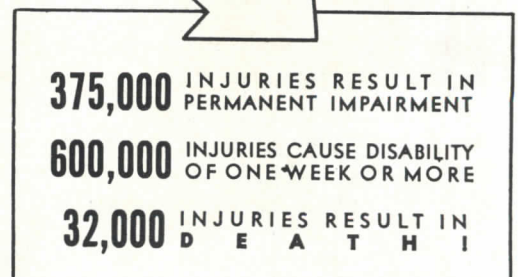
Many danger points in house design are unconsciously

PRINCIPAL CLASSES OF ACCIDENTAL DEATHS

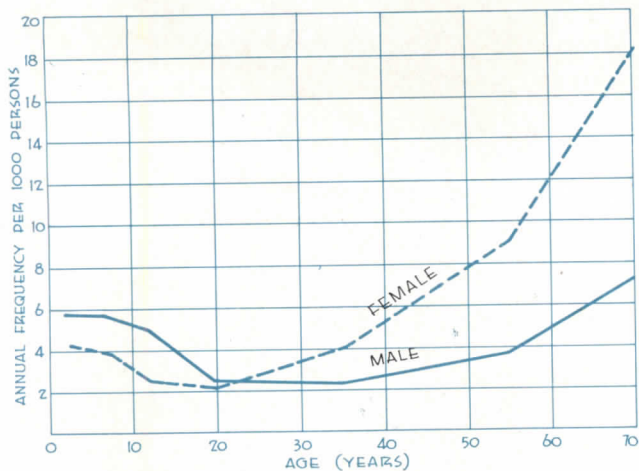


\* Occupational and motor vehicle duplication 3%.

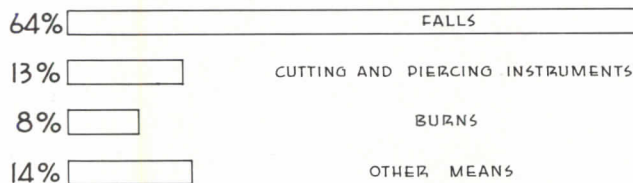
3,032,000 TOTAL ACCIDENTS IN THE HOME



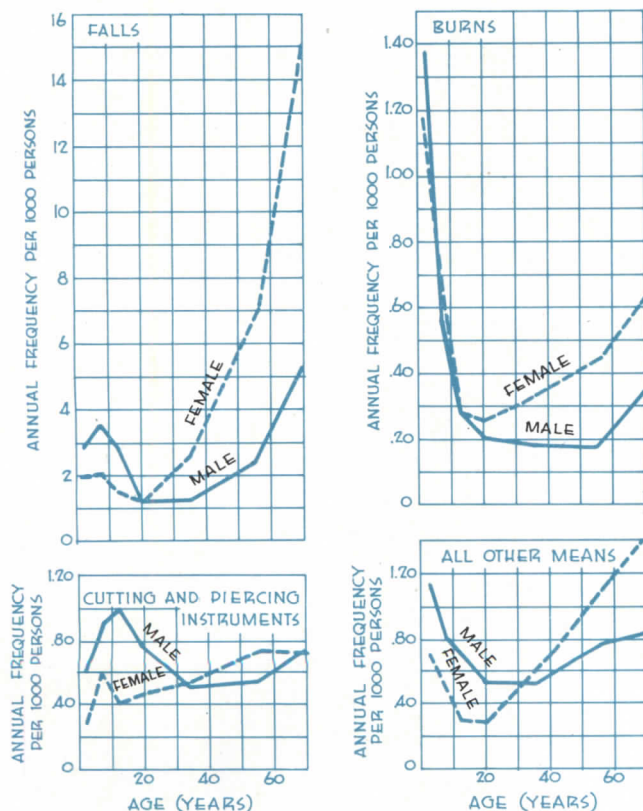
Source: National Safety Council.



**ANNUAL FREQUENCY (per 1,000 persons) OF HOME ACCIDENTS DISABLING FOR A WEEK OR MORE.** Note that after 20 years—i.e., the age when most women become housekeepers—the rate for women overtakes that of men. Earlier lead of males is probably due to fact boys are more active and adventurous than girls\*



**TWO-THIRDS OF ALL ACCIDENTS DISABLING FOR A WEEK OR MORE ARE DUE TO FALLS,** which indicates that movement—under even the best conditions—is a dangerous operation. Here, as on the highway, scientific "traffic planning" is in order\*



**ACCIDENTS IN THE HOME ARE BY WAY OF BEING "OCCUPATIONAL" IN NATURE** where adult women are concerned. Notice for example how sharply their curve on burns (top, right) overtakes and passes that of men at 20 years\*

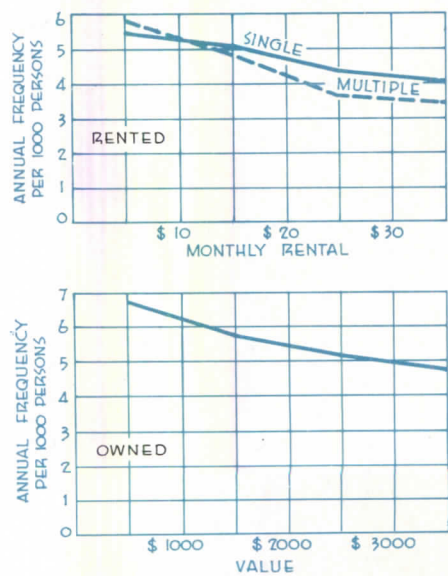
avoided by a good architect without his being conscious of the safety issue per se. But many other danger points remain because of the same approach. Accidents in the home are the result of characteristic movements and processes which require the closest scrutiny by the architect if they are to be prevented. This does not always imply change in the design. Thus an interior stairway may be inherently dangerous because it is steep, slippery, badly lighted or winding; but it may also be dangerous because the only phone is at its foot and the housewife is always in a hurry when running down to answer it. The first instance might indicate need for redesign of the stair; the latter might indicate need for two phones. Another set of factors for which the architect can only indirectly be held responsible are collisions with furniture in a dark bedroom or stumbling over toys in the living room (both statistically important as a source of injury). In the first case, if the architect's plan anticipates the necessary furniture, it will largely determine its placement. In the second case, if he provides supervised play space or (at the minimum) storage space for toys, the child is much likelier to be taught to put his toys away.

**Safety is cheaper in the long run**

The fact is that it is the architect, and the architect alone, who determines the "safety factor" of the house. The manufacturer of a non-slip flooring material or an efficient lighting fixture can only produce the product; it is the architect who decides whether or not to use it and, if so, how. Although the initial cost of many safety features may be higher, in the long run they cost less. This is true not only in a general statistical sense (such as Dr. Armstrong's estimate of \$600,000,000 annual loss), but in a concrete and specific way (such as USHA's 98 per cent reduction in costs of liability insurance and 59 per cent reduction in fire insurance). Safety can be made to pay its way!

\*Source: "Home Accidents as Recorded in the National Health Survey" by Britten, Klebba and Hailman. Public Health Reports, Vol. 55, No. 45, November 1940.

†Source: "Certain Characteristics of Urban Housing" by Britten, Brown and Altman. Milbank Memorial Fund Quarterly, Vol. XVIII, No. 2, April 1940.



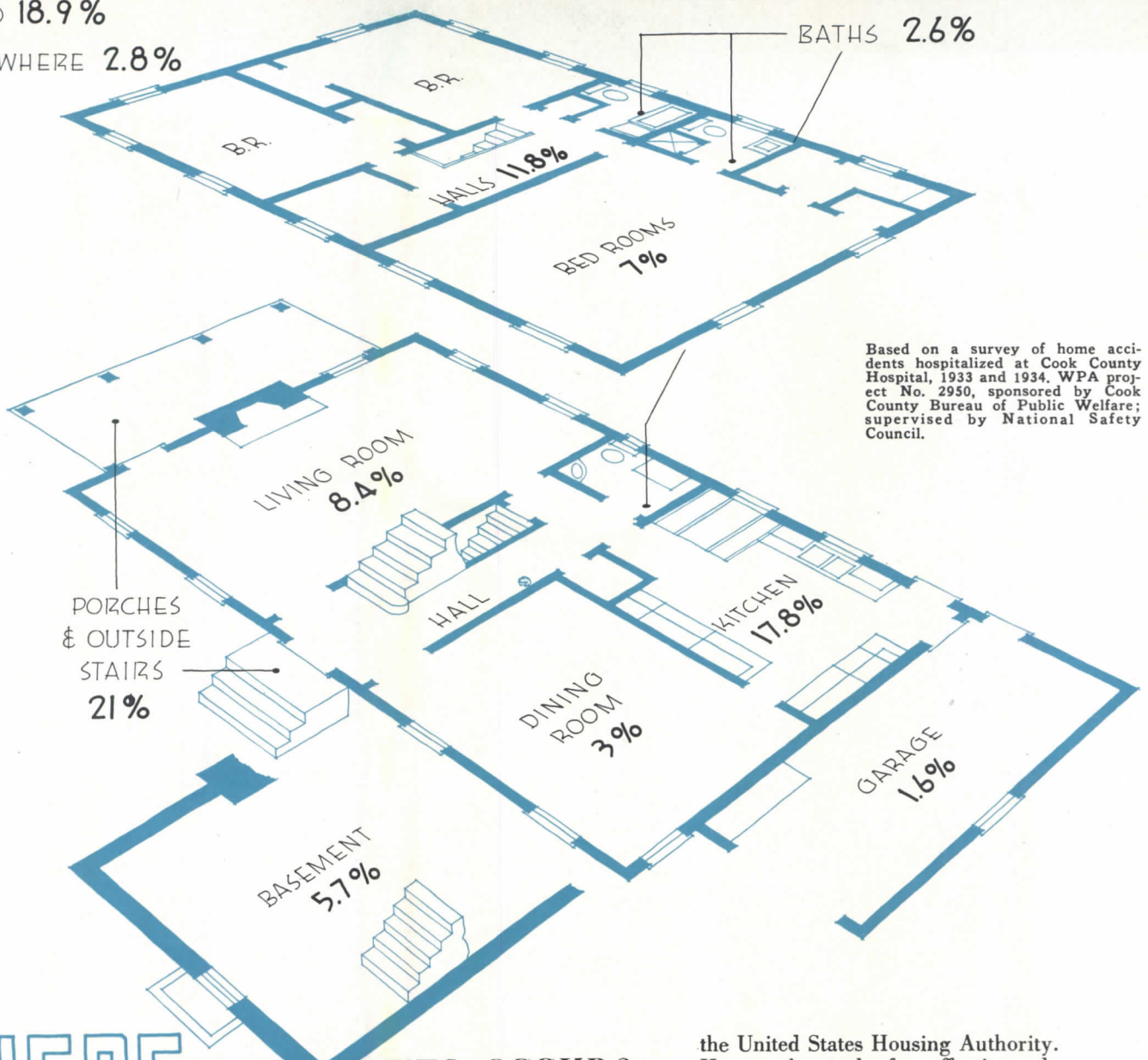
**THE MORE EXPENSIVE HOME OR APARTMENT IS NOT NECESSARILY SAFER THAN ITS CHEAPER COUNTERPART.** This would seem to indicate that safety depends as much upon the way in which the house is designed as upon the materials out of which it is built†



YARD 18.9%

ELSEWHERE 2.8%

BATHS 2.6%



Based on a survey of home accidents hospitalized at Cook County Hospital, 1933 and 1934. WPA project No. 2950, sponsored by Cook County Bureau of Public Welfare; supervised by National Safety Council.

## WHERE DO ACCIDENTS OCCUR?

NOT ALL AREAS of the house are equally dangerous, nor are the various types of accidents evenly distributed through the house. Thus outside stairs and porches are over seven times as dangerous as the bathroom, while falls are twice as prevalent on outside stairs and porches as in the bathroom. This of itself constitutes impressive proof that accidents in the home are not due merely to "human nature" but to very specific factors which can be anticipated and largely eliminated by the canny architect. Where there's an accident there's a reason; and this reason may be partly due to what experts in the field call "unsafe conditions" and partly to "unsafe practices." Here reference to industrial experience may come in handy. In industrial safety work, percentages and types of accidents are correlated with the type of work being done in those departments. Three major factors are investigated: the condition of the building itself;

the process carried on in the building; and the practice of the workers. Reduction of the accident rate may involve any or all of the three.

The same analysis may be fruitfully applied to residential design. What characteristic processes are carried on in a kitchen? To what extent can the design of the room itself increase its safety (omission of live storage space above eye-level, inclusion of electric dishwasher, etc.)? To what extent can the process itself be made safer (e.g., elimination of deep fat frying or washing of cutlery by hand)? And to what extent must the housewife herself learn safe practices in housework (to cut bread *away* from the body, to keep poisonous or explosive chemicals clearly marked and closely locked)?

In the first two categories the architect is clearly in a position to reduce accidents, although the only large scale opportunity to apply this technique in the building field has been in

the United States Housing Authority. Here, as the result of an effective code of safety standards in design and construction, an exceptionally favorable safety record has been established as compared with average annual frequencies:

General accident rate per thousand—4.65  
 USHA accident rate per thousand—1.85  
*i.e., a 61% reduction!*

Investigation showed that a further reduction in accidents of 31 per cent and in fires of 59 per cent might have been achieved by safer planning and designing.\*

"Ordinary care in eliminating physical hazards in buildings is not adequate protection," says the Greater New York Safety Council. "*Extraordinary care, constant inspection, prompt maintenance and repair* are required to assure the minimum . . . personal injuries." Thus, in the following pages, are presented detailed suggestions for raising the safety factor of the average American home.

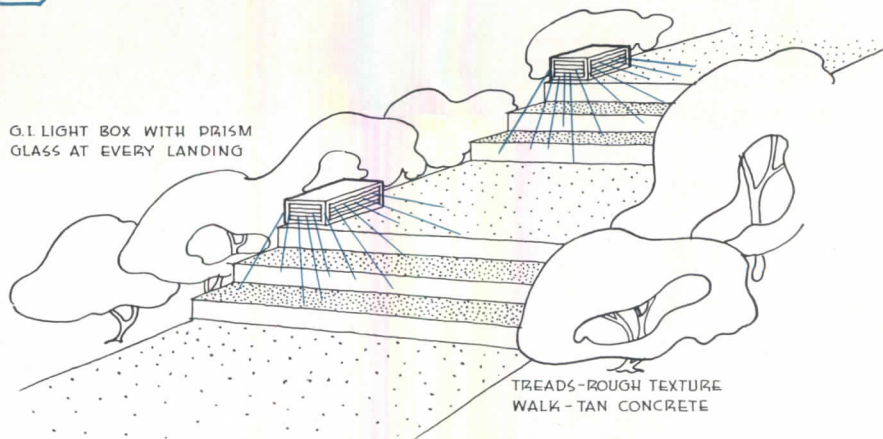
\*Results of USHA's experience in this field are summarized in an excellent new pamphlet *Planning for Safety*, recently published by the Authority, and source of many of the specific suggestions in this study.

# HOW SAFE IS THE YARD

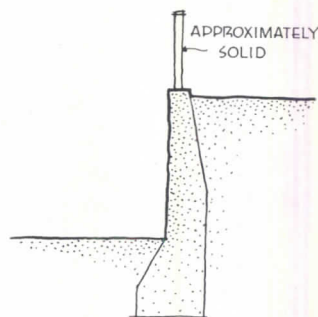
## PERCENT OF ALL ACCIDENTS 18.9%

<b>Falls</b> .....	<b>72.8</b>
on stairs .....	.7
on floors .....	.3
on rugs .....	.7
on walks or ground .....	27.9
from chairs, tables .....	.4
from windows .....	.7
from ladders or scaffolds .....	4.2
from fences .....	7.4
from other outside elev. ....	17.2
over objects .....	10.4
in or out of bed .....	1.2
all others .....	2.4
<b>Struck by flying, falling objects</b> ..	<b>5.6</b>
<b>Stepping on, striking</b>	
<b>against object</b> .....	<b>5.8</b>
coll. with inanimate obj. ....	
nail or splinter .....	
needles, pointed objects .....	
<b>Handling, lifting, carrying</b> .....	<b>2.9</b>
<b>Burns, scalds, explosions</b> .....	<b>3.7</b>
by gasoline, cleaners .....	
by steam, hot liquids .....	
all others .....	
<b>Asphyxiation, suffocation</b> .....	
<b>Firearms</b> .....	<b>.9</b>
<b>Poison (excl. poisonous gas)</b> ....	
by food .....	
all others .....	
<b>Cut or scratch</b> .....	<b>3.2</b>
<b>Bitten by animals</b> .....	<b>.5</b>
<b>Foreign bodies</b> .....	<b>.5</b>
<b>Hand caught in wringer</b> .....	
<b>All others</b> .....	<b>4.1</b>

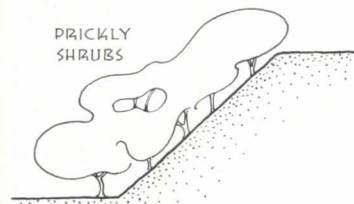
Source: National Safety Council.



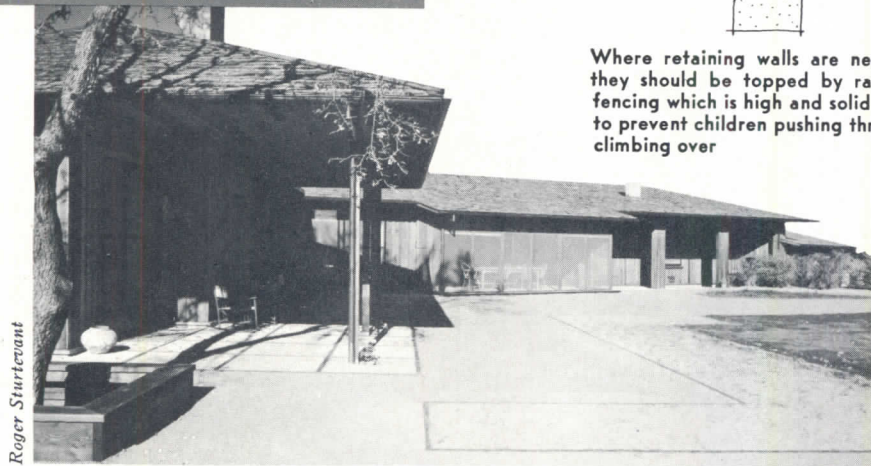
Where topography makes outside stairs necessary, an arrangement such as this is a definite safety factor—short flights of easy stairs, lighted from below eye level, and interspersed with platforms. John E. Dinwiddie, Architect



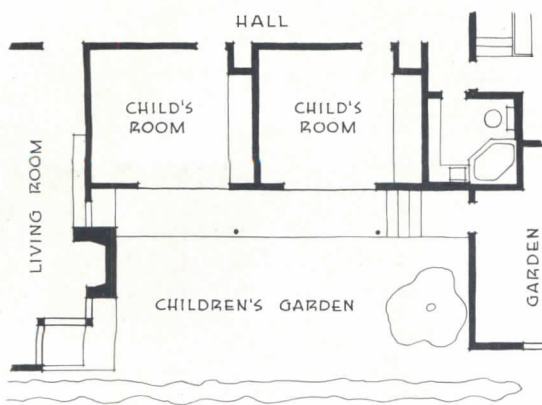
Where retaining walls are necessary, they should be topped by railing or fencing which is high and solid enough to prevent children pushing through or climbing over



Terracing is a much safer way of handling sharp changes in contours. Prickly shrubs will discourage "short-cuts," reduce maintenance and prevent erosion



Elimination of any small, sharp changes in grade, in yard around living areas, is important—especially where the plan is "open." William Wilson Wurster, Architect



Protected play area, easily supervised from house, is biggest safety factor where small children are concerned. Gregory Ain, Designer

**THE YARD**—The location of almost one-fifth of all home accidents is precisely that area over which the architect all too often has no control—the yard. He usually determines the location of the house, and its immediate relation to the ground around it; but the development of the plot is too often left to chance. In general the same rules—separation of function, provisions for traffic, careful design where abrupt changes in level occur, adequate lighting of walkways—apply as to the design of the house itself.

**PLAYSPACES**—In spite of the fact that there are children in most single-family houses, special areas are seldom set aside for their play in the plot plan. The majority of accidents occurring "outside the house" involve young children, for whom there is no real alternative to supervision. Such areas should thus be located so that they can be observed from the house, and should preferably be level and free from obstructions. If equipment is included regular playground standards should be observed both in design and placement.

**FIRE**—In those parts of the country where dry seasons occur, or in many rural locations, brush and grass fires represent a real safety hazard. In such cases, development of the grounds should provide for an easily-maintained "fire belt" around the house.

# HOW SAFE IS THE GARAGE

## PERCENT OF ALL ACCIDENTS 1.6%

<b>Falls</b> .....	<b>25.9</b>
on stairs .....	1.2
on floors .....	3.7
on rugs .....	
on walks or ground .....	
from chairs, tables .....	
from windows .....	
from ladders or scaffolds .....	6.2
from fences .....	
from other outside elev. ....	7.4
over objects .....	7.4
in or out of bed .....	
all others .....	
<b>Struck by flying, falling objects</b> ..	<b>27.2</b>
<b>Stepping on, striking</b>	
<b>against object</b> .....	<b>14.8</b>
coll. with inanimate obj. ....	6.2
nail or splinter .....	6.2
needles, pointed objects .....	2.4
<b>Handling, lifting, carrying</b> .....	<b>9.9</b>
<b>Burns, scalds, explosions</b> .....	<b>8.6</b>
by gasoline, cleaners .....	6.2
by steam, hot liquids .....	
all others .....	2.4
<b>Asphyxiation, suffocation</b> .....	<b>2.5</b>
<b>Firearms</b> .....	
<b>Poison (excl. poisonous gas)</b> .....	
by food .....	
all others .....	
<b>Cut or scratch</b> .....	<b>4.9</b>
<b>Bitten by animals</b> .....	
<b>Foreign bodies</b> .....	
<b>Hand caught in wringer</b> .....	
<b>All others</b> .....	<b>6.2</b>

Controls for garage doors which are operated by or from the car may prevent many a fall on icy pavements



ALTHOUGH RELATIVE TO OTHER AREAS of the house, few accidents occur in the garage, it is the scene of many fatal accidents—notably those caused by carbon monoxide poisoning — and serious accidents caused by fires and falls.

**GOOD VENTILATION** is naturally the best guarantee against monoxide poisoning. In most parts of the country this is a simple matter—open sides (“carport”), open eaves or louvered gable ends. In more severe climates, natural ventilation may not be desirable. Here, easily or perhaps mechanically operated doors are the surest guarantee that

owner will open them before starting motor.

Spontaneous combustion often occurs in oily wastes, while greasy floors cause both bad falls and bad injuries. Adequate space for storage and repair should encourage “safer practice” on the owner’s part, while a fireproof floor with drain whose surface is the equivalent of sand float or scored concrete, should reduce falls and fires.

**SPECIAL CARE** should be taken, in laying out drives and turn-arounds, that easy grades and maximum visibility are obtained. Many automobile accidents occur right in the yard.

**OLD TREES** which are not sound and/or not checked by competent tree surgeons constitute another hazard, if close enough to strike the house in falling — either from lightning, wind- or ice-storms.

**STORAGE FOR GARDEN TOOLS** is important. Many serious falls occur from tripping over garden tools; an upturned rake is particularly dangerous. Racks should be located for this equipment in a convenient spot.

**GARDEN POOLS** are dangerous where there are young children, who have been known to fall in, striking their heads against rocks and drowning before regaining consciousness. Heavy bird baths and statuary likewise present hazards unless firmly secured to a base which is likewise firmly anchored in the ground.

**WHERE STEEP GRADES** are involved terraces are safer than retaining walls; they may be planted with prickly shrubs to discourage short cuts, hold soil, and reduce maintenance. Where grade difference is considerable, retaining walls should extend above upper level, or be topped with fencing or chains. Railings and fences should be designed to discourage children climbing or squeezing through them. Never use “barbed wire” or low inconspicuous wires to deflect

traffic; instead use clearly visible fencing.

**ALL GUY WIRES** for newly planted trees should have white markers.

**THE NUMBER** of outside steps should be held to a minimum. House and open areas should be arranged to reduce the number of slopes and abrupt changes in grade which will necessitate steps. House plans can frequently be adapted to sloping sites in such a way as to substitute interior stairs for outside steps.

### WALKS

1. *Proper pitch for drainage* both lengthwise and crosswise. The crosswise slope should never exceed ½ in. per ft. A slope of ¼ in. per foot is recommended.

2. *Careful location of catch basins.* The gratings should not be located within the walk proper but in a depressed area 2 ft. or more from the walk. Top of gratings should be approximately 3 in. below the walk level.

3. *Conservative slopes.* Steep slopes are hazardous, especially on the north side of buildings where walks are more likely to be covered with ice or snow.

4. *Careful location of walks in relation to downspouts.* Water should not drain directly across walks, particularly in localities where frequent freezing may occur.

5. *Nonslip walk surfacing.* This should be comparable in finish to sand float or scored

cement. Concrete surfaces should not be sprinkled with neat cement during finishing and should not be steel-trowel finished. Surfacing with open joints in which high heels might catch should not be used.

### STEPS

1. *Conservative gradients.* Outside steps should be no steeper than 10 in. tread and 7½-in. rise.

2. *Uniform ratio of tread width to riser height* for each flight of steps, and for all steps in the same general area.

3. *Elimination of short step run.* Steps should be provided only where three risers or more are necessary. A sloping walk of low gradient can be used where the change in grade would otherwise require only one or two steps.

4. *Handrails and landings* for long step runs and where special protection is needed. Grass areas are desirable adjacent to steps which are not protected by handrails.

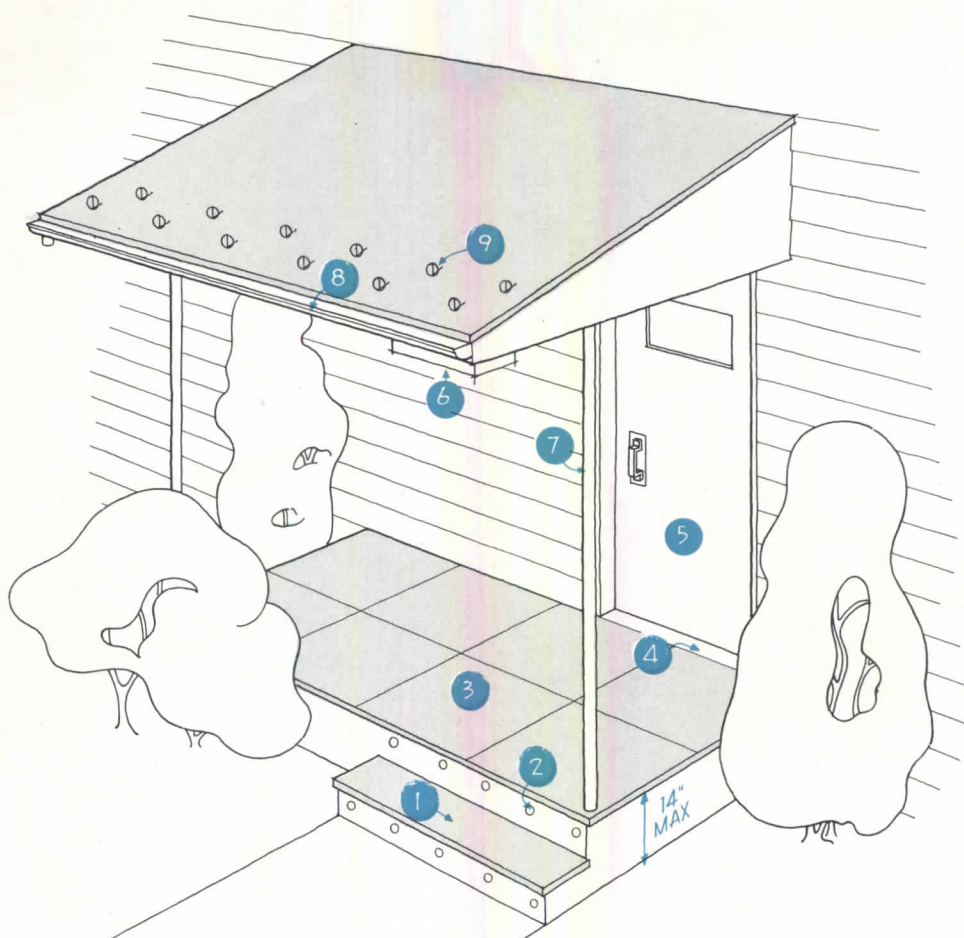
5. *Nonslip treads.* Step surfaces should be finished in the same manner as walk surfaces: a finish comparable in traction to sand float or scored cement.

Ramp slopes should not be steeper than 1 to 8 and the surfaces should be nonslip. Combination stairs and ramps are not desirable. Ramps should be provided with hand-rails. Windows with out-swinging sash should not be located over ramps.

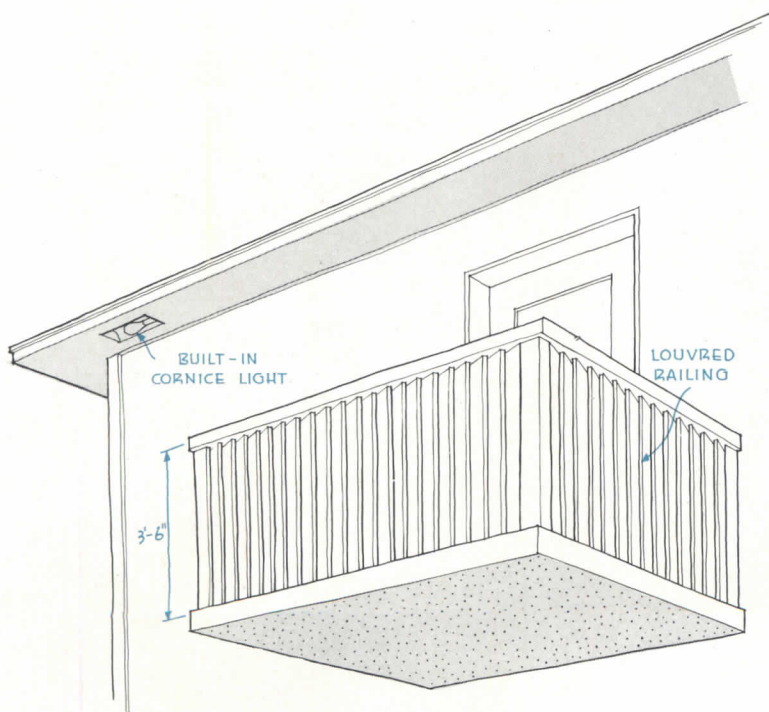
# HOW SAFE IS THE PORCH

PERCENT OF ALL ACCIDENTS **21.0%**

<b>Falls</b> .....	<b>92.2</b>
on stairs .....	60.2
on floors .....	3.5
on rugs .....	.2
on walks or ground .....	.5
from chairs, tables .....	.6
from windows .....	.4
from ladders or scaffolds .....	.8
from fences .....	.1
from other outside elev. ....	24.0
over objects .....	1.4
in or out of bed .....	.3
all others .....	.2
<b>Struck by flying, falling objects</b> ..	<b>.8</b>
<b>Stepping on, striking</b>	
<b>against object</b> .....	<b>3.1</b>
coll. with inanimate obj. ....	1.6
nail or splinter .....	1.1
needles, pointed objects .....	.4
<b>Handling, lifting, carrying</b> .....	<b>.7</b>
<b>Burns, scalds, explosions</b> .....	<b>.6</b>
by gasoline, cleaners .....	.4
by steam, hot liquids .....	.1
all others .....	.1
<b>Asphyxiation, suffocation</b> .....	<b>.1</b>
<b>Firearms</b> .....	<b>.1</b>
<b>Poison (excl. poisonous gas)</b> ....	<b>.3</b>
by food .....	.3
all others .....	.3
<b>Cut or scratch</b> .....	<b>.7</b>
<b>Bitten by animals</b> .....	<b>.2</b>
<b>Foreign bodies</b> .....	<b>.2</b>
<b>Hand caught in wringer</b> .....	<b>.1</b>
<b>All others</b> .....	<b>.9</b>



1. Hold number of steps to minimum, with approx. 7 1/2-in. riser to 10-in. tread. Non-slip, light-colored surface.
2. Counter-sunk reflectors.
3. Non-slip, level surface.
4. Minimum change in level at door.
5. No glass at bottom or pushing area of door.
6. Downlighting for steps.
7. Posts difficult for children to climb.
8. Gutter.
9. Snow guards for cold climates.

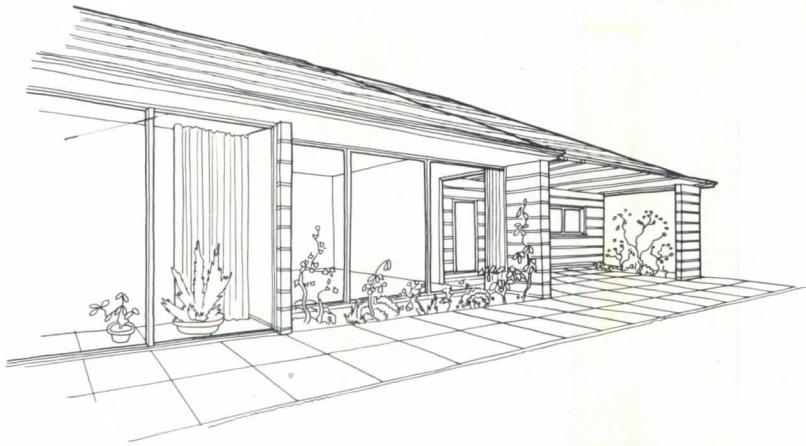


Where ventilation is a problem, balcony railings might be of vertical louvers; where solid materials would cut off necessary light, wire-glass railings might be substituted. Note combined yard and burglar light in cornice

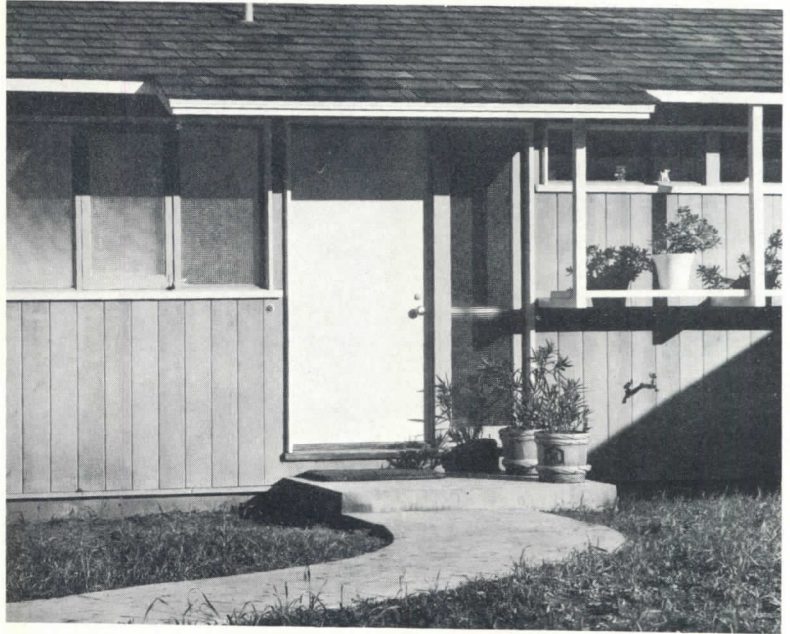
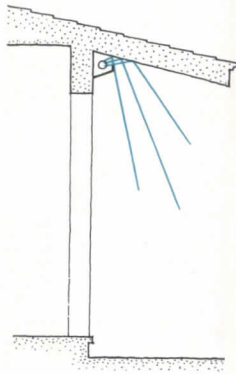
THE PORCH AND OUTSIDE STAIR are the scene of 21 percent of all home accidents—they are, in other words, the most dangerous elements in the house. Moreover, 92 percent of these accidents are due to falls, which indicates that the architect's chief problem is one of "traffic control." Here three factors are of crucial importance: (1) absolute minimum in grade changes; (2) non-slip, protected stairs; and (3) adequate lighting for porches, stairs and walks.

**ENTRANCE PLATFORMS**, according to USHA, should be only *one step* above grade. Where this is not possible, stairs and platforms should have railings, and should be protected from rain, sleet and snow. Porch and stoop roofs should be equipped with gutters and—in areas where snow is heavy—snow guards.

**SECOND FLOOR PORCHES** and balconies should have toe boards and high railings. These should be designed to discourage children from climbing over or pushing through them.



Here differentials in floor and terrace levels are held to a minimum while glass wall of living and dining rooms lights the entire area. John Ekin Dinwiddie, Architect

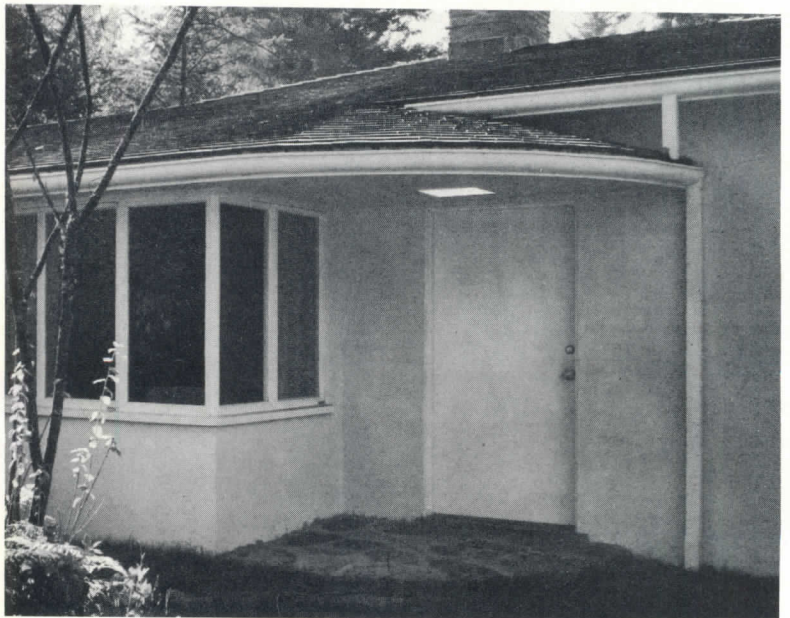


This entrance meets most requirements for safety — indirect lighting, solid wood door, protected platform and step, minimum number of steps. Door sill might have been somewhat lower, since average person does not expect a change in floor level which comes right at door. John Ekin Dinwiddie, Architect

**PORCHES AND TERRACES** should also be at or very near finished floor level. Rough flagging or brick paving which might catch high heels should be avoided in areas where traffic is heavy.

Where porches are screened, they should have sturdy railings and frames, since insecurely fastened screens often give a deceptive sense of security.

**ADEQUATE LIGHTING** of porches, platforms and steps should be of conservative intensity but wide distribution. A bright, unshielded bulb at or near eye level may prove more hazardous than none at all, especially if located so that one walks into it. The use of built-in eave lights — already widespread in some parts of the country as a protection against burglary — are also a safety measure since, if properly designed, they can illuminate the entire yard. Small reflectors (such as used on highway signs) counter-sunk in walks or steps are another economical safety measure.



Another entrance where accident hazard is reduced to minimum — built-in down-lighting, solid door, guttered roof, 4-in. differential between floor and grade. Van Evert Bailey, Architect

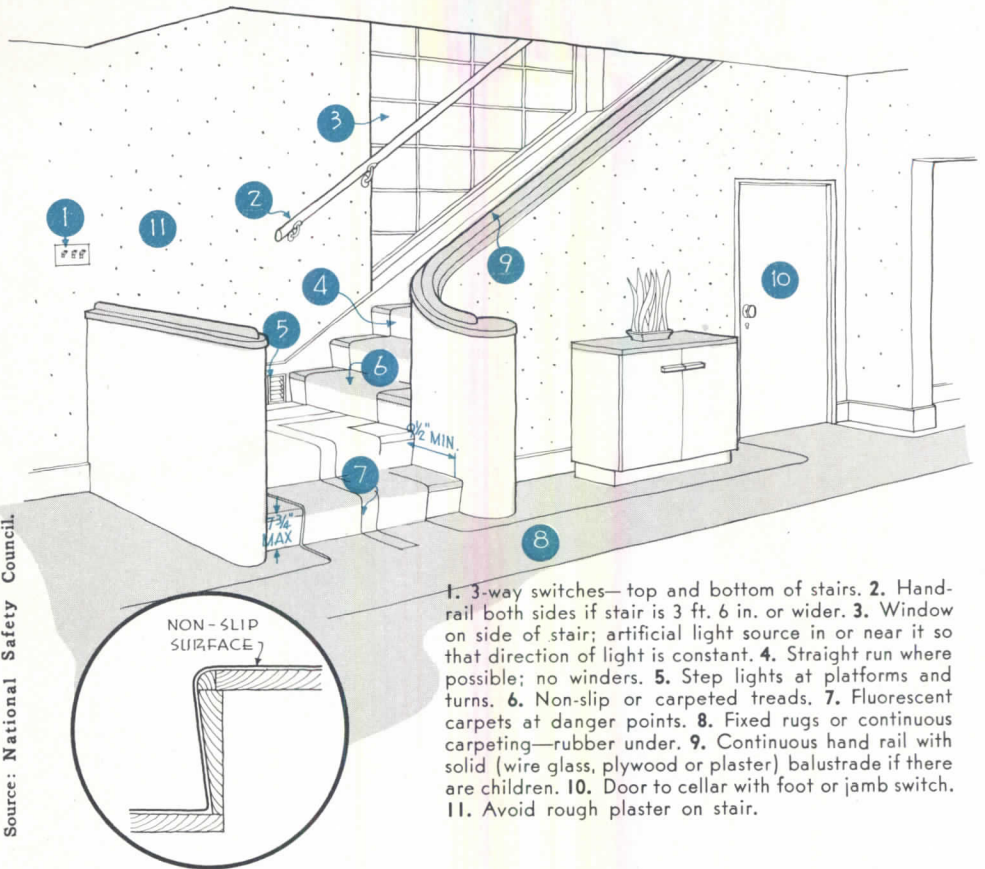
Roger Sturtevant

# HOW SAFE IS THE INSIDE STAIR AND HALL

PERCENT OF ALL ACCIDENTS **11.8%**

<b>Falls</b> .....	<b>92.3</b>
on stairs .....	80.3
on floors .....	3.8
on rugs .....	2.4
on walks or ground .....	.7
from chairs, tables .....	
from windows .....	1.1
from ladders or scaffolds .....	1.1
from fences .....	
from other outside elev. ....	.2
over objects .....	1.8
in or out of bed .....	.4
all others .....	.5
<b>Struck by flying, falling objects</b> ..	<b>.9</b>
<b>Stepping on, striking against object</b> .....	<b>2.4</b>
coll. with inanimate obj. ....	1.1
nail or splinter .....	.5
needles, pointed objects .....	.8
<b>Handling, lifting, carrying</b> .....	<b>.5</b>
<b>Burns, scalds, explosions</b> .....	<b>.8</b>
by gasoline, cleaners .....	.2
by steam, hot liquids .....	.2
all others .....	.4
<b>Asphyxiation, suffocation</b> .....	<b>.8</b>
<b>Firearms</b> .....	<b>.8</b>
<b>Poison (excl. poisonous gas)</b> .....	<b>.8</b>
by food .....	
all others .....	
<b>Cut or scratch</b> .....	<b>.8</b>
<b>Bitten by animals</b> .....	<b>.8</b>
<b>Foreign bodies</b> .....	<b>.8</b>
<b>Hand caught in wringer</b> .....	<b>.8</b>
<b>All others</b> .....	<b>1.5</b>

Source: National Safety Council.

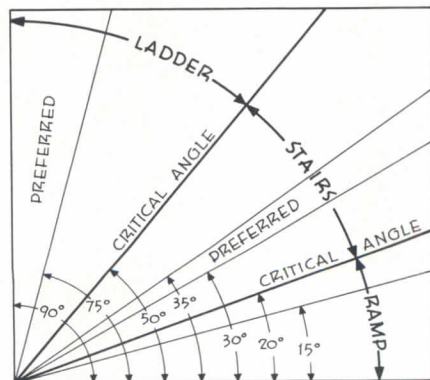


1. 3-way switches—top and bottom of stairs. 2. Hand-rail both sides if stair is 3 ft. 6 in. or wider. 3. Window on side of stair; artificial light source in or near it so that direction of light is constant. 4. Straight run where possible; no winders. 5. Step lights at platforms and turns. 6. Non-slip or carpeted treads. 7. Fluorescent carpets at danger points. 8. Fixed rugs or continuous carpeting—rubber under. 9. Continuous hand rail with solid (wire glass, plywood or plaster) balustrade if there are children. 10. Door to cellar with foot or jamb switch. 11. Avoid rough plaster on stair.

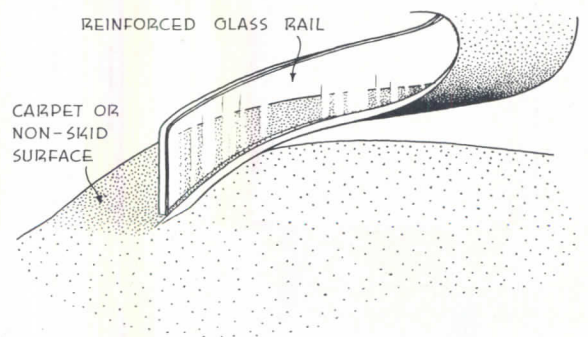
IN VIEW OF THE FACT that the most intensively used areas in the house are its stairs and halls (i.e., its circulation system), it is not surprising that accident rates are high. But falls account for 92 per cent of all accidents, which indicates that such areas are inherently dangerous and require careful detailing if they are to be made safe.

Falls are preponderantly the result of bad illumination and slippery surfaces. Cardinal principles in lighting stairs and halls: (1) Intensity and location of both daylight and artificial illumination should be approximately equal. (2) Users of stairs and halls

should never have to walk *into* the light or (conversely) in their own shadow. Thus, where possible, light sources should be on side or ceiling of stair. Many practices common in the commercial field—such as lighted treads, lighted rails, fluorescent carpets—might well be considered in domestic practice. Highly polished floor surfaces should be avoided—especially in stairs—in favor of carpeting or non-slip materials. Use of loose rugs or runners should be discouraged. Stairs are difficult and dangerous to clean: surfaces, contours, and joints should be detailed with this fact in mind.



ANGLES OF ASCENT for ramps, stairs, and ladders—well known, but still too often ignored. Changes in floor level should never be less than two steps; winders should be avoided



RAMPS require more space than stairs but are otherwise less expensive. They offer fewer hazards and are much easier and safer to clean and maintain. A solid wire-glass balustrade transmits light, keeps children from climbing up or pushing through



Ohio Rubber Co.

# HOW SAFE IS THE BATH

## PERCENT OF ALL ACCIDENTS 2.6%

<b>Falls</b> .....	<b>40.5</b>
on stairs .....	.8
on floors .....	21.4
on rugs .....	
on walks or ground .....	1.6
from chairs, tables .....	.8
from windows .....	4.8
from ladders or scaffolds .....	.8
from fences .....	
from other outside elev. ....	.8
over objects .....	1.6
in or out of bed .....	7.9
all others .....	7.9
<b>Struck by flying, falling objects</b> ..	<b>4.8</b>
<b>Stepping on, striking against object</b> .....	<b>5.6</b>
coll. with inanimate obj. ....	
nail or splinter .....	
needles, pointed objects .....	5.6
<b>Handling, lifting, carrying</b> .....	
<b>Burns, scalds, explosions</b> .....	<b>15.8</b>
by gasoline, cleaners .....	
by steam, hot liquids .....	8.7
all others .....	7.1
<b>Asphyxiation, suffocation</b> .....	
<b>Firearms</b> .....	
<b>Poison (excl. poisonous gas)</b> ..	<b>16.6</b>
by food .....	
all others .....	16.6
<b>Cut or scratch</b> .....	<b>7.1</b>
<b>Bitten by animals</b> .....	
<b>Foreign bodies</b> .....	<b>1.6</b>
<b>Hand caught in wringer</b> .....	<b>4.8</b>
<b>All others</b> .....	<b>3.2</b>

Source: National Safety Council.

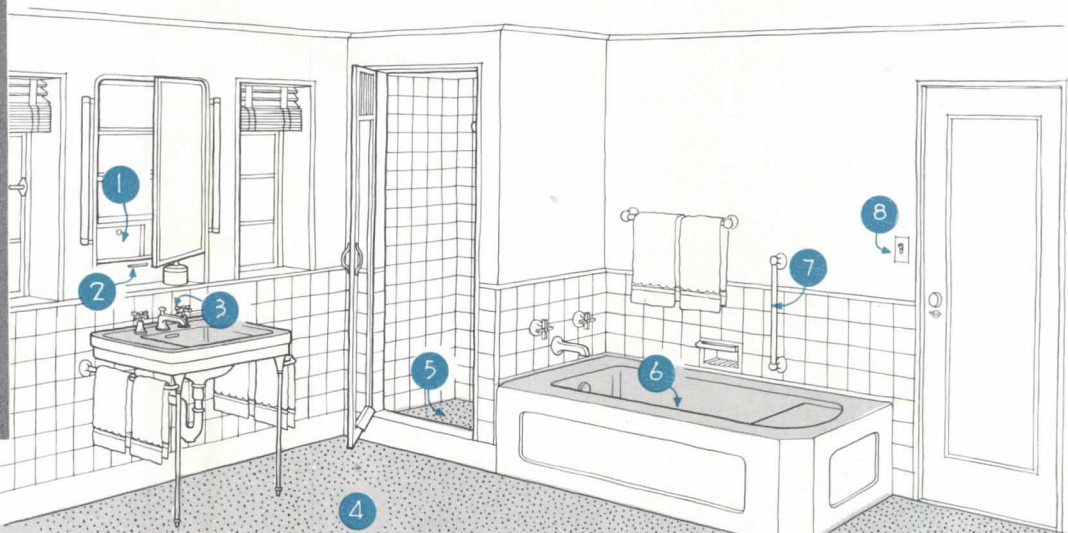
ALTHOUGH — contrary to popular belief — fewer accidents occur in the bathroom than in any other single area in the house, many serious falls, burns and poisonings do occur here.

Flat-bottomed tubs with rolled rims providing a continuous grab support are recommended by USHA, while importance of non-skid floors in shower stalls is obvious. Towel and grab bars, soap dishes and fixture handles should be metal, as serious cuts often occur with china ones. Manual or thermostatically controlled mixing valves on

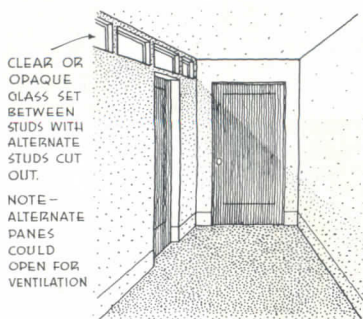
showers have prevented many a serious scalding.

A night light controlled by a switch in the door jamb is a safety feature. All switches should be located so that they cannot be manipulated from bathtub or lavatory; all individual lights should be operated by a pull cord. If required, electric heaters should be built-in.

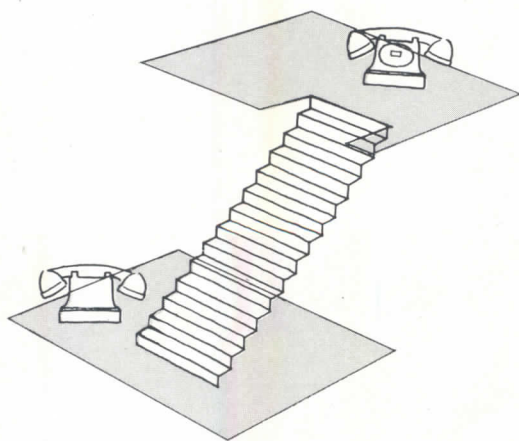
Since used razor blades in waste baskets are a real hazard, a razor blade slot is desirable, as is a locked and lighted compartment for poisonous drugs and chemicals.



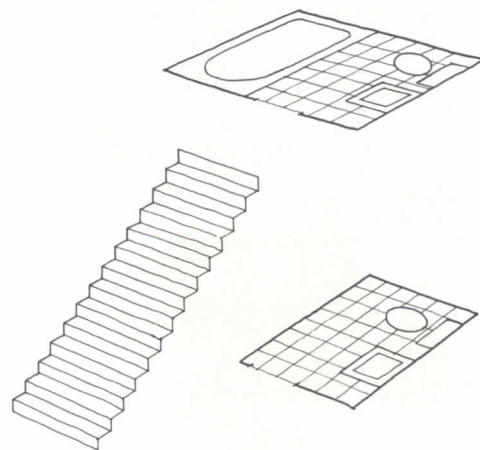
1. Locked and lighted compartment for drugs.
2. Razor blade slot. 3. Metal handles on fixtures.
4. Non-slip floor when wet. 5. Non-slip shower pan. 6. Flat bottomed tub. 7. Securely fixed metal grab bar. 8. Light switch at door.



HALLS should be well lighted, without steps or loose rugs; all doors should either slide horizontally or swing in. Many a hall could be easily illuminated by "borrowed" light



TWO PHONES in a two-story house are an investment in safety, reducing accidents caused by hasty efforts "to get downstairs before the phone stops ringing." Few stairs are designed for "fast traffic"



TWO BATHS in a two-story house are similarly an investment in safety (even more than in convenience) — especially where there are children or elderly people, for whom stair-climbing offers one of the greatest hazards

# HOW SAFE IS THE KITCHEN

PERCENT OF ALL ACCIDENTS 17.8%

<b>Falls</b> .....	<b>32.8</b>
on stairs .....	.7
on floors .....	11.6
on rugs .....	1.6
on walks or ground .....	.3
from chairs, tables .....	10.1
from windows .....	1.7
from ladders or scaffolds .....	2.2
from fences .....	
from other outside elev. ....	.3
over objects .....	3.0
in or out of bed .....	.1
all others .....	1.2
<b>Struck by flying, falling objects</b> ..	<b>3.8</b>
<b>Stepping on, striking against object</b> .....	<b>8.0</b>
coll. with inanimate obj. ....	1.7
nail or splinter .....	1.3
needles, pointed objects .....	5.0
<b>Handling, lifting, carrying</b> .....	<b>3.4</b>
<b>Burns, scalds, explosions</b> .....	<b>26.8</b>
by gasoline, cleaners .....	4.3
by steam, hot liquids .....	14.4
all others .....	8.1
<b>Asphyxiation, suffocation</b> .....	<b>.9</b>
<b>Firearms</b> .....	<b>.9</b>
<b>Poison (excl. poisonous gas)</b> .....	<b>9.2</b>
by food .....	7.4
all others .....	1.8
<b>Cut or scratch</b> .....	<b>6.1</b>
<b>Bitten by animals</b> .....	<b>.7</b>
<b>Foreign bodies</b> .....	<b>2.3</b>
<b>Hand caught in wringer</b> .....	<b>1.7</b>
<b>All others</b> .....	<b>3.4</b>

Source: National Safety Council.

THE KITCHEN is the most dangerous single area in the house, not only to the housewife but also to children. Although the greatest danger comes from the use of fire and the presence of gas and hot liquids, falls, cuts, scratches and other types of accidents also occur in the kitchen. A great many kitchen accidents are the result of the hazards implicit in present customs of preparing, cooking and serving of food. (Frying in deep fat, for example, is the cause of many serious burns, while children are often scalded by overturning a boiling liquid on the stove.) Prevention of this category of accidents is largely a matter of education, rather than architecture. However, careful study by the architect can vastly reduce safety hazards in the kitchen.

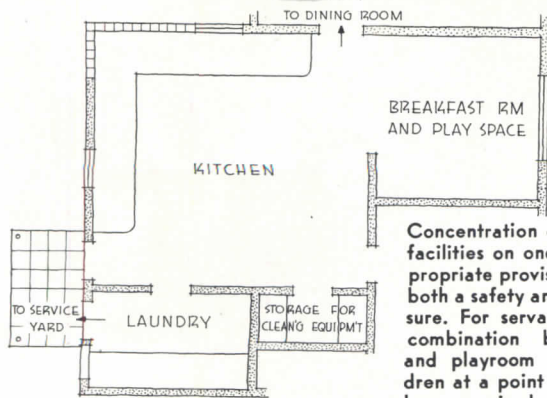
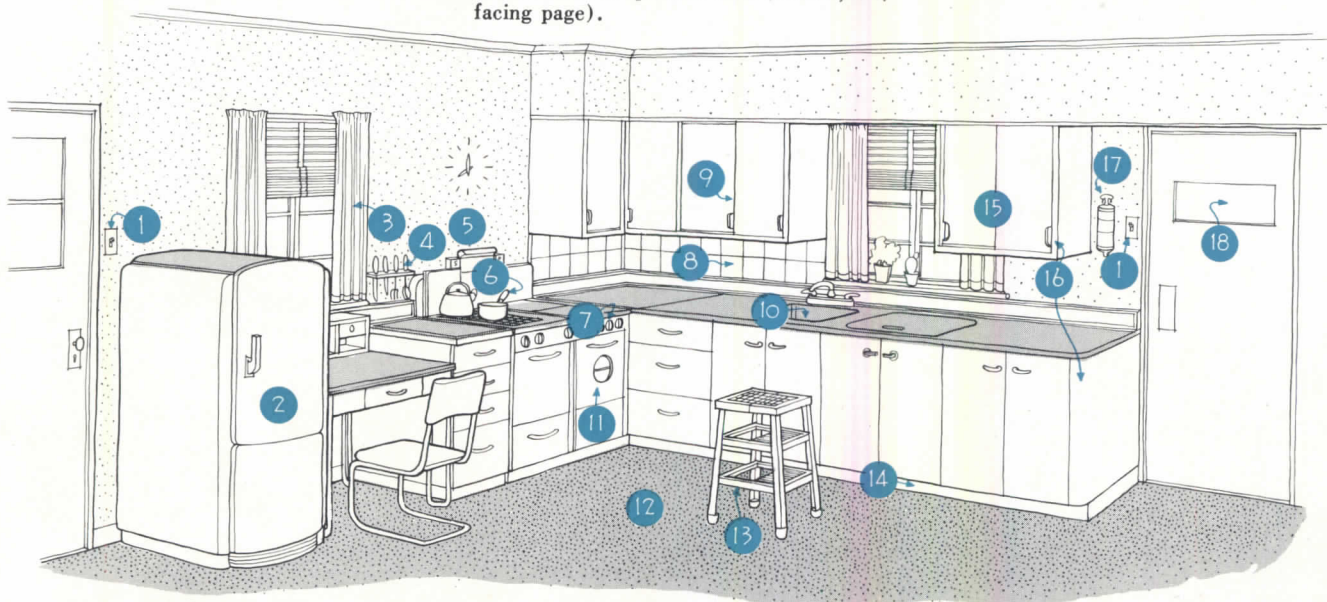
**COOKING RANGES** should always be located at least 1 ft. from window jambs. According to USHA, curtains blowing across range burners are a principal source of fires. By the same token, cupboards or shelving should not be located above ranges. Even when there is no danger of fire, the risk of falling against a burner while trying to get something out of the cupboard is great.

Ranges should conform to at least the minimum standards of the American Gas Association or the Underwriters' Laboratories. High ovens and very low ones constitute safety hazards which cause many serious burns. One alternative might be the use of separate cooking units, built into the cabinet work at optimum level (bottom, left, facing page).

**STORAGE SPACE** in the kitchen is a recognized necessity, since more equipment is required there than in any other area of the house. Moreover, this equipment is in relatively constant use, so that most storage space is "live." Ease of access to this "live" storage space is of paramount importance. Many bad falls result from it being too high, while lifting strains occur if it is too low; it should be concentrated in a horizontal zone from about 1 ft. off the floor to a little over eye level.

Such cabinets should have no exterior angles; where necessary, they should be rounded. Sliding doors are likely to be less hazardous than hinged ones. All handles and escutcheons should be of metal.

**ADEQUATE LIGHTING** both natural and artificial, is perhaps more important in the kitchen than elsewhere. Many types of kitchen accidents are directly traceable to poor lighting. Both general and local illumination are necessary, but well-lit working surfaces are especially desirable, since general lighting alone forces the housewife to work in her own shadow. Continuous backlighting of counters by means of glass or glass block panels, plus continuous downlighting from overhead cabinets, offers one solution (bottom, right, facing page). General lights should be controlled from switches at door. All light switches and fixtures should be out of reach of plumbing fixtures and refrigerator.



Concentration of housekeeping facilities on one level, with appropriate provisions for each, is both a safety and a health measure. For servantless houses, a combination breakfast room and playroom keeps the children at a point where they can be supervised

1. Light switches at all entrances.
2. Refrigerator and light switches far enough from sink so that simultaneous contact is impossible.
3. Range at least 1 ft. from window jamb so curtains can't burn.
4. Cutting knives stored in racks—not drawers.
5. Vent all combustion stoves to outside.
6. Keep all pan handles turned in.
7. Gas range petcocks should have safety clips.
8. Continuous lighting for counters.
9. Sliding cupboard doors to avoid bumped heads.
10. Garbage disposer or built-in garbage compartment with outside access.
11. Oven and broiler high enough to avoid stooping and lifting heavy hot objects.
12. Non-slip floors.
13. Breakfast-play room adjoining kitchen.
14. Toe recess.
15. Adequate shelving—not too high, not too low.
16. Avoid projecting cabinets; where necessary, round off corners.
17. Fire-extinguisher at door to rest of house.
18. Glass panel in double acting door to dining room.



**PERCENT OF ALL ACCIDENTS 3.0%**

<b>Falls</b> .....	48.2
on stairs .....	7.7
on floors .....	7.0
on rugs .....	7.0
on walks or ground .....	7.0
from chairs, tables .....	9.0
from windows .....	8.4
from ladders or scaffolds .....	4.2
from fences .....	1.4
from other outside elev. ....	4.2
over objects .....	4.9
in or out of bed .....	7.0
all others .....	4.9
<b>Struck by flying, falling objects</b> ..	4.9
<b>Stepping on, striking</b>	
<b>against object</b> .....	10.5
coll. with inanimate obj. ....	2.1
nail or splinter .....	1.4
needles, pointed objects .....	7.0
<b>Handling, lifting, carrying</b> .....	2.1
<b>Burns, scalds, explosions</b> .....	11.2
by gasoline, cleaners .....	1.4
by steam, hot liquids .....	4.2
all others .....	5.6
<b>Asphyxiation, suffocation</b> .....	7.0
<b>Firearms</b> .....	1.4
<b>Poison (excl. poisonous gas)</b> .....	8.4
by food .....	8.4
all others .....	8.4
<b>Cut or scratch</b> .....	4.2
<b>Bitten by animals</b> .....	7.0
<b>Foreign bodies</b> .....	4.2
<b>Hand caught in wringer</b> .....	4.2
<b>All others</b> .....	3.5



Dining room in a large residence by Victor Civkin, Architect

LIKE THE BATH, the dining room is the scene of relatively fewer accidents than other areas. This is probably due to the fact that it is normally used only at meal times. Many of these accidents occur as the result of "unsafe practices" (children pulling table cloths off a loaded table, people leaning back in fragile chairs, housewives getting badly burned on the waffle iron). Against accidents of this type, the architect can obviously do little.

**ADEQUATE CHINA STORAGE** — either in the dining room or between it and kitchen

— is an essential. Like the kitchen, the equipment here is in daily use; this implies "live storage" without stooping or reaching.

Another portion of dining room accidents are due to the room's being used for purposes other than that of eating—i.e., sleeping, children's playing, sewing, etc. This is inevitable in a small house where space is at a premium and sheer pressure forces the improper use of the dining room. Hence the design of dining rooms might well provide for combination use by flexible layout and adequate storage space.



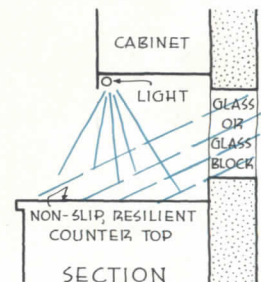
Padilla Studios

This kitchen, designed by J. R. Davidson, features a series of cooking units (instead of a stove) so organized as to prevent stooping or reaching



Insulator Div., Owens-Illinois Glass Co.

Counter space, well-lighted day and night, is the best prevention of many of the cuts and burns which occur in the kitchen



# HOW SAFE IS THE LIVING ROOM



Illuminated soffit gives general illumination of room at night same general direction and distribution as in daytime



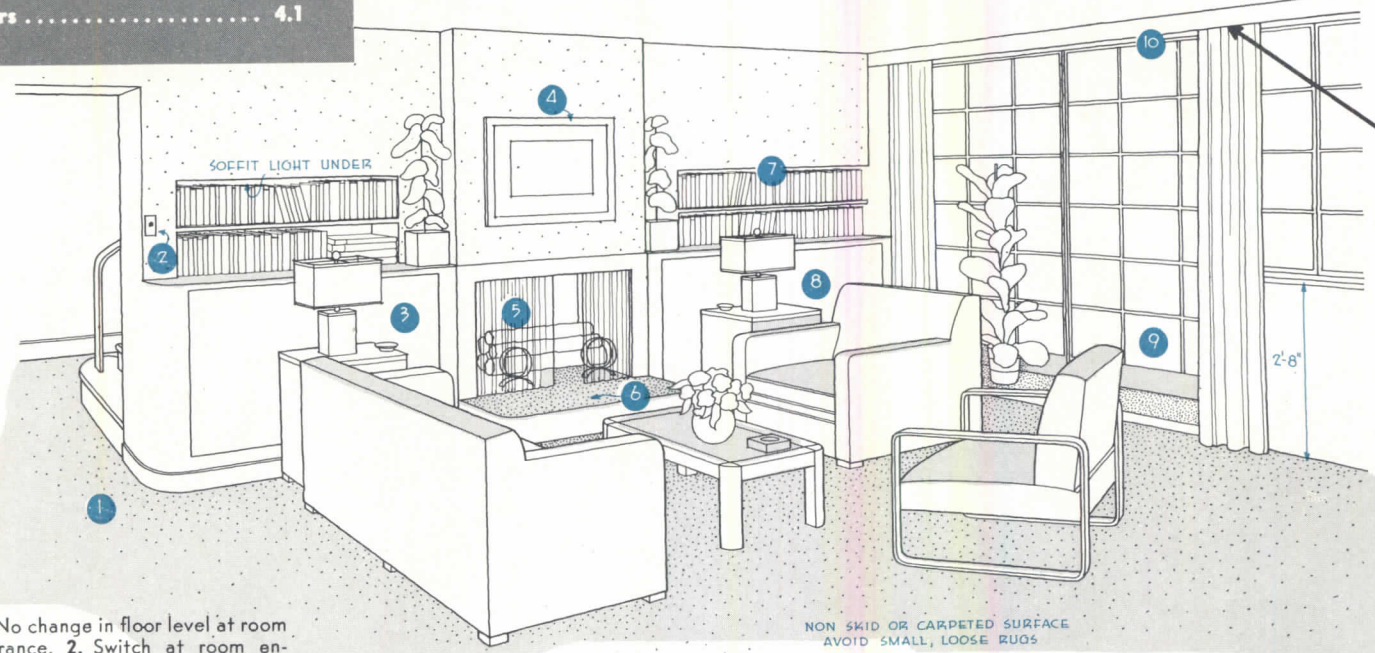
Westinghouse

These bookshelves are located for easy visibility and access in the optimum storage zone

## PERCENT OF ALL ACCIDENTS 8.4%

<b>Falls</b> .....	<b>57.8</b>
on stairs .....	.8
on floors .....	9.9
on rugs .....	9.2
on walks or ground .....	.3
from chairs, tables .....	13.7
from windows .....	10.5
from ladders or scaffolds .....	6.6
from fences .....	.5
from other outside elev. ....	3.3
over objects .....	1.5
in or out of bed .....	1.5
all others .....	1.5
<b>Struck by flying, falling objects</b> ..	<b>4.8</b>
<b>Stepping on, striking</b>	
against object .....	12.0
coll. with inanimate obj. ....	1.5
nail or splinter .....	1.5
needles, pointed objects .....	9.0
<b>Handling, lifting, carrying</b> .....	<b>3.1</b>
<b>Burns, scalds, explosions</b> .....	<b>5.9</b>
by gasoline, cleaners .....	.5
by steam, hot liquids .....	1.0
all others .....	4.4
<b>Asphyxiation, suffocation</b> .....	<b>1.3</b>
<b>Firearms</b> .....	<b>1.5</b>
<b>Poison (excl. poisonous gas)</b> ....	<b>.4</b>
by food .....	.2
all others .....	.2
<b>Cut or scratch</b> .....	<b>2.5</b>
<b>Bitten by animals</b> .....	<b>.5</b>
<b>Foreign bodies</b> .....	<b>6.1</b>
<b>Hand caught in wringer</b> .....	<b>4.1</b>
<b>All others</b> .....	<b>4.1</b>

Source: National Safety Council.



1. No change in floor level at room entrance. 2. Switch at room entrance. 3. Fuel storage near fireplace. 4. Adequate provisions for hanging pictures. 5. Flush, adequate fire screen. 6. Raised hearth—safer and easier to clean. 7. Bookcases at or near eye level. 8. Storage for special equipment— toys, card tables, etc. 9. All large areas of fixed glass should be protected by low platform or rail. All regular windows should be 2 ft. 8 in. off floor. 10. Adequate special and general lighting: Light sources similar day and night.

THOUGH THERE ARE recorded cases of persons having been killed in living rooms by heavy picture frames falling off the wall, the majority of accidents are again caused by falls, and stepping on or striking against inanimate objects. Desirable safety measures are consequently similar—good lighting, non-skid floors, design of room and layout of furniture for multiple use and easy circulation. As in the dining room, many of these accidents are due to the varied and often conflicting activities which take place here—playing, sewing, studying, dancing, sleeping, etc. Since, especially in the small house, this is the only area in which such activities can occur, it is essential that they be anticipated and provided for.

**GOOD GENERAL ILLUMINATION**, with ap-

proximately the same distribution as daylight, is generally desirable. Localized lighting for reading, writing, etc., is of course essential. Ordinary windows should be at least 32 in. off the floor (unless protected), should be easily cleaned from the inside, and securely screened. Where glass areas extend to the floor, they should be protected by low rail or platform, unless they also serve as doors to porch or terraces; in which case changes in level should be held to a minimum.

**FLOORS** should not be too highly polished. Avoid small rugs unless mounted on rubber “grippers” to prevent sliding.

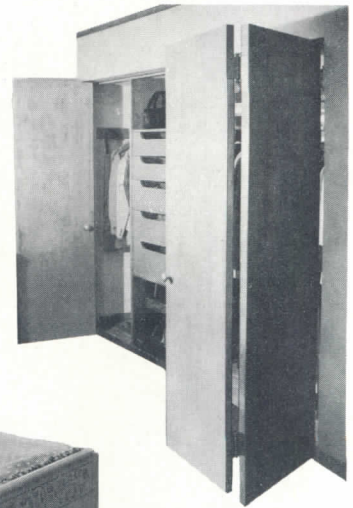
**FURNITURE** should be organized for easy movement through room to reduce hazard of “colliding with inanimate objects.”

# HOW SAFE IS THE BEDROOM

Source: National Safety Council.

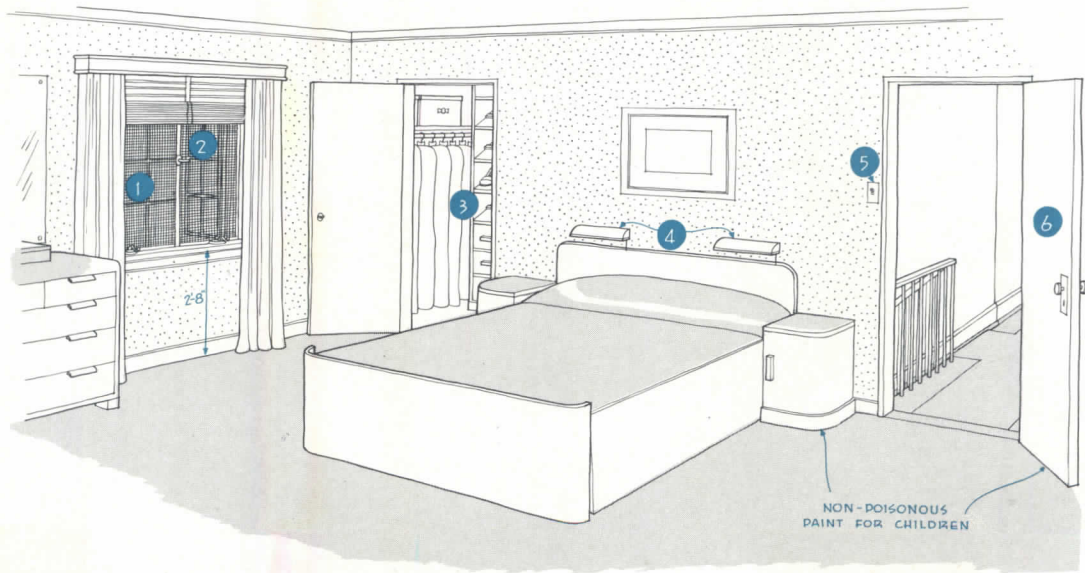
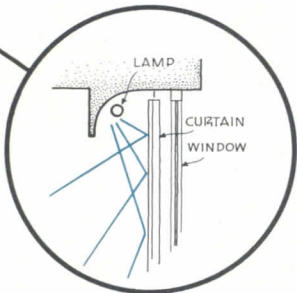
**PERCENT OF ALL ACCIDENTS 7.0%**

<b>Falls</b> .....	<b>48.6</b>
on stairs .....	.6
on floors .....	7.0
on rugs .....	2.4
on walks or ground .....	
from chairs, tables .....	1.8
from windows .....	8.8
from ladders or scaffolds .....	3.7
from fences .....	
from other outside elev. ....	.3
over objects .....	2.7
in or out of bed .....	18.6
all others .....	2.7
<b>Struck by flying, falling objects</b> ..	<b>3.7</b>
<b>Stepping on, striking</b>	
<b>against object</b> .....	<b>7.3</b>
coll. with inanimate obj. ....	2.7
nail or splinter .....	.6
needles, pointed objects .....	4.0
<b>Handling, lifting, carrying</b> .....	<b>3.3</b>
<b>Burns, scalds, explosions</b> .....	<b>10.9</b>
by gasoline, cleaners .....	1.5
by steam, hot liquids .....	1.5
all others .....	7.9
<b>Asphyxiation, suffocation</b> .....	<b>2.4</b>
<b>Firearms</b> .....	<b>2.7</b>
<b>Poison (excl. poisonous gas)</b> .....	<b>3.7</b>
by food .....	1.0
all others .....	2.7
<b>Cut or scratch</b> .....	<b>1.5</b>
<b>Bitten by animals</b> .....	<b>1.0</b>
<b>Foreign bodies</b> .....	<b>3.7</b>
<b>Hand caught in wringer</b> .....	
<b>All others</b> .....	<b>11.2</b>



Adequate storage space (above) accessible without reaching or bending. Built-in local lighting for reading in bed (left)

1. Windows washable from inside; at least 32 in. above floor. 2. Well secured screens. 3. Adequate storage; suits, dresses and shoes at eye level. 4. Permanent local lighting.
5. Switch at room entrance, controlling general lighting. 6. Door opens into bedroom, not too near stair head.



BEDROOMS are the scene of many types of accidents of which, ironically, "falling in or out of bed" is one of the most common. Many cases involve children — suffocation by bed clothes, poisoning from eating paint off furniture or woodwork, cuts or scratches from razor blades or needles dropped in the wastebasket.

**OTHER CAUSES** of many serious injuries and deaths in the bedroom are fire and smoke. The two-story house should have a fire-extinguisher

in hall within easy reach of all bedrooms. If fire alarms are included they might well ring in each bedroom.

**WINDOWS** in bedrooms — especially second floor bedrooms—should be 32 in. off floor, securely screened and easily cleaned from inside.

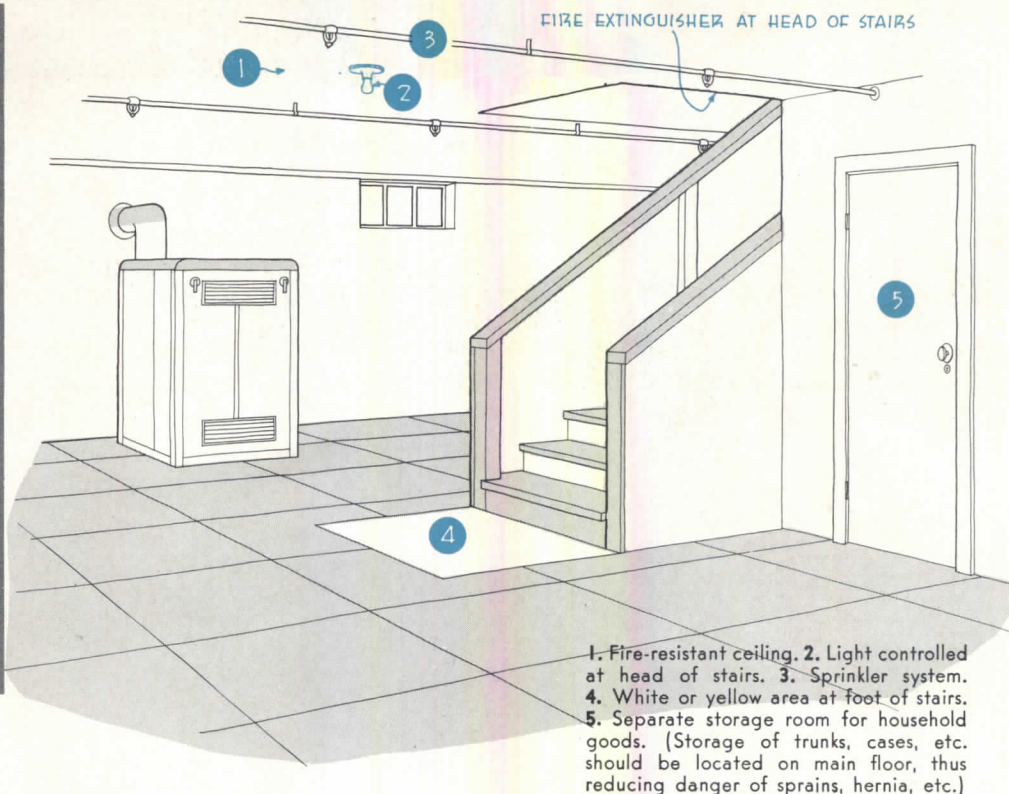
**NEED FOR** adequate lighting, safe non-slip floors, and efficient organization of furniture is as great—if not more so—here as elsewhere in the house.

# HOW SAFE IS THE BASEMENT

## PERCENT OF ALL ACCIDENTS 5.7%

<b>Falls</b> .....	<b>25.8</b>
on stairs .....	3.8
on floors .....	9.5
on rugs .....	.4
from chairs, tables .....	1.5
from windows .....	1.1
from ladders or scaffolds .....	1.5
from other outside elev. ....	1.1
over objects .....	5.0
in or out of bed .....	.4
all others .....	1.5
<b>Struck by flying, falling objects</b> ..	<b>10.7</b>
<b>Stepping on, striking</b>	
<b>against object</b> .....	<b>12.2</b>
coil with inanimate obj. ....	1.9
nail or splinter .....	4.2
needles, pointed objects .....	6.1
<b>Handling, lifting, carrying</b> .....	<b>15.6</b>
<b>Burns, scalds, explosions</b> .....	<b>9.2</b>
by gasoline, cleaners .....	2.3
by steam, hot liquids .....	2.3
all others .....	4.6
<b>Firearms</b> .....	<b>.8</b>
<b>Cut or scratch</b> .....	<b>9.2</b>
<b>Bitten by animals</b> .....	<b>.4</b>
<b>Hand caught in wringer</b> .....	<b>13.4</b>
<b>All others</b> .....	<b>2.7</b>

Source: National Safety Council.



THERE ARE CERTAIN safety factors which cut across the entire house and must consequently be handled as *systems* rather than as isolated factors which occur in each room.

**FIRE PROTECTION.** The best house is naturally one which is literally non-inflammable. But such construction is beyond the reach of the majority of clients; and there is the added fact that most household furnishings and equipment are highly inflammable, so that disastrous fires can occur in houses which are structurally non-inflammable. Thus the most economic measures are usually the fireproofing or fire-retarding of vulnerable areas such as roof, furnace-room and kitchen. Domestic sprinkler systems and fire alarms are two features which could economically be included in most houses, with little increase in cost and great increase in safety. The absolute minimum in a non-fireproofed house should be fire extinguishers in kitchen and/or furnace room. If the house is two-storied, there should be an additional extinguisher on the second floor, since open stairs offer a natural flue for spreading flames. In general, fire-prevention measures may be grouped under these heads: 1. fireproofing of entire structure; 2. fire resistance of vulnerable areas; 3. sprinkler systems; 4. fire alarms; 5. fire extinguishers.\*

**ADEQUATE DAY AND ARTIFICIAL LIGHTING.** In the last analysis, it may be said that inadequate lighting is the principal cause of accidents, since even hazardous conditions can be avoided if well-lighted. Where possible, both day and artificial lighting should conform to accepted standards for specific seeing tasks. Of great importance is continuity *in time* (minimum variation from day to night)

and *in space* (minimum variation from room to room).\*\*

**STORAGE.** Adequate storage space — carefully designed for a specific purpose — is much more a problem of *safety* than of mere convenience. The majority of falls are the result of either (1) an attempt to get or replace an article in storage or (2) falling over or colliding with an article which should have been stored but wasn't because of lack of proper storage facilities. Zones of active storage (i.e., articles in constant use) should be designed so that no reaching or climbing, resulting in strains or falls, is necessary. Zones of inactive storage (i.e., articles in seldom or seasonal use) should be on main floor wherever possible.

**TRAFFIC.** Architects as a rule devote a good deal of attention to "circulation": yet this is too often approached as simply a matter of plan, rather than one involving non-slip surfaces, easy turns, good illumination, minimum changes in level, etc.

**SPECIAL PROVISIONS FOR THE VERY YOUNG, THE AGED AND THE INFIRM.** As indicated in charts on page 68, even the best house is hard on the very young or the aged user. Since these age groups are *in the minority* in the average family, and since even this minority changes with time, it is seldom possible to make optimum provisions for them. However, a careful study of the house from the standpoint of their special needs can do much to eliminate hazards to their health and safety.

\*See AR, 10/40, pp. 81-83, for specific fire protection measures.  
\*\*For extended discussion of this problem, see AR, 12/40, pp. 49-55, and 4/41, pp. 69-76.

# WINDOW DESIGN AND SELECTION

By RONALD ALLWORK

## MANUFACTURING TRENDS

RAPID industrial and technological advances have affected the window industry as they have other manufacturers. But the manufacturer whose product has sold well may need a special stimulus to enable him to see the potential value of improvements in existing products and advances in design. These stimuli have come notably from competition within the industry, development of new materials and techniques, new types of building services (air conditioning, for example), demands of building designers for windows which function more satisfactorily.

**Within the industry,** competition has produced almost unbelievable results. Industrial production demands specialized attention to each step of fabrication; to sell in today's markets, the product has to be uniformly well constructed; so good construction is today a commonplace.

The advent of metal, new to the industry several years ago, had in particular a tremendous impact. Use of metal sash demanded use of metal frames; in time, the "packaged window," pre-fitted to a frame, became common in wood as well. This, along with greater precision in manufacture and hence more continuously satisfactory use, offers time savings in installation. Out of such beginnings have come substantial efforts at standardization. Wood and metal window trade associations, governmental requirements, and the simple necessity of limiting products to a competitively practical range, have aided the process.

For the architect, this means that, within certain limits, the draftsman and specification-writer can select a stock design to suit particular needs without limiting competition. As currently isolated examples of window units multiply, the architect, builder and owner stand increased chances of getting cheaper and better buildings.

But regional preference, climate, orientation, direction of winds, type of interior curtail development of scientific standards for sizes, glass areas, etc. Building code regulations for minimum sizes are concerned primarily with ventilation—which is only one function. And though industry-imposed rules may govern tolerances between frame and sash, some manufacturers pare down the sash, some enlarge the frame. So at present it seems preferable to order sash and frame from one manufacturer.

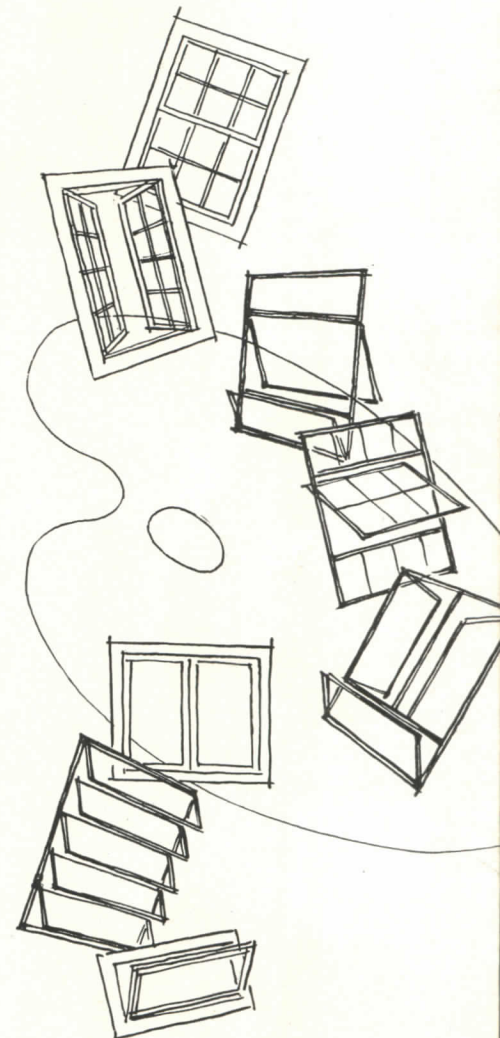
**Development of new materials** and techniques has likewise opened up tremendous possibilities—in design, for the architect, in sales, for the manufacturer. Chief of these is probably the application to all kinds of buildings of the principle of frame construction and curtain walls. Even the brick residence is now most often a frame with a masonry veneer. And the curtain wall can be a series of windows as well as wood or metal, masonry or glass block. Thus the area usable for windows has been substantially increased.

It is further enlarged as the strength of materials for supporting framing is increased or made more readily available; as engineering principles—truss, cantilever, etc.—are applied to permit wider use of long horizontal windows, tall vertical ones, corner windows, bays, and a great variety of architecturally free forms.

**New services.** Of these, air conditioning seems to be causing the greatest changes in window design. Differences in indoor and outdoor temperature and humidity cause condensation. Long troublesome, this phenomenon is combatted by double glazing. A few years ago, windows could be equipped with storm sash at extra expense. Today, rare is the manufacturer who does not offer integral double glazing, or windows designed to permit its easy installation. And the cumbersome storm sash is most often replaced by a simple sub-frame which the housewife moves easily for cleaning.

As to cleaning: demountable or tilting sash, extension hinges, larger glass areas, simpler mouldings—all these reduce hazards and increase cleaning ease.

A keener appreciation of health hazards and demands for greater comfort, plus intra-industry competition, have made available durable screens in sturdy, demountable or movable units, and window operators which penetrate the screen or its surrounding frame.



The wide range of types and sizes available in wood and metal windows offers the designer almost unlimited choice

**THE DESIGNERS' DEMANDS**

Primarily, a window must admit light and air; but both have to be controlled. Secondly, a window has to distribute light, to permit a controlled degree of vision, to exclude inclement weather, reduce heat loss, air infiltration and condensation. Some available means of answering these demands are apparent from the foregoing.

**Light and vision** have to be considered concurrently in some respects. At present, quantity and distribution of light are usually controlled by appendages to the window—awnings, shutters, shades, venetian blinds—or by obscure glazing, which interferes with vision. Occasionally this latter is no drawback; for instance, in some factories.

Three alternatives seem practical. One is to design the entire building shell with control of light in mind. Examples include the Brazilian Press Building in Rio de Janeiro,\* whose entire exterior wall is a series of louvers, oriented to exclude the tropic sun yet admit adequate light; and in numerous schools in our own far West vertical fin walls and horizontal canopies, sometimes louvered, exclude the noon sun while admitting sun at other times.

Another consists in use of glazing materials which distribute light to reflecting surfaces (mostly ceilings). "Distributing areas" of glazing might conceivably be combined with "vision areas" of clear glazing. Materials available include prismatic and pebbled glass, and plastics. It would seem that principles applied to prismatic lenses for lighting fixtures, which bend rays in almost any desired direction, might also be applied to window glazing.

The third method involves application of a number of standard practices and materials in combination. In one type of stock window, standard roller shades run in tracks on tilting sash, producing a sort of awning when the sash is pivoted horizontally. Another employs translucent slat shades as an integral part of the sash. One type of screen has fixed flat transverse wires which act as slat blinds.

**Air** has also to be controlled in quantity and direction. Degree to which sash opens controls only the quantity admitted; and in large windows the proportion of fixed to movable sash (particularly in metal casements) seems to be increasing. This may be due partly to decreasing size of structural members and consequent greater need for immobility, partly to the designer's desire for windows easier to curtain, partly to general recognition of the fact that, once a certain percentage of window area is open, not much more "air" is gained by opening the remainder.

Direction can be controlled by installing "ventilators," which guide incoming air to ceiling. Hinged or pivoted sash may take advantage of prevailing winds.

Air infiltration can be eliminated by proper installation. Most manufacturers offer standard details to achieve this result.

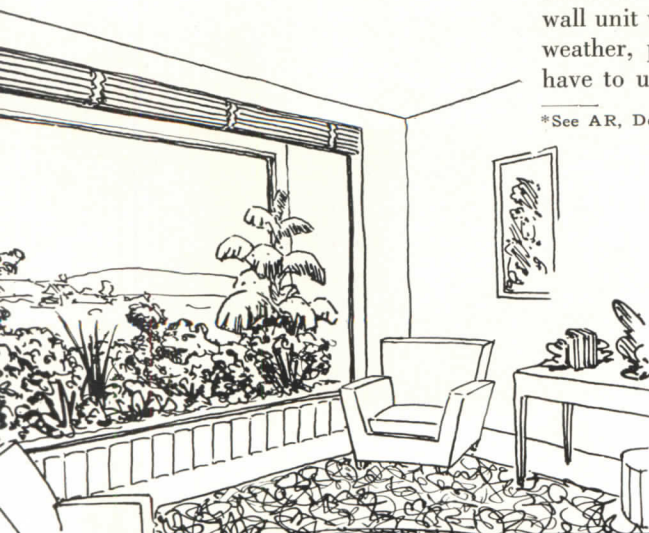
**Heat loss** can be combatted mechanically by weatherstripping, by using any "pre-fitted" window, and by double glazing. One refinement on the latter consists of sash with sealed double glazing; the air space is dehydrated and partially evacuated. This problem is probably most apparent because heat loss causes rising fuel bills.

Heat gain is more difficult. Some instances of use of large glass areas, to heat houses by solar rays, are extant. Complete shading seems the most practical means of excluding heat, but interferes with vision. Certain types of glass reflect heat rays away from human-level portions of the interior; others absorb some solar heat.

**Weather exclusion** is also achieved by weatherstripping. Rain and snow must be excluded when sash is open; some awning-type windows serve this purpose.

Alden Dow used a plastic cornice in Midland, Mich., to admit light, and open, screened eaves admitted air. Vision was, of course, excluded. Glass block has been used. None of these serve all functions of a window at once. Until we achieve a wall unit which will give light and air when, where and as we want it, which excludes weather, permits adequate vision, eliminates condensation and mosquitoes, we will have to use what we have—and the range is wide enough to satisfy most demands.

\*See AR, Dec. 1940, p. 74.



There's no reason why stock window units cannot be used in a house to form a double glass wall, with planting space between

Information on these sheets was collected and prepared by Ronald Allwork. Sources include the Metal Window Institute; R. L. Clingerman, Engineer; and numerous manufacturers of metal windows.

**Stock metal windows**, of the types most commonly used, are described on the following pages. They are available in a number of metals and alloys; those most widely accepted are steel, bronze, and aluminum.

**Standardization** of metal windows, particularly as to type, construction, and quality of materials, has been established to a degree. Sizes, however, have not been completely standardized. Some progress has been made in this respect as regards glass sizes, number of lights, etc. For overall dimensions, or rough opening requirements, the designer is referred to the various manufacturers.

**Bronze windows** are available in both casement and doublehung types.

**Aluminum windows** are made in both casement and doublehung types, usually of extruded sections with riveted or welded joints.

**Steel windows** are divided into three general product groups: industrial, casement, and doublehung. Industrial and casement types are made from special rolled-steel shapes, while doublehung types are fabricated from sheet steel of various gauges. These may be further divided into four sub-groups of heavy, intermediate, light steel and hollow metal. The corresponding general gauges prevailing in each sub-group are roughly 12, 14, 18 and 24.

The essential difference between industrial and casement windows lies in design of steel sections used, and in construction details of frames. In casement sections, contact surfaces of ventilator frame to window frame are flat and parallel. In industrial windows contact is made between the flat surface of one section and the edge of another. The casement type, therefore, offers a more weather-tight window due to the fact that the distance between the contact surfaces of the sections is definitely and accurately controlled in the rolling of the shape, and any slight excess or discrepancy in the metal occurs in the end

of the legs, which are not themselves in contact.

Another point of difference is that the corners of all casement ventilators and frames are solidly welded, while for industrial windows it is more common practice to rivet all mechanical joints, with possibly a tack weld to provide greater security.

Industrial frame sections are also provided with an outside leg of sufficient length to permit installation directly in masonry; although casement windows may also be so equipped, casements are more often set in masonry rebates, or in sub-frames. When window frames are set directly in masonry (other than cut stone) a continuous fin is usually attached to provide proper anchorage.

**Protection against corrosion** should be provided for in all windows. Some metals come by this naturally. Bronze and aluminum are commonly considered to possess this characteristic because under usual conditions a protective film is formed on the exposed surfaces of the metal (through a process of corrosion) which retards further breaking down of the metal.

Because no such protective film is formed on steel, painting is the most widely accepted method of protection. To be successful, however, it is essential that the surface of the metal be properly prepared. This is best accomplished by: (1) removing all mill scale by shot or sand blasting (or a similar process), or by pickling; and by (2) providing a protective surface film on the metal prior to painting. Such a film may be of iron phosphate, which is resistant to corrosion and forms the basis for such well-known processes as Bonderizing and Parkerizing. The films formed by these processes, while not sufficient to protect the metal entirely by themselves, provide an excellent base for paint. Finally, the paint selected should tend to prevent the steel from rusting through the process of chemical action on its surface, rather than only by retarding moisture and oxygen penetration.

Installations of metal windows should further insure against corrosion at the point of setting, particularly where steel is imbedded in concrete or any porous material subject to moisture penetration. This is sometimes provided for by painting with asphaltum or similar

preparation, by setting the frame on wood strips, by caulking, or by applying a bituminous coated fabric to all surfaces contacting the masonry. Where adequate precaution is not observed, rust may occur; and metal expanded by rust may cause distorting of the frame, spalling of the masonry, breakage of glass, and leaks.

**Hardware**, except for special items, is regularly furnished with metal windows, and is of a design, quality and metal appropriate to the type of frame.

Casement ventilators (side-hinged) may be equipped with a lever handle and suitable friction arrangement for holding the window open, or a roto-operator designed to control sash through or below a stationary screen.




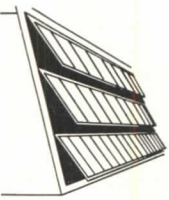

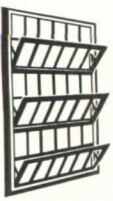
**Weather stripping**, applied at factory, is generally obtainable in metal windows of the casement and doublehung types, although on some types it is considered an extra.

**Screens** are available for most window types and are fitted, on order, at the factory. Roll, sliding, and hinged screens are available. Winter windows are designed to be used in place of screens.






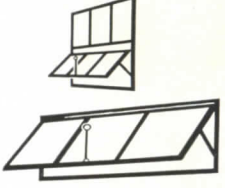
**Other items** such as shade and drapery bracket holes may be specified. Steel sills, radiator brackets, grilles, spandrels, trim, etc., are also obtainable; integral double glazing is also available.






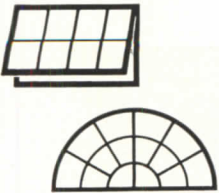
## CHECK

- Type of window
- Type of ventilator (pivoted, projected or hinged)
- Size and location of ventilator
- Swing of ventilator (in or out, from side, top, or bottom)
- Location of horizontal mullions
- Detail of wall at point of window attachment
- Mastic and caulking
- Hardware
- Glass thickness
- Location of shade and drapery bracket holes
- Steel stoves, sub-frames, radiator brackets, grilles, spandrels, trim, screens, winter windows

TYPE	USE	DESCRIPTION
<p>PIVOTED</p> 	<p>For industrial buildings, garages, etc., and for boiler rooms in all types of buildings.</p>	<p>"Industrial" construction. Joints of abutting members are usually tenoned and riveted. Windows are designed for interior glazing. Ventilators swing out at bottom and in at top, and are not readily adaptable for screening. Mechanical operators are available for opening and closing banks of windows in unison.</p>
<p>COMMERCIAL PROJECTED</p> 	<p>Adapted to same uses as pivoted windows.</p>	<p>Similar in construction and quality of materials to pivoted windows, but method of ventilator operation affords more positive and convenient control, and facilitates screening, shading, etc. Windows are designed for interior glazing. This type of window is not readily adaptable to mechanical operation.</p>
<p>ARCHITECTURAL PROJECTED</p> 	<p>Suitable for schools, institutional buildings, offices, etc. Is often combined with <i>Pivoted</i> or <i>Commercial Projected Windows</i> on industrial projects when a better window is desired for the more important openings, such as those in the office portion.</p>	<p>Although made of the same "Industrial" sections employed in Pivoted Windows, Architectural Projected Windows are superior in construction; all corners are welded and sash have bronze hardware. Glazing may be either interior or exterior. Interior glazing is bedded in putty and secured by metal sections, coped or mitred at corners.</p>
<p>CONTINUOUS</p> 	<p>For monitors or saw-tooth roof construction.</p>	<p>Continuous windows are of heavy construction, are hinged at the top, and provide suitable ventilation plus full protection during inclement weather. They are available in standard heights of 3, 4, 5, or 6 ft., with length of runs made to suit individual job requirements. Usually controlled by mechanical operators, either manually or electrically operated. Glazing is exterior. Wire glass, not less than 1/4-in. thick, is most commonly used.</p>
<p>DETENTION</p> <p>Protection Design</p>  <p>Industrial</p> 	<p>Protection windows are intended for moderate protection of openings in retail stores, warehouses, factories, tool rooms and offices in all types of commercial and industrial buildings.</p> <p>Security windows are intended for moderate protection against forced entry.</p> <p>Industrial Detention: Intended primarily for moderate protection against exit in institutions for psychopathic patients.</p> <p>Guard: Intended for protection against forced exit in penal institutions.</p>	<p><i>Protection windows</i> consist of a grilled main frame with muntins continuous from head to sill and from jamb to jamb, and a ventilating unit (or units) made up of a ventilator and an auxiliary frame superimposed on the inner face of the grille. Glass sizes of grille lights do not exceed 88 sq. in. Glazing is interior or exterior depending on requirements.</p> <p>Identical with <i>Protection Windows</i> in materials and construction except that glass size is considerably larger: 5-13/16 x 18 in. (nominal). Windows are interior glazed.</p> <p>Identical in materials and construction with Pivoted or Commercial Projected Windows. <i>Glass lights</i> do not exceed 160 sq. in. in area. Ventilators are not higher than 16 in. and usually project in at top.</p> <p>Design of muntins and ventilator similar to Protection Design. Glass lights do not exceed 108 sq. in. in area and are applied from the exterior.</p>



TYPE	USE	DESCRIPTION
<p>CASEMENT</p> 	<p>For homes, apartments, dormitories, offices, institutions and other types of buildings.</p>	<p>Casement windows are made in several weights to meet various service requirements. Weather-stripping, screens, winter windows, etc., may be had with this type. Casements may also be obtained with wood surrounds installed at factory and shipped ready for erection.</p>
<p>PROJECTED CASEMENT</p> 	<p>For all types of buildings where high quality is desired; particularly hospitals, schools, offices, etc., because of the convenient method of controlling natural ventilation.</p>	<p>Similar in quality of materials and construction to casement windows. Ventilator opens by either projecting out at bottom as top slides down or projecting in at top as bottom slides up.</p>
<p>COMBINATION CASEMENTS</p> 	<p>For same types of buildings as <i>Projected Casements</i>.</p>	<p>Similar to projected casement in quality of materials and construction, and differs only in that it offers a combination of side-hinged and projected ventilators.</p>
<p>AWNING</p> 	<p>Suitable for schools, hospitals, auditoriums, gymnasiums, armories, power houses, public buildings.</p>	<p>Ventilators operate in unison, either by manual control or by concealed mechanical operators, as desired. Fully opened, windows provide approximately 100% ventilation.</p>
<p>LOUVER</p> 	<p>Same as for awning type, and also suitable for residences. May be used as a detention window for buildings housing psychopathic patients.</p>	<p>Similar to awning windows in that louvers operate simultaneously, but is of much lighter design. Louvers may be had as small as 5 in. high. Operating mechanism is concealed and controlled by hand crank.</p>
<p>BASEMENT AND UTILITY</p> 	<p>Suitable for basements (residences, apartments, dormitories, barracks, camps, etc.) and barns and other farm buildings.</p>	<p>Construction and materials similar to pivoted windows. Ventilators for basement windows usually are hinged at bottom and open inward. Ventilators for utility windows may be hinged or projected to open inward at top or outward at bottom. Glazing is generally from interior.</p>

TYPE	USE	DESCRIPTION
<p>AUSTRAL</p> 	<p>For schools, hospitals, institutions, public buildings, where good ventilating and shading are required.</p>	<p>Upper and lower sash are counterbalanced on arms pivoted to the frame. Balance arms are free to revolve through a quarter circle; upper and lower sash operate simultaneously and balance each other.</p>
<p>DOUBLEHUNG</p> 	<p>For all types of buildings where high quality is desired.</p>	<p>Doublehung windows are made in several weights to meet various service requirements. Also made in Kalamain. Weather-stripping generally (though not always) provided as standard. A number of types of balances are offered with these windows.</p>
<p>DOUBLEHUNG with Ventilator</p> 	<p>Same as doublehung, but particularly suitable for hospitals, and office buildings.</p>	<p>Similar to doublehung in all features; in addition, has an inprojecting ventilator.</p>
<p>DOUBLEHUNG Detention</p> 	<p>For hospitals, sanitariums, and other institutions for mental patients.</p>	<p>Similar to Security type in muntin design. Top sash is fixed. Grille extends from bottom of top sash to sill and is usually hinged for cleaning. It is secured by lock. Bottom sash is operated by spring balances.</p>
<p>REVERSIBLE</p> 	<p>For homes, apartments, dormitories, offices and all buildings where good ventilation and easy cleaning are important.</p>	<p>Made in two types. Doublehung reversible window retains all doublehung window features and in addition permits sash to be tilted for ventilation or reversed for cleaning. The second type does not slide up and down; sash are openable only by means of the tilting feature.</p>
<p>TRANSOMS, CIRCLE HEADS</p> 	<p>Used in conjunction with casement windows or separately as decorative sash.</p>	<p>Construction similar to casement windows; available in a number of special shapes.</p>

Information on this sheet was collected and prepared by Ronald Allwork. Sources include the National Door Manufacturers' Association and various manufacturers of wood windows.

**Types of stock wood windows** are described overleaf. They are adaptable to all forms of construction. Pine is the material most widely used, but stock windows can be had in other woods as well. It is possible to obtain windows in almost any desired shape or muntin arrangement at reasonable cost.

**Standards** for manufacturing stock window frames and sash have been set up by the manufacturers' association and are rigidly followed. These standards, particularly as applied to doublehung windows, vary according to locale and embody differences established by common practice in various sections of the country. Within a particular geographical market, therefore, while such items as sizes of stiles and rails may vary slightly with different manufacturers, the finished opening or overall size of a window is essentially the same for similar products.

Many manufacturers offer certain types as complete units only, both window and frame being factory-fitted. However, it sometimes happens with doublehung windows especially, that frames are obtained from one manufacturer and sash from another. This practice may lead to unsatisfactory results. For example, some manufacturers provide clearance between sash and runway by making sash slightly undersize; others make their sash full thickness and runways a trifle oversize. Thus it is quite possible to have a combination of sash and frame which results in a window either too loose or too tight.

**Dimensions.** Thickness is usually  $1\frac{1}{4}$ ,  $1\frac{3}{4}$

or  $1\frac{3}{4}$  in., with a "thickness tolerance" not exceeding  $1/16$  inch less than the nominal thickness being allowed. Sash can also be made  $\frac{3}{4}$ ,  $2\frac{1}{4}$  and  $2\frac{1}{2}$  in. thick.

Sash are generally either mortised-and-tenoned or slot-mortised. In frames for masonry walls, sills are customarily rebated to receive jambs, while in frames for frame construction, jambs are rebated to receive sills. Mouldings (or "sticking") are either ogee or ovolo in design, depending on the manufacturer.

**Toxic preservation treatment** is offered by many manufacturers as a means of protecting the wood against decay resulting from fungus growths and other organisms. Treatment consists of dipping the frame and sash members in a toxic oil developed by the association, in accordance with standard specifications.

**Screens and storm windows** are readily applied to most standard sash. There are available stock designs which incorporate double glazing as an integral part of the sash, or which are designed for an easily-applied extra glazing unit in its own frame. Special rebates are not necessary. All types of screens—stationary, hinged, sliding, roll, etc., are adaptable.

**Hardware** is not usually furnished with windows; common practice is to specify it separately and install it on the job.

**Casement windows** (side-hinged) may be equipped with either a lever handle and suitable friction arm, or a roto-operator designed to control the opening or closing of the ventilator through or below a stationary screen.

**Doublehung windows** may be equipped

with any one of a number of types of sash balances, such as typical sash weights, special (flat) sash weights, spiral balances, spring balances.

**Weather-stripping** may be factory-applied, or applied at a later date. Its cost is usually extra.


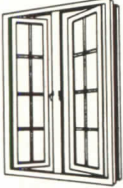


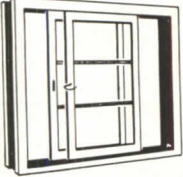
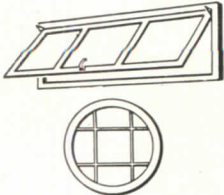
**Installation.** Some manufacturers recommend that installation of sash be delayed until trim is applied within the building. In this case, openings can be closed with storm windows, or with muslin-covered frames, etc.

One manufacturer recommends that a stout spreader piece be inserted in the frame at the check-rail line to prevent bulging due to moisture released by wet plaster; and that sash be not installed until plaster is thoroughly dry.

**Packaged windows**, precision-fitted at the factory, complete with frame, sash, weather-stripping, screen, storm window, etc., are offered by many manufacturers. These are shipped either knocked-down or completely erected.

#### CHECK

- Type of window
- Thickness of sash
- Number of lights
- Type of sash balance
- Quality of lumber
- Wall construction and dimensions
- Swing of casement
- Priming or preservative treatment
- Hardware
- Glazing
- Weather-stripping
- Storm windows
- Screens
- Flashing

TYPE	USE	DESCRIPTION
<p>DOUBLEHUNG WINDOWS</p> 	<p>For all types of buildings.</p>	<p>Most widely used of wood types, this window is available in a variety of weights and sizes. It is also regularly made to accommodate the different kinds of sash balances, such as weight, spring and spiral types.</p>
<p>CASEMENT WINDOWS</p> 	<p>For residences, apartments, etc.</p>	<p>Casements are regularly made with either inswinging or outswinging sash. With inswinging casements, screens do not have to be opened to operate sash. Outswinging casements may be equipped with crank operators which obviate the necessity of opening screen. Details should be inspected to insure watertightness.</p>
<p>REVERSIBLE WINDOWS</p> 	<p>For hospitals, apartments, offices, and all buildings where good ventilation and ease of cleaning are important.</p>	<p>Available in two types: <i>doublehung</i> reversible windows which retain all the features of the regular doublehung window also permit the sash to be tilted for ventilation or reversed for cleaning; and a second type which does not slide up and down—sash are opened only by means of the tilting feature.</p>
<p>AUSTRAL TYPE</p> 	<p>For schools, hospitals, institutions, public buildings, where good ventilation and shading are required.</p>	<p>Upper and lower sash are counter-balanced on arms pivoted to the frame. Balance arms are free to revolve through a quarter circle, the upper and lower sash operating simultaneously and balancing each other.</p>
<p>SLIDING WINDOWS</p> 	<p>Suitable for residences, camps, bungalows, barracks, and other structures.</p>	<p>Available in two types. In first, one half of sash slides in back of other half, which is fixed; in the second type operation is similar except that both sash slide, and when closed, both sash are in same plane.</p>
<p>BASEMENT AND SPECIAL SASH</p> 	<p>Basement windows are suitable for basements, cellars, and in the larger sizes, for barracks, camps, etc. Special or ornamental types are available for various purposes.</p>	<p>Basement windows are constructed similarly to casement type, and have hinged sash. Ornamental windows, such as quadrant, elliptical, bull's-eye design, are available.</p>



Planned

# LARGE-SCALE HOUSING

## A BALANCE SHEET OF PROGRESS

by CATHERINE BAUER . . . "Large-scale housing" is an abstract idolum that trips lightly off the tongue of every technician, architect and economist. What do they mean by it? What can we expect of it? Do we really want it, and if so are we achieving it? If not, why not?

### THE HOUSERS' CREDO

*THE ESSENTIAL FACTS* underlying the housing problem are already clichés and probably even Mr. Arbuthnot would put them about as follows:

- We have slums, which hurt health and morale, waste taxes;
- We also have millions of not-so-good homes, including many brand new ones, rapidly dragging huge areas into blight and tax-delinquency;
- And we are about 2½ million dwellings short (NRPB), quite apart from replacement of bad homes, and defense crises.
- Something is wrong with the residential building industry—its instability undermines our economic welfare;
- Something is wrong with the private home market—it's still a luxury trade by and large serving only the top third income group;
- Something is wrong with residential building costs first and last—a house costs more while other things cost less;
- Something is wrong with methods of production—the organization has no inner spur to greater efficiency;
- Something is wrong with methods of finance—money lies idle, while slightly better terms would vastly increase the building market;
- Something is wrong with methods of location, layout, design and neighborhood control—or "blight" would not descend so rapidly.

### Q. E. D.: "LARGE-SCALE HOUSING"

*AND NOW*, when we are just beginning to attack these traditional problems, we confront two huge new ones:

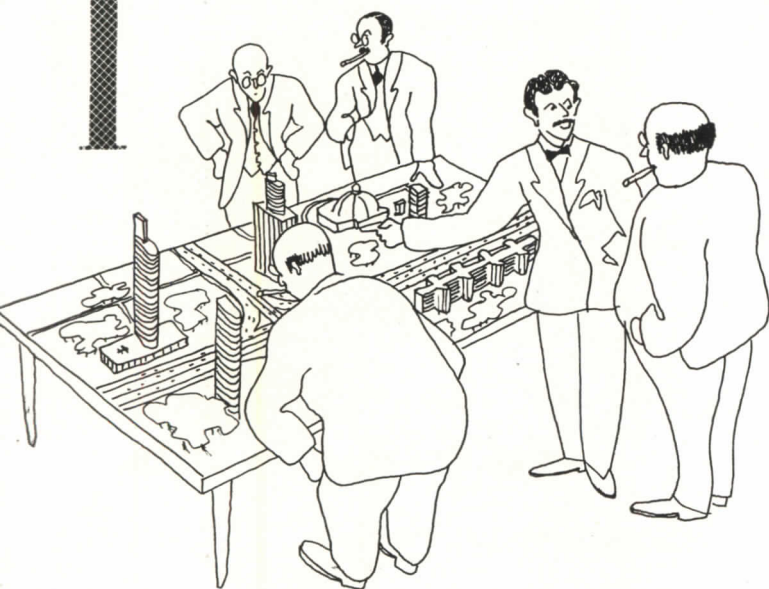
1. The defense housing emergency provides a sobering test: what have we really learned since the last war?
2. And when the defense boom recedes and the international crisis shifts to a domestic one, then what? The foresighted are saying: "Housing in a big way . . . or else ???"

### A BUILDING TYPES STUDY

CATHERINE BAUER, with assistance from SAMUEL RATENSKY, of U. S. H. A.'s Technical Division, surveys the background, attainments, and problems that still face sponsors of multi-family developments, both private and public. . . . And on page 106 EUGENE H. KLABER, F.A.I.A., presents a graphic method of determining the financial practicability of rental projects

# A DYNAMIC EQUATION WITH 3

1



**THE EXPERTS** . . . architects, planners, technicians, welfare people, civic officials, economists, social philosophers. Although their claims vary greatly in emphasis and are frequently even contradictory, a composite definition of their principles will here boldly be attempted:

“By planning, building and operating a large number of dwellings as one unit: (1) first costs may be reduced by standardization, elimination of middlemen, mass purchasing, efficient land use and layout of utilities and streets, and rationalized production methods; (2) annual costs may further be reduced by investment financing and efficient operation and maintenance; (3) pleasanter living may be provided at no extra cost by superbloc planning—substituting playgrounds and gardens and a minimum of access walks and drives for the usual gridiron criss-cross of streets and lots; (4) “blight” and civic waste may be avoided by the use of planned neighborhoods as the unit both for suburban extension and central reconstruction; and (5) essentially the same principles and techniques apply, whether it be housing for middle income families by private initiative, or rehousing the lowest income group with a subsidy by public action—with the added advantage in the latter case of raising the general level of health and civic morale.”

**THE OPPONENTS OF CHANGE** . . . those who guard the status quo, whether from the inertia of habit and established practice, or from direct vested interest. Forces operating against the experts include the following:

Existing street patterns, building ordinances, zoning laws; speculative property values bolstered by congestion or the hope of it, and crystallized by tax valuations. . . .

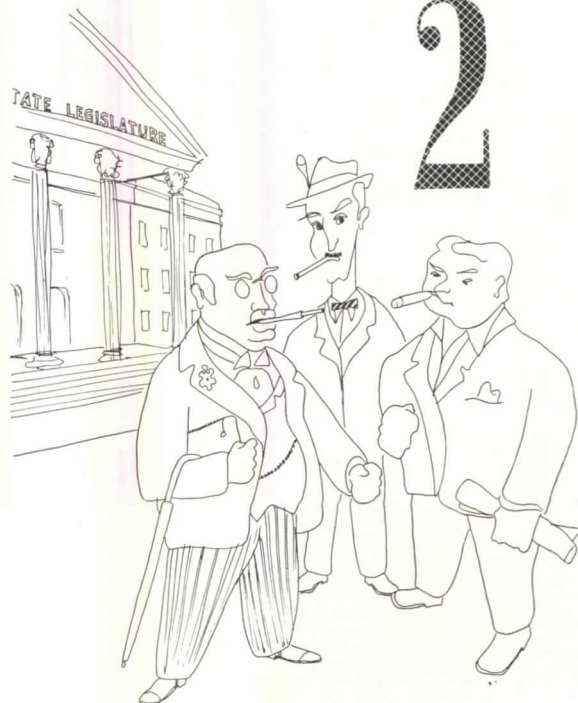
Lot subdividers; the small builder operating on a shoe-string; all builders, large and small, working on a speculative quick-profit basis. . . .

A material and equipment industry horizontally organized (if at all), accustomed to dictating prices and selling through infinite layers of middlemen, and unaccustomed to the principles of standardized mass-production. . . .

Financial institutions geared almost solely to speculative building and the terms of interest and amortization thereby necessitated. . . .

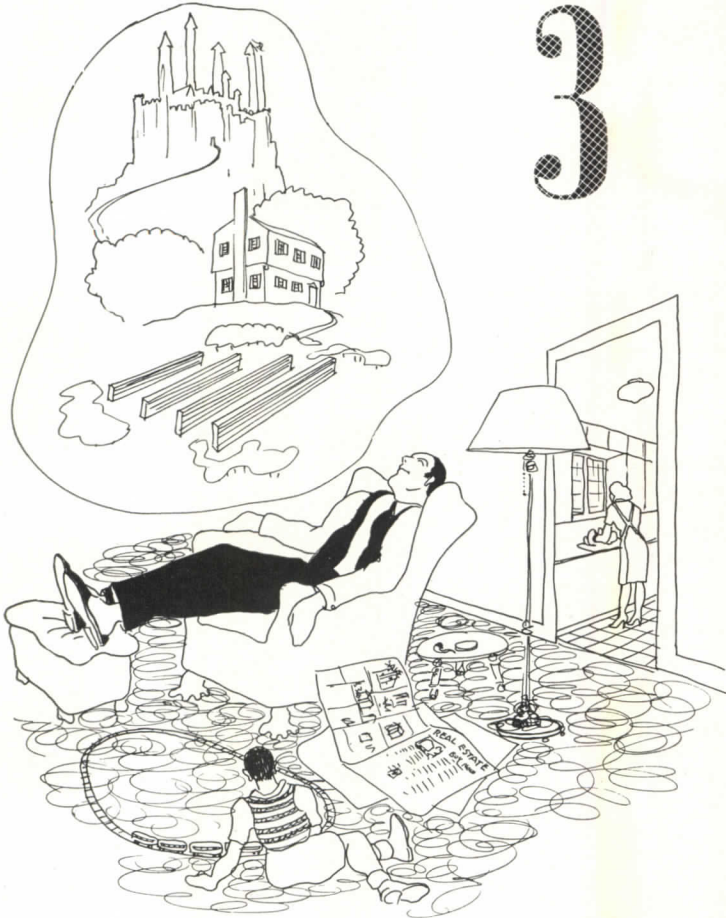
Political opponents of subsidized low-rent housing. . . . But most of all, those who fear that existing presumed values of residential property, set either by speculative hopes or inefficient methods of production, may have to be reduced if better new homes are available at less cost.

2



# ELEMENTS . . . variable but not entirely unknown . . .

## 3



**THE PUBLIC** who, because they choose the home they buy or rent, elect officials and pay the taxes, will really decide the whole matter. The average consumer rarely acts with scientific precision in his own interest, and is frequently swayed by reasons which make the experts tear their hair. But in the long run he usually takes a common sense line. What does he want in a house, basically, and how does this jibe with (1) what he gets now, and (2) what the experts are offering him?

The popular ideal is still for most families a tailor-made house, free-standing and of "individual" design, on a good-sized lot. But actuality is very far from this for all except the favored few. And there are many strong influences at work which should make the "planned project" more palatable, if what the experts claim for it is true. These influences include:

- Increasing identification of health with sun, air, safe recreation places for children;
  - Greater acceptability of apartments, probably due to busy mothers interested in efficiency and convenience rather than conspicuous waste, and also to sad experiences with speculative home-ownership;
  - More family social life outside the home, making individuality of facade less important as a symbol;
  - Vastly increased mobility, in travel and in moving from one town to another . . . (the auto court itself is, for better or worse, a small housing project);
  - The growing idea of "neighborhood" quality and resources as a thing of importance equal to the house itself.
- (N.B. The most recalcitrant representatives of the public with respect to the rational virtues of housing projects are the intellectuals—particularly the large-scale housing experts themselves, who usually live in hideaways in the country or in highly individualistic urban slums. Any really comprehensive and imaginative city plan will preserve at least one badly blighted but picturesque area for the intelligentsia to exercise its ingenuity in.)

... and the equation works this way. If the experts equal E, their opponents, the guardians of the status quo, O, and the public P, then . . .

$$E + P > O \text{ but } E < O + P$$

**The big question is not: Are the experts right and the tight-sitters wrong? But, will the public believe they are?**

Sketches on this and subsequent pages are by William E. Haible and B. Leonard Krause, Research Assistants, Bemis Foundation. Photos not otherwise credited are courtesy USHA, FHA, FSA, PBA

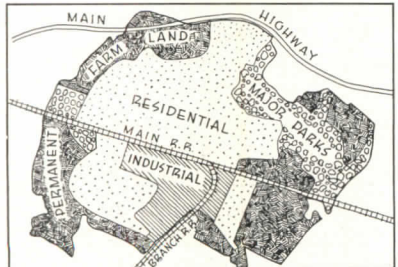
From these

# HISTORIC PRECEDENTS..... we now have

## EUROPE



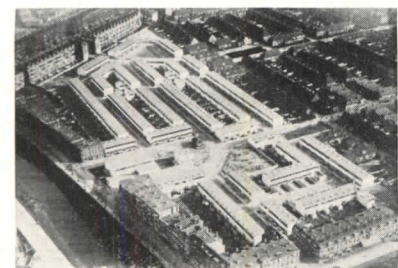
Nyboder, Copenhagen, built 1630



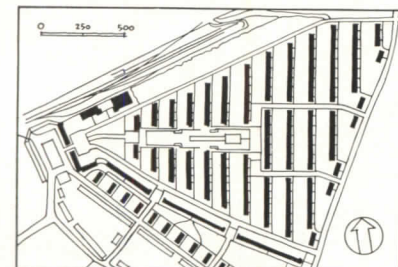
Land-use, Welwyn Garden City, England



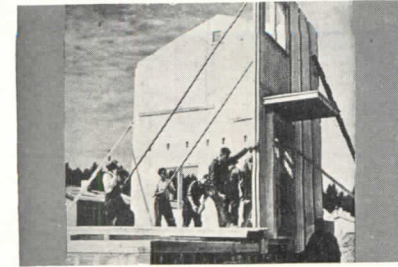
Cul-de-sac, Wythenshawe, Manchester



Municipal project, Rotterdam

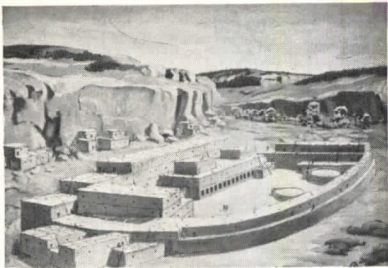


"Zeilenbau" plan, Merseburg (pre-Nazi)



Swedish "self-help" suburban house

## AMERICA



Chetre Keti pueblo in New Mexico



Radburn, N. J. superblocks (original)



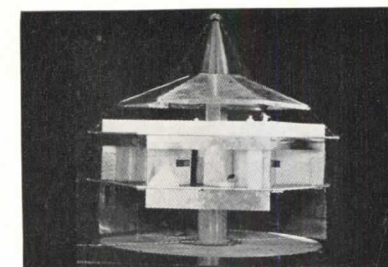
1917 Defense houses, Groton, Conn.



Lakeview Terrace, Cleveland, O. (PWA)



Chatham Village, Pittsburgh



Buckminster Fuller's Dymaxion house

**PLANNING  
IN THE  
DIM PAST**

**UTOPIA  
INTO  
GARDEN  
CITIES**

**PUBLIC  
HOUSING:  
SUBURBAN**

**SLUM  
CLEARING**

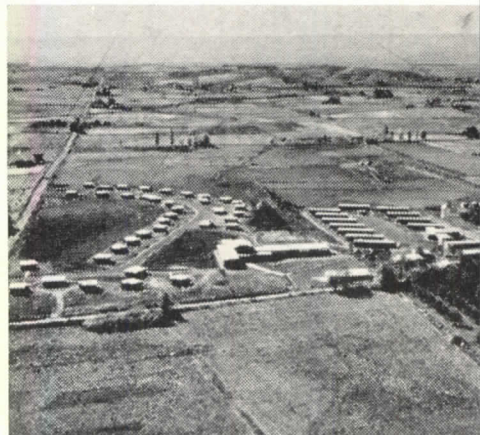
**LIMITED  
DIVIDEND**

**RATIONAL-  
IZATION**

# A PUBLIC HOUSING



Brentwood Park, Jacksonville, Fla.; Mellen C. Greeley, Archt.



FSA in Washington State; houses rent for \$8.25 per month including utilities; one-room shelters for seasonal workers, \$1.00



Newton D. Baker village, Columbus, Ga., USHA-financed, for families of noncoms at Fort Benning; L. D. Haines, Chief Archt.

*Aerial Surveys of Pittsburgh, Inc.*



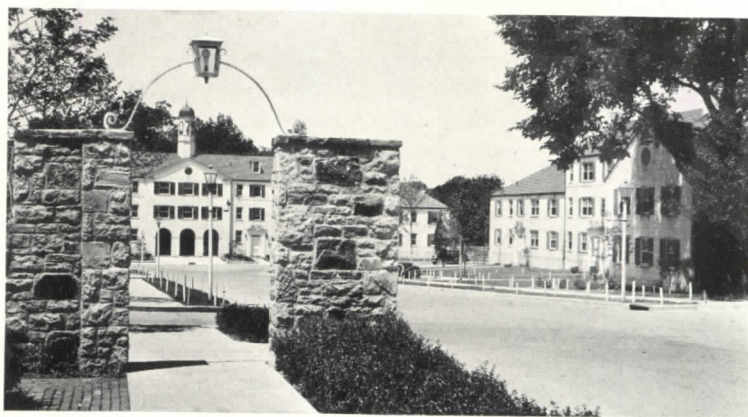
# MECHANISM . . . . . and the beginnings of large-scale

## PRIVATE INVESTMENT HOUSING

**URBAN.** USHA was set up late in 1937. To date there are at least 580 active city and county authorities in 37 states, the District of Columbia, Hawaii and Puerto Rico; 233 of these have funds allocated by USHA. 175 projects, totaling 61,547 dwelling units, have dwellings open for occupancy. 48,363 dwellings are now occupied. Monthly shelter rents average \$12.64, plus \$5.30 for utilities. In the meantime, 33 localities are building 45 defense projects with Lanham Act funds, through USHA.

**RURAL.** There are a few rural USHA projects; most are under the Farm Security Administration, which inherited Resettlement Administration projects (including 3 Greenbelts). FSA now administers 20,211 dwellings in rural housing and tenant purchase programs. 13,825 families now live in its 164 projects. Housing is only part of its rural rehabilitation program, which includes everything from rehabilitating existing houses to construction and guidance of agricultural producers' cooperatives. Recent programs are largely devoted to western migrants' emergencies: mobile camps, grouped shelters with central facilities, 4- and 5-room houses. FSA, because it can operate only under the Department of Agriculture's budget, exists from hand to mouth. Now it is called into the defense housing program, for trailer camps and demountable units.

**DEFENSE.** We're a year ahead of last war in housing necessarily migrant defense workers—but it took 6 months to recognize experienced housing agencies; and their position remains unclear to date. Conservative military antipathies at first ruled out such agencies as USHA: of the first \$100 million appropriated, the Navy is building its share directly; the Army turned to the Public Buildings Administration, which ordinarily builds post offices. PBA also had first crack at the Lanham Act's \$150 million (largely for civilian defense-workers' housing), but value of experience and success of local authorities with 20-odd USHA-financed defense projects have resulted in changes, and the Lanham Act project score now stands: PBA, 32; local authorities through USHA, 45; FSA, 4; TVA, 2; FWA (through local authorities or direct), 5.



Olentangy Village, FHA-insured, Columbus, O., Raymond C. Snow, Architect

**FHA** is empowered to insure mortgages up to 80 per cent of valuation, up to 20 years, on large-scale rental projects. Certain controls on rents and return on equity govern for the life of the mortgage. Maximum interest rate has been 4½ per cent plus FHA's ½ per cent. In many projects community planning principles have been applied, often with great success. FHA has insured 274 multifamily projects for 333,361 families, of which 11 have been refinanced without mortgage insurance. About half a dozen projects have more than 500 homes; "garden" apartments of 2 or 3 stories predominate. Average rent is approximately \$15 per room per month, or \$55 per dwelling—still out of reach of the middle-income group. Olentangy, above, was designed for an average rent of \$14.50 per room, \$50.98 per dwelling; some projects have dwelling rents under \$40.

Since 1938-39, when amendments to the National Housing Act dictated prevailing wages and mortgages limited to construction costs, this branch of FHA activity has been somewhat impeded. Thus it is evident that some problems remain unsolved.

**MORTGAGELESS.** Metropolitan Life's Parkchester in New York is the biggest housing project in the world built and financed all in one operation, and a dramatic example of mortgageless "equity financing." It has 5,000 apartments renting from \$32 for 2 rooms to \$71 for 5 rooms (including utilities). This project is preceded by such successes in 100 per cent financing as Buhl Foundation's Chatham Village in Pittsburgh, and is to be followed by other large projects in California. Insurance and financial institutions need outlets for funds; if Metropolitan can demonstrate that well-planned, well-managed, nonspeculative housing can be safely financed, on terms more reasonable than the usual mortgage, tremendous possibilities are ahead. At last private enterprise can tap the middle-income market—and help out a sadly neglected group.

**ALSO**—In the speculative-home-building field certain trends are worth noting, even if few results are directly pertinent to this study. Fostered mostly by FHA, these include: Virtual elimination of second mortgages; "controlled" subdivisions (sometimes snobbery, often sincere); larger scale enterprise, plus serious attempts at the \$2,500 house, some efforts toward rational building practice.

# THE BIG QUESTIONS...

## 1. IS IT REALLY CHEAPER?

ECONOMIES IN CAPITAL COST have not been spectacular. But as designers, builders and manufacturers have gained experience, costs *have* decreased. And they can go still farther down. However, dwellings remain expensive because we demand such a contradictory variety of services from them.

Average value of FHA's 1939 rental projects was about \$5,000. Through 1940, USHA's average cost per dwelling (including land but excluding site clearance) was \$4,068, with the trend firmly down. Average net construction cost, excluding fees, equipment and overhead, of local authority projects dropped from \$2,948 in 1939\* to \$2,560 in 1940.† In the same localities, average value of residential building permits was \$3,867. And . . . all public and most private large-scale projects are built at prevailing wages; most projects are "fireproof" or "fire-resistant"; and such projects have to be designed for long life and economical maintenance.

The basic question, however, is *annual costs*—economic rent. Here, together with capital cost, we must consider financial terms, maintenance, repairs, etc. We have perhaps learned something. Monthly charges per dwelling (\$3,500 capital cost overall) for a large project recently completed by a western authority are shown in Table 1. Of course, a USHA contribution plus tax exemption would reduce net shelter rent to \$11 or \$12—but it is worth noting that even at \$26, with *no* subsidy, this project would be well within reach of \$1,500-income families, now completely outside the new-home market in this locality.

But on the other hand, on 25-year FHA terms (Table 2), rent would be over \$35—which means a family income of over \$2,000. This difference is vital because at least one-quarter of the families in the area served have incomes between \$1,500 and \$2,000. Even a 1 per cent interest reduction and 40-year financing would open tremendous new markets.

So the answer becomes: It can be still cheaper, though it's already cheap enough to do a necessary job, *if* it can produce neighborhood conditions sound enough to attract capital on a reasonable long-term investment basis.

TABLE I — USHA

Interest @ 3.62%	\$10.50
Operation, insurance, repairs, etc.....	8.50
	\$19.00
Plus taxes if the project is not subsidized.....	7.00
<b>ECONOMIC RENT</b> .....	<b>\$26.00</b>

TABLE II — FHA

Interest @ 4½% plus FHA's ½%	\$16.00
Return on equity at 6%.....	4.00
Operation, insurance, repairs, etc.....	8.50
	\$28.50
Plus taxes.....	7.00
<b>ECONOMIC RENT</b> .....	<b>\$35.50</b>

\*First 4 months  
†Last 6 months

## 2. IS IT REALLY BETTER? ... better than what?



10 million poorest families live this way



These are average American homes



Can you afford this on a \$2,000 income?

## 3. DOES IT HAVE THE EFFECTS CLAIMED? They're hard to measure, but...



Juvenile delinquency is almost non-existent in public housing, though most families come from areas where rates are high. Community facilities are really used; low accident incidence has reduced public liability insurance rates by over 50 per cent; relative health level cannot yet be scientifically determined, but neighborhood clinics are successful



Bad housekeeping, managers report, is no problem; American families respect decent homes when they get them



Evidence that even a very low-rent project stimulates neighborhood improvement, and may (not always fortunately) raise surrounding property values

# SEVERAL THINGS LEARNED

*A few illusions lost...  
some problems yet unsolved...*

## 1. LOCATION . . . *To clear or not to clear...*

EMOTIONAL THEORIZING on this question has stirred up many a local controversy. But there *are* no abstract rules. Each potential site must be weighed as to its relative advantages or disadvantages for the immediate purpose, and for the long-term needs of the community. Usually there are at least four distinct kinds of location possible.

### CENTRAL SLUM SITE

#### ADVANTAGES

Destruction of an eyesore and social problem area.

Convenience to work; minimum displacement of racial or national groupings. Utilities, schools, transportation available.

Possible encouragement of improvements in neighborhood (not always an advantage).

#### DISADVANTAGES

Expensive—hence higher rent subsidies. Difficult to acquire—many small parcels. High cost may lead to “freezing” undesirable densities.

May be swamped if not big enough. Frequent unsuitability of slum sites.

Decrease in supply of dwellings for a year; problem of relocating evicted tenants.

### BLIGHTED AREA

May be cheaper than above, but still convenient, etc.

May have strategic advantage in stopping spread of blight, reviving neighboring districts. (Henry Wright)

Less direct attack on slum problem, plus lack of public education in planning, may undermine popular support. Probability of more homeowners here than in slum areas may mean trouble in acquisition.

### OUTLYING RAW LAND

Cheap, easy to acquire, quick. Can be planned entirely fresh. May protect from spotty subdivision or shantytown blight.

Relieves shortage, at least until “equivalent elimination” develops elsewhere.

By syphoning slum population, facilitates systematic condemnation elsewhere, may facilitate eventual purchase of slum property.

Possible additional municipal cost for new schools, transportation, roads, etc. Possible additional tenant cost for transportation.

Possible encouragement of city expansion beyond ultimate needs.

Undesirability of dormitory suburbs. (If beyond city limits, modest-income families won't pay taxes enough to support adequate services.)

### VACANT SITES IN BUILT-UP AREAS

Cheaper and easier than reconstruction, more convenient than outlying.

Possibility of utilizing sites passed over by subdividers seeking standard footage.

Meager supply of suitable tracts.

Danger of using land which might better be turned into parks.



SLUM: Site of Robt. Mills Manor, Charleston, S. C.



BLIGHTED: Site of Peralta Villa, Oakland, Calif.



OUTLYING: Parkdale, Great Falls, Mont.; A. V. McIver, Arch



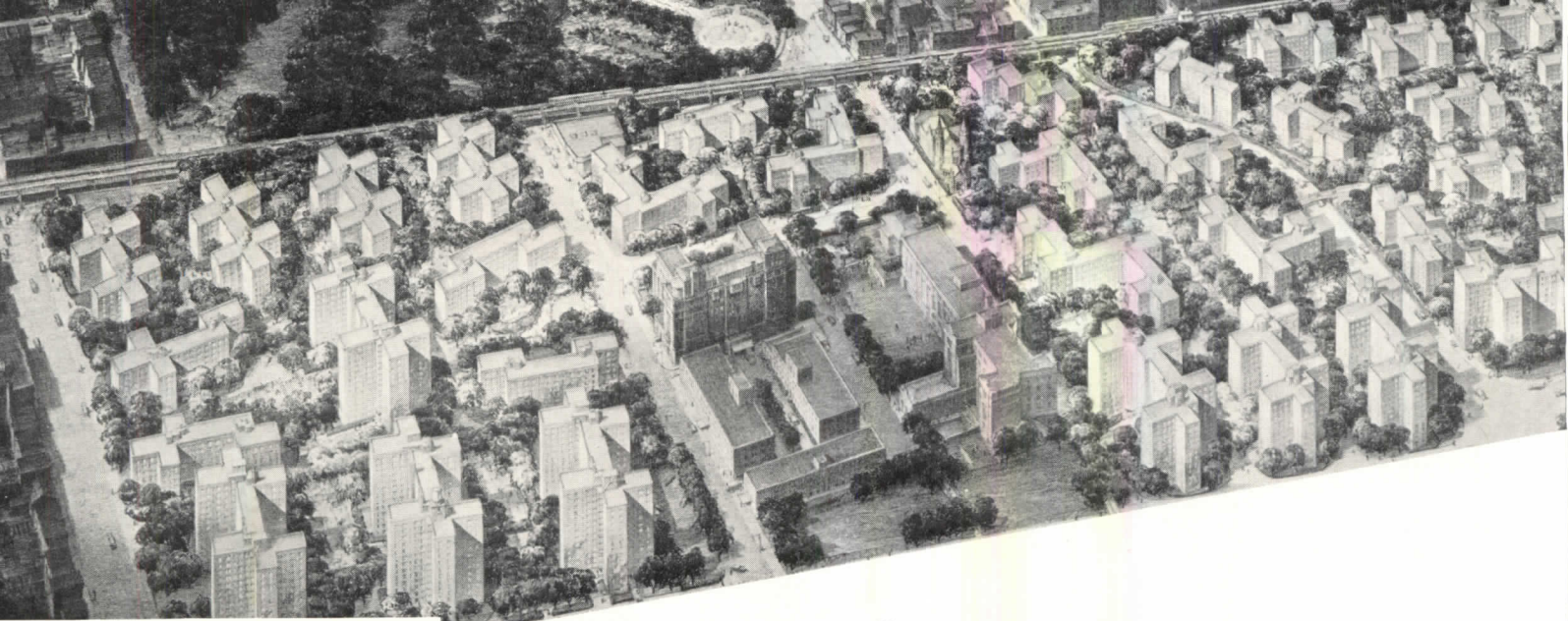
VACANT: No. Blvd. Homes, Tampa, Fla.; M. L. Elliott, Arch

About half the public projects involve clearance and reconstruction; most cities have “balanced programs” with several kinds of site. Private projects rarely resort to clearance; they lack condemnation power. In the east clearance is popularly favored because it is dramatic, and because it may shore up property values. But in the west, slums are spotty, often not recognized as such, and this situation frequently is reversed.

**NEEDED:** Measures to reduce cost of central slum areas. (Systematic condemnation under police power; strict rezoning with adjustments in tax valuations; possibly the English system—pay nothing for *buildings*.)

Regional land-use control to establish specific areas for development, to direct coordinated public and private building, residential and otherwise, into such areas.

Responsible local and regional planning commissions with sound premises as to the whole future development of their communities and hinterland. This means more and better planners as well.



## 2. HOW LARGE IS LARGE-SCALE?

RATIONALIZED large-scale building has certain real advantages and economies . . . but this doesn't mean the larger the better under all circumstances. The principle of super-block, and the use of standard units within a flexible plan, can be successfully applied in very small groups of homes, as witness the Texas project at left. (USHA thinks that under ordinary circumstances economies are not much greater over 300 units, until the Parkchester scale is reached, where Metropolitan was in a position to bargain for the output of whole factories in some cases.)



Contrast Fort Greene Houses, Brooklyn, N. Y. (W. F. R. Ballard, Consulting Archt.), with Rosewood, Austin, Tex. (Page & Southerland). Three groups of associated architects are collaborating on different sections of Fort Greene

**NOT ENTIRELY SOLVED:** Variety of aspect in very large projects, although Fort Greene, by giving a fairly free hand to different groups of architects, is worth watching.

**UNSOLVED:** Variety in the social and economic groups provided for, to avoid unhealthy segregation.

**EQUALLY UNSOLVED:** Methods of fitting private and public action, new construction and modernization, together into a comprehensive rehabilitation scheme, or the orderly development of new suburban communities.

## 3. IN THE MATTER OF STANDARDS . . . . . a revolutionary principle

ONCE MINIMUM STANDARDS of light, air, sanitation, privacy and convenience are accepted in the public interest, and good construction in the interest of long life and low maintenance costs . . . then major class distinctions and symbols of relative pecuniary success are no longer feasible in the general aspect of housing. More space, a few more gadgets, more luxurious materials . . . that's about all.

The only answer to the "too good" argument is that everyone who wants it ought to have housing at least *as good* . . . This principle does not imply regimentation. There is still plenty of room for variety by virtue of different types of use, location, and architects' ideas . . . and for individuality in gardens and interiors.

**THE PROBLEM:** Don't let this principle work backwards, as it did in England where private housing in the late boom apparently had to look "different" from council housing, at whatever cost in stained glass and gimcracks.

MASS  
PRODUCTION

+

RATIONAL  
PLANNING

+

MINIMUM  
STANDARDS

=

ELECTRIC

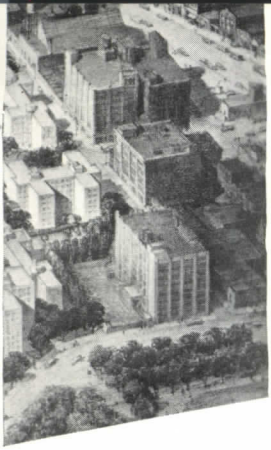


LIGHT

DOMESTIC



RADIO



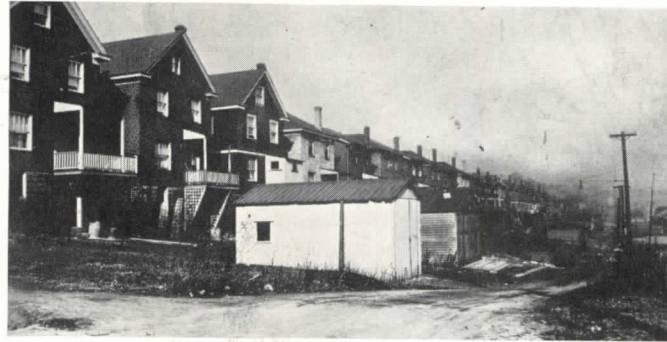
## 4. AS TO SITE PLANNING .....we've learned a lot

**A GOOD SUPERBLOCK** plan really does save money in development over the usual gridiron schemes. (\$200 per family in the cost of walks, drives, garages, water lines, sanitary and storm sewers, according to a recent analysis by Kline Fulmer.)

But the most substantial reason for it is that it makes a pleasant place to live in and bring up children.

**THE LONG STRAIGHT** carefully oriented parallel rows of identical buildings we inherited from modern housing practice in pre-Nazi Germany are still usually the cheapest and most strictly "functional" way to lay out a housing project. . . .

But they can be very dreary, even to a sophisticated modernist eye. Also, the maximum sun at all periods of the year for everyone is not an unmitigated blessing in most parts of this country. Other things must be considered: the view, inward and outward (good or bad); grouping of buildings on a more human, less formal scale; separation of service yards from recreation areas, not necessarily of identical width; and the virtue of supplying different types of accommodation, requiring different building types and heights.



Are the backs of speculative houses . . .



. . . better than a superblock's interior?



First came mechanical rows . . .



. . . but planning is now more human  
(Dixie Court, Ft. Lauderdale, Fla. R. T. Pancoast, Supv. Archt.)

PRIVATE



TRANSPORTATION

MINIMUM



HOUSE

MODERN

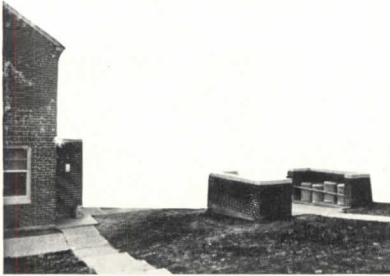


BATH

for the Colonel's Lady AND Judy O'Grady



**COMMUNITY PARKS** with all open space landscaped by the management make handsome air photographs. . . . But private gardens, with row houses and flats, are cheaper to keep up and probably more useful and livable for most American families. (There's nothing wrong with the old theory that you need an occasional neglected garden to prove the others good.)

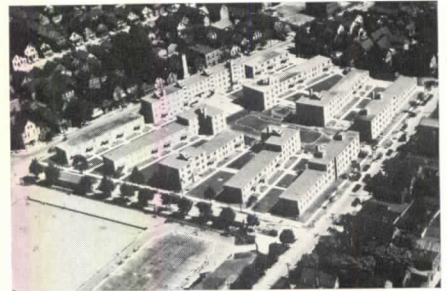


**GARBAGE** . . . Centralized services save time and labor for the tenant. But incinerators, central heat and hot water, etc., are frequently incompatible with minimum or moderate rentals

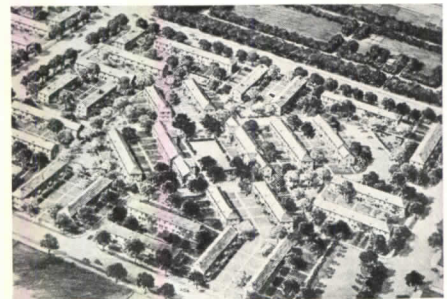


**GARAGES** . . . Most people are willing to walk 300 ft. or more to their cars, in return for a quiet, green, usable environment. In the very lowest rent projects only parking places are provided. Shelters are enough in such moderate rental developments as FHA's Wyvernwood

The whole matter of what is good **ZONING** may have to be reopened. . . . Good modern community planning frequently runs counter to even the reputedly best current zoning ordinances—by grouping homes and pooling open space, by introducing different types and heights of building for variety of use and aspect, and by including such neighborhood needs as shops and community buildings.



**DENSITY** of buildings and population should obviously, according to any sound land-planning theory, be determined by the most suitable type of use for the particular people and area, and the desirable overall density pattern of the city.



But neither housing authorities nor private builders have yet found a way to evade the fact that high land costs seem to predetermine less land per person in the project. Perhaps, when tax payers and city officials are better educated in city planning matters, they may agree to a policy of "breaking" speculative or exploitive land prices by (1) drastic rezoning, (2) reduction of tax assessments in return for low open building, and even (3) public building of—say—two-story homes on the lower East Side, to establish thus dramatically a new standard of land-use for the whole area.



## 5. BUILDING TYPES . . . old and new

**SHIFTING IDEALS . . . SKY-SCRAPERS** and "model tenements" were the romantic idolom for most Cities of the Future in the roaring twenties. . . . But the trend in multiple housing is now definitely toward two and even one-story structures; the top limit for walk-ups has descended from five to four to three stories.



**BASIC PRINCIPLE . . . A GOOD ROW HOUSE** is not only cheaper and more efficient than a free-standing house on a narrow lot . . . it saves useless open space for a park or playground or garden, and actually has more privacy. Also, due to lack of public halls, possibility of private gardens, and tenant maintenance, row houses or 2-story flats can usually be rented more cheaply than equivalent apartment buildings.

**BEST APARTMENTS** are shallow buildings, two rooms deep, as straight and unbroken as possible, with two apartments per stair hall—hence with cross-ventilation. But in elevator buildings where even moderate rents are important, more than two apartments per entry hall are an economic necessity. And even in Queensbridge there had to be wasteful apartment foyers hopefully labeled "dining alcoves." Balcony corridors for outside access are successful on the West Coast.

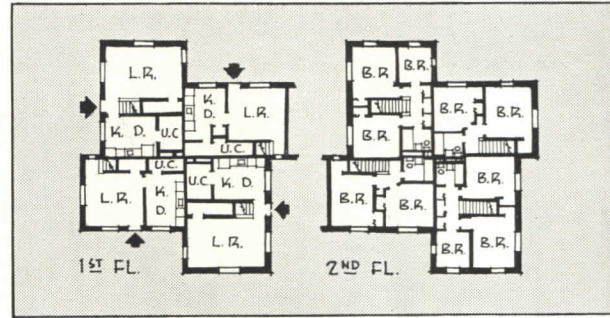
### AND OUT IN THE COUNTRY . . .



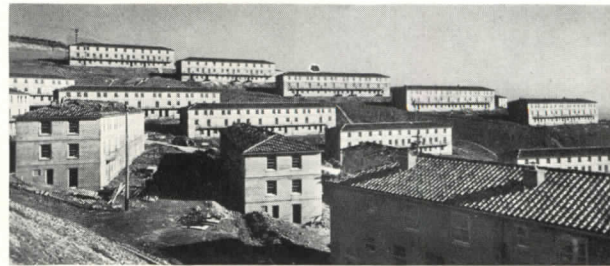
Row houses in FSA's Chandler, Arizona, part-time farm project have adobe party-walls; FSA farm labor homes at Winters, California, are free-standing, in groups. Others provide bare shelter plus central utility buildings



One-story double house, by FSA at Ceres, California



Quatrefoil scheme, from USHA



Three-story duplex, Potrero Terrace, San Francisco



Parkchester, New York; R. H. Shreve, Chief Archt.

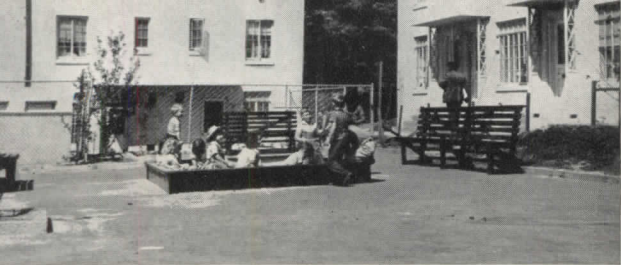


Queensbridge Houses, New York; W. F. R. Ballard, H. S. Churchill, F. G. Frost, B. C. Turner, Archts.



Two-story apartments with outside corridors, California

**TWO THINGS NEEDED:** Modernized zoning and building ordinances; prefabrication research and experiment geared to flexible "group housing" instead of just to individual houses.



PLAY area, Holly Courts, San Francisco; A. Brown, Jr., Archt.



SPRAY POOLS are frequently provided



Social room, Community Building, Oglethorpe Homes, Ga.



Laundry, solar water heater, Dixie Court, Ft. Lauderdale, Fla.

## 6. SOME COMMUNITY FACILITIES . . .

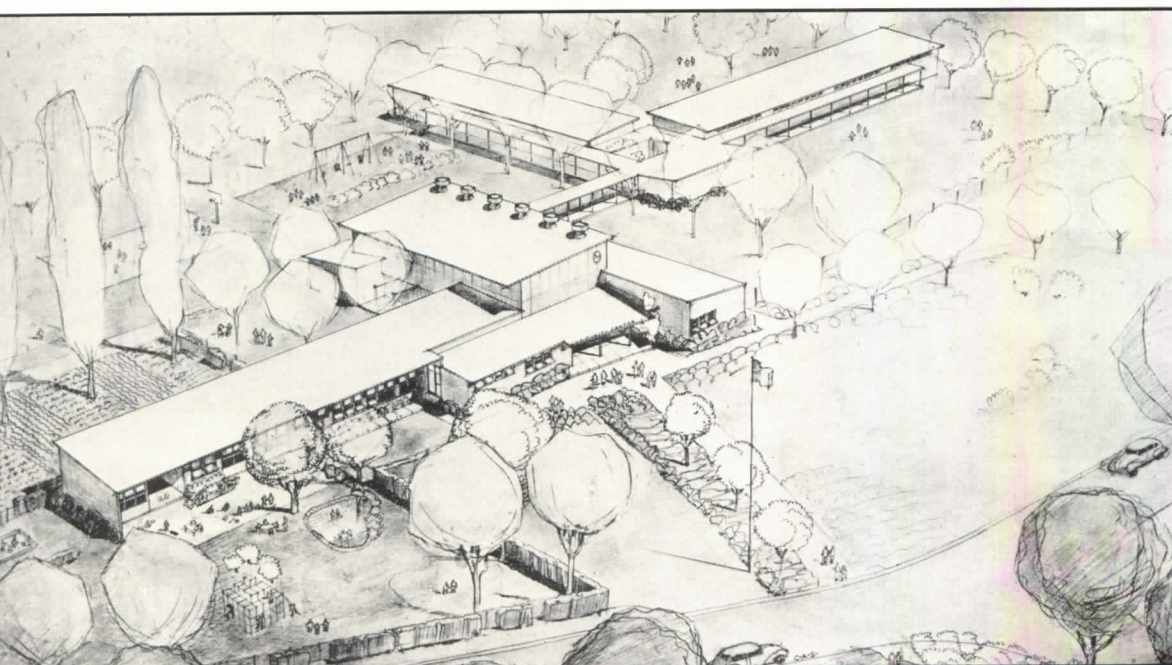
*are now standard equipment*

ESSENTIAL PARTS of the "complete neighborhood" so dear to the heart of the planners are many things besides houses. Most of them cost money, unfortunately, and only the Greenbelt Towns are really complete in any ideal sense. Nevertheless . . . play areas for small children (*never* say "tot-lots") are always provided in USHA and usually in FHA projects.

Some indoor social space, large enough for gatherings, and equipped with cooking facilities and toilets, is also usually provided in public housing projects. Too often this is merely in a basement. Big projects can support real community buildings, however, which may include auditorium, clinic, workshops, etc. A great many critics feel that the major purpose of the low-rent housing program will be lost if we do not raise standards of community facilities. Simple space for a nursery school, usually double-duty, is frequently provided in public housing projects *if* responsibility for operation is assumed by some agency outside the project. As time goes on, this is likely to become standard equipment in every project of any size. Spray pools are often provided, never swimming pools (although the pool at PWA's Carl Mackley Houses in Philadelphia has, by making a small charge, been able to cover more than operating expenses).

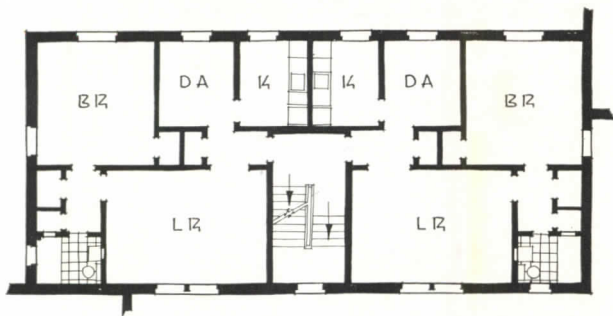
A GENERAL PRINCIPLE for all housing projects: community recreational facilities should be designed for the use of the entire neighborhood and not restricted to project families

AND AN UNSOLVED PROBLEM. Although "built-in" shopping centers would add greatly to the convenience and looks of most large projects, public housing policy never includes stores at present—partly to avoid the gamble of operating them, more to maintain good relations with existing neighborhood retailers

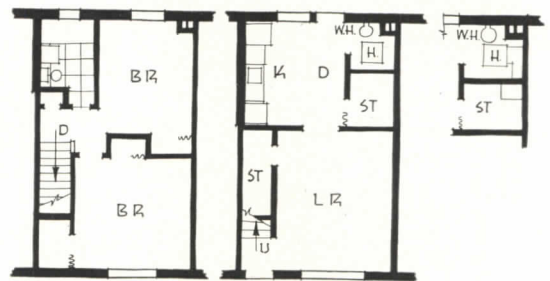


FSA camps' minimum shelter is compensated by such community centers as this, now building at Woodville, Calif., which includes assembly, nursery school, clinic, library, home economics room, and has adjoining school





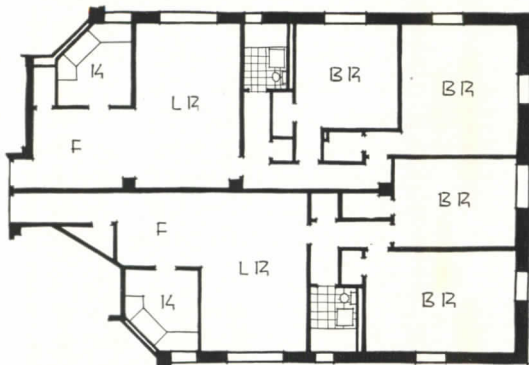
**FHA:** Shallow building only two rooms deep; through ventilation in every apartment; only two apartments per floor per stair hall; minimum corridor area; reasonable closet space; adequate wall space for furniture



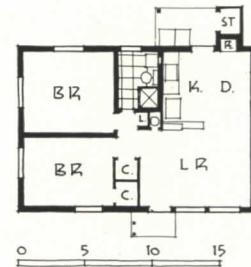
**USHA:** Twinning of plumbing stacks for both kitchens and baths and vertical alignment.

"Zoning" of storage facilities in accordance with management experience:

- a) general storage under stairs
- b) kitchen storage separated from heater room for cleanliness and convenience
- c) heater room directly adjacent to outdoor coal storage
- d) ample dining space in kitchen or living room



**PRIVATE:** Metropolitan's Parkchester, multi-storied and hence requiring several apartments per elevator, cannot provide through ventilation in all apartments. Three different vertical cores, to which may be attached any of 5 typical apartment wings, provided standardization without regimentation. Use of identical baths and kitchens, and similar economy measures, were not allowed to preclude ample furniture space, closets, etc.



**FSA** typical one-story individual house for the west coast. Has one-third acre for subsistence garden. Compact, ultra-simple walls, rooms; minimum hall space; each bedroom sleeps two; couch in living room if necessary; utilities backed; living and work space open through into one another

Above are current standard plans, showing equipment ordinarily provided, and some of the reasoning behind each particular layout

## 7. Rationalized DWELLING PLANS AND EQUIPMENT

**THE BIG ISSUES** frequently center around the small items: When is a *mechanical* refrigerator "too good"? (Congress recently took that one up, in arguing the additional allocations under the Lanham Act.)

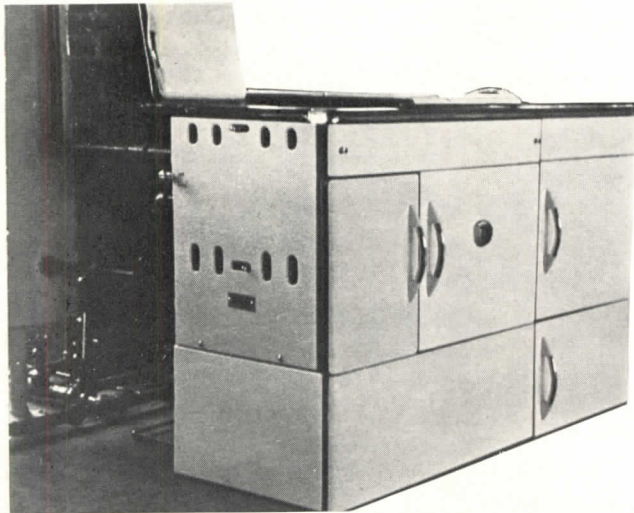
Closet doors for public housing? (Mrs. Roosevelt thinks yes; USHA thinks no, except for one general storage closet.)

Porches and balconies? (Many Europeans say yes; most Americans, at any rate those who "review" projects, say no.)

Can X's "front" door face Y's "back" yard? (Why not, if both X and Y get more livable dwellings and better land-use that way—but will they like it?)

## 8. CONSTRUCTION MATERIALS *and*

Buckminster Fuller's "Mechanical Wing," in which are combined in one mobile unit all essential services, is the most advanced of the theoretical fabricated possibilities. Bath, heater, laundry and kitchen are incorporated in the "Wings" trailer.



"Three-way heater" (coal range, hot water heater and furnace) developed by Anthracite Industries Laboratory with USHA. Complete dwelling units have been successfully undertaken by such pioneers as American Houses, Inc. (Holden, McLaughlin and Associates, Consulting Architects); but by 1940 their 1932 houses asbestos, aluminum, and unashamed—were clothed in shingles—still, however, asbestos. And the frame, for ease of fabrication, has changed from steel to wood-and-plywood, factory-assembled. Both high-rent apartments and low-rent workers' houses have been built

THE "FORD HOUSE" idea, factory-packaged of synthetic materials and delivered hot to your lot, is pretty dead . . . however, the pre-fabricated bath-kitchen unit has some real possibilities. Buckminster Fuller's "Mechanical Wing" is the most advanced expression of this idea, but the American Radiator & Standard Sanitary Corporation has been making progress with a utility wall, kitchen on one side, bath on the other.

Experience with panel fabrication, particularly plywood, does indicate great potential usefulness at least where speed or high salvage value are prime considerations—and we have a right to expect some positive demonstrations in the defense program.

But otherwise, even allowing for the conservative pressure of local building ordinances, union practices, and traditional material interests, the old materials seem to be about the best for most all-round purposes, especially long-term economy.

Except Fort Wayne, the local authorities have admittedly made rather few experiments with new materials or processes thus far. But USHA has done considerable research, often in cooperation with manufacturers, with such practical if unromantic results as the 3-way heater illustrated. A Congressional allocation for bona fide research and experiment through the Bureau of Standards, directed by the housing agencies, would prove very fruitful at this point.

It is only realism to face the fact that, in a program as controversial and experimental as this, in any case, you can't buck everything and everybody all at once. First things must come first—and the first things in this case are proper land-planning, design, job organization, and financing. This means, however, establishing a framework within which any potential innovations in materials, however revolutionary, *can be much more effective* than they could ever be in the present single-lot speculative-builder pattern.

Rational organization of the job (bench fabrication by FSA, precutting by American Houses and others, application of skyscraper-refined production methods to housing work by contractors) has already made considerable strides.

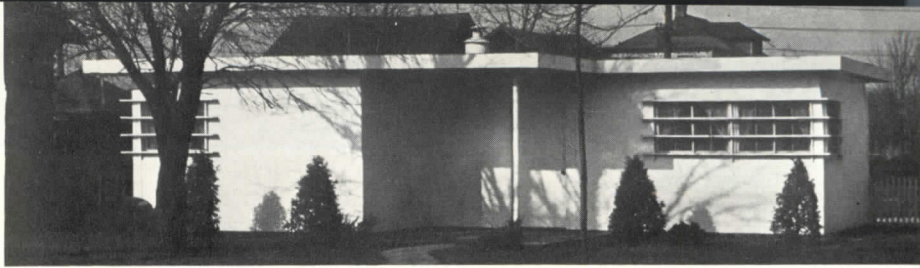
## METHODS

### PROBLEMS, of course . . .

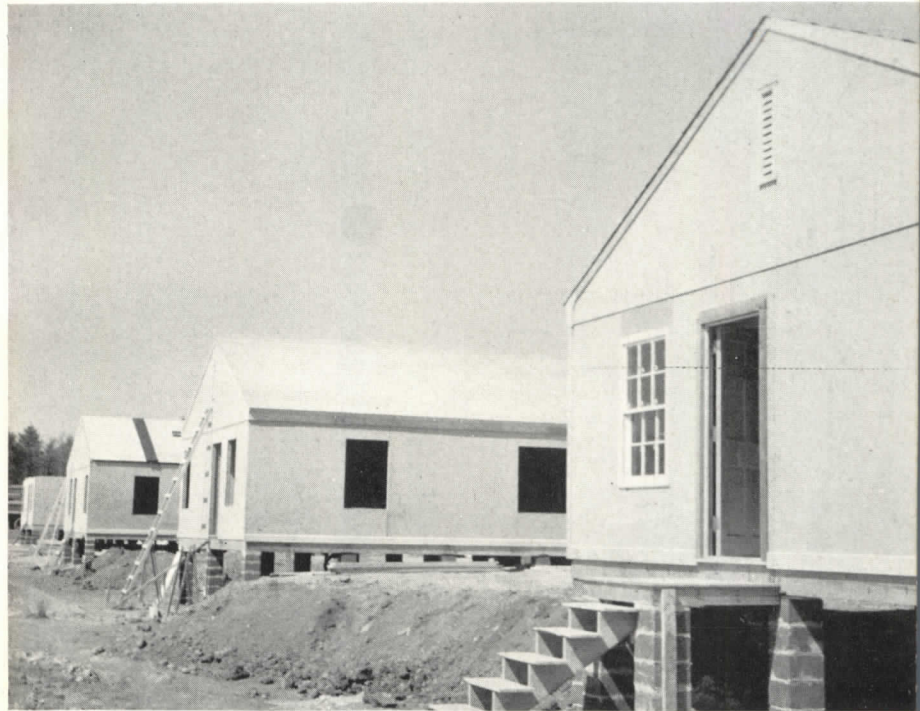
The TNEC recommends to the housing industry:

- Research ("most important")
- Standardization
- Trust- and collusion-busting
- Building code revision
- Scientific management
- Mechanization

Only very large-scale enterprise, private and public, strong enough to say when necessary, "If *you* won't do it, then we'll get it done ourselves," can make a dent in most of these problems.



The Fort Wayne Housing Authority's first project, heard 'round the world, was plywood prefabricated by WPA; houses to be moved from one lot to another (at top). . . . But the same Authority, for one reason or another, now builds much more traditional projects through USHA (above)



A PBA experimental project at Indian Head, Md., of prefabricated demountable houses



Rationalized and mechanized USHA job operation: excavation by mechanical trench diggers



Planned and integrated construction methods on a PBA defense project



Standardized mass production on the site, for FSA farm homes, unimpeded by building codes



## 9. *On the aesthetic side...* IS HOUSING ART?

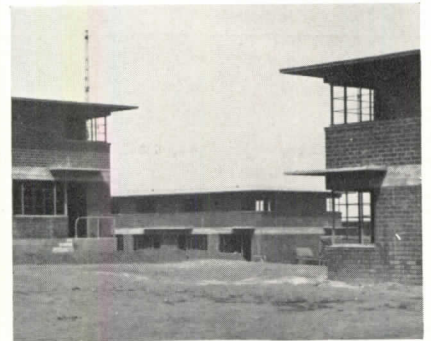
ONE THING IS CLEAR: appliqué "Architecture" merely piddles and cheapens a housing project. Real architectural effect depends on bold masses and arrangement, on landscaping, and on careful design of standard details—especially windows, roofs, and entrances. At least, public housing can't afford even a descendant of gay nineties décor, which can be pretty dull. . . . And nature probably contributes more than buildings to a project's attractiveness.



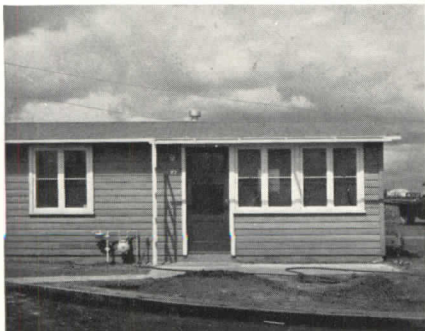
BALCONIES are standard equipment on Swedish and English apartments for use *and* beauty . . . but here the PWA was condemned for such extravagance as this, in Cleveland. Should we relax on this point?



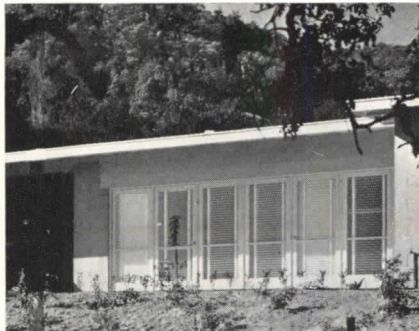
ENTRANCES all treated as "focal points" become ridiculous mimicry in a long row of houses. Even the purest classic taste is better served by the simplicity of Liberty Square, Miami; H. D. Steward, Ch. Archt.



ROOFS with an overhang, like this from Los Angeles county, prevent 2-story brick rows from looking like old freight cars on a siding. They add delicacy, and prevent summer sun's glare. Reginald Johnson, Archt.



WINDOWS can make or break a housing project. And they don't have to be fancy to be good, as witness the plain doublehung sash on the little FSA house at left. High horizontal strip casements frequently merely prevent tenants from seeing anything but another building, and tiny panes are an insult to the planning profession. Glass to the ground gives the double house in a small private California project elegance and openness (right)



**A PROPOSITION:** The tax-payers' investment in public housing has incidentally financed the education of about a thousand architects in the elements of housing design. There should soon be a larger percentage of projects which accomplish more, visually, than mere crystallization of minimum standards. . . . But it's not all the architects' fault. Housing projects usually have to use stock windows, hardware, fixtures . . . and good inexpensive designs are frequently just not available.

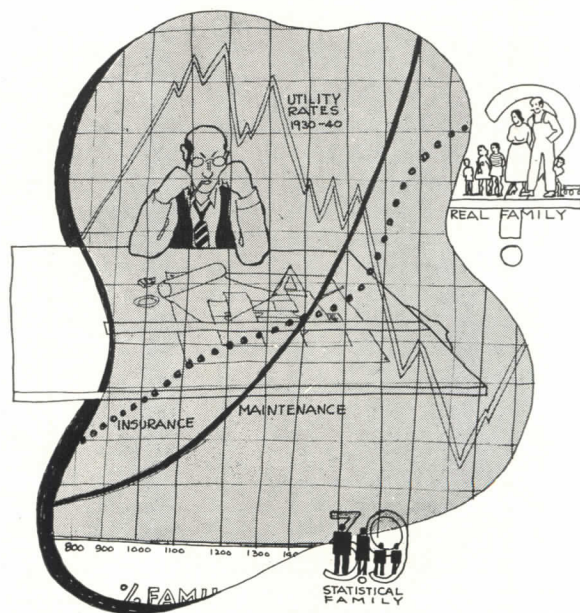
## 10. LARGE-SCALE HOUSING *in* OPERATION

REAL STRIDES have been made in reducing operating expense, the cost of use—including negotiation of wholesale utility rates (reductions now average \$5 per family per month)—and substantial insurance reductions. In one large eastern city, PWA and USHA projects combined to save over \$100,000 annually on electricity.

Experience with tenant maintenance: care of landscaping is an essential and popular part of operating policy in hundreds of USHA projects. In Washington, Jacksonville and other USHA projects, tenants paint dwellings with the management's paint; in many apartment-type units, tenants maintain stair halls.

The local authority or private entrepreneur should hire both a good management chief and architects—and see that they collaborate.

QUESTIONS: Who will live there? And how can some of that deep driving desire of American families to improve their home environment be transformed into a dynamic push for more and better community housing—public *and* private? Is individual ownership possible in large-scale housing, and what strings would have to be attached? Cooperative forms of initiative and management should certainly be devised and encouraged . . . also some means of avoiding paternalism, increasing stability of tenure, and using potential initiative.



Some concrete things already learned: to design community spaces flexibly, for multiple use; to design outdoor space for use, not decoratively; to design heating systems with a temperature range 5° to 10° less than that commonly accepted; importance of, and means of preventing, condensation in roof structures; to locate radiators and openings so furniture can be well placed.

## 11. . . . and finally, the matter of FINANCING

**FOR PUBLIC HOUSING,** financial *methods* are pretty well solved, even though adequate *means* are still a question. The steady decrease in annual subsidies required to reach necessary low rent levels, both in actual dollars and in proportion to capital cost, has amply demonstrated the virtues of this form of assistance—in flexibility, and in maintaining a vigilant regard for economies in both capital and operating costs.

The increasingly interested private market for the bonds of local housing authorities, at rates even lower than the government can legally charge, indicates the probability that very little public capital will be required to do the big public housing job of the future.

But more annual subsidies *will* be required—and these can be made available only by Congress.

**FOR PRIVATE LARGE-SCALE BUILDING,** financing is still one of the biggest headaches. Decent new homes within reach of any large part of the middle third income-group absolutely require better terms than 4½ or 5 per cent for 20 years. The Metropolitan, by demonstrating successful equity financing and direct initiative by a large potential source of investment funds, points one way. There must be others. (The TNEC recommends raising the 80 per cent mortgage-to-value ratio on FHA's insured rental housing projects to 90 or 95 per cent, reducing interest rates, and restricting rents rather than limiting return on equity. This should be given serious consideration, although it raises certain administrative questions.)

**PROBLEM:** How to make public housing the relatively healthy and non-partisan issue in Congress that it already is in hundreds of localities "back home."

**WHAT'S NEEDED,** specifically: Longer term, lower interest financing for large-scale private projects, with enough public control to insure both low rents and the planning standards which would justify reasonable financial terms.

The proper formula for enlisting private as well as public enterprise in planned rehabilitation (such a proposal was recently made to financial institutions in New York for a vast enterprise on the East Side, but it was turned down)—and also in new suburban areas where and as needed.

The proper formula for cooperative enterprise. (A little initiative in this field from some of the housing experts now hidden away on romantic but sub-standard farms would do wonders.)

# ANALYSIS OF RENTAL HOUSING PROJECTS

by EUGENE W. KLABER, F.A.I.A.

Experience with almost two thousand housing projects has shown that at least three projects out of four proposed were never built. Architects, builders and promoters have expended effort and money, only to find their efforts wasted. Frequently this has meant serious financial loss to the architect, first to be asked to spend money on a housing project; but even though his preliminary work has been paid for, there is economic waste involved. What causes this waste? Can it be avoided?

In many cases a project fails of acceptance for a mortgage for reasons that cannot be foreseen. For instance: sponsors feel they have a good site, but lenders disagree; equity money is not forthcoming; legal difficulties prevent acquisition of land; final bids on construction are beyond expectations. These are the fortunes of war.

But there are many cases—in which location is good, equity adequate, sponsors reputable, design competent—which nevertheless are disapproved because appraisal of the project as presented proves it economically unsound. To clarify the analyses here presented, a brief summary of postulates of the appraisal of rental housing projects is in order.

**What is economic soundness?** Economic soundness requires that *value* of the project shall equal or exceed *cost*.

*Cost*, or summation value, of a project is the estimate of the expenditures necessary to produce it. Costs may be grouped into three general categories: cost of land, cost of improvements, and carrying charges during construction.

*Value*, in rental housing, is conceived as the present worth of a series of annual benefits accruing to the total capital invested. Such annual benefits are what is left of the rental after expenses and taxes have been paid, reserves set up for replacements and depreciation deducted. The capitalization of these net benefits is the value of the project; in other words, the amount investors are assumed to be willing to place in a housing venture, with the estimated return as an inducement. Capitalization of future income involves consideration of five principal elements.

- a. How much net income can the project produce when new?
- b. When will it reach full productive power?
- c. If net income will decline with the years, how rapidly?  
(Premise of declining income.)
- d. How long will the project continue to produce a substantial income? (Economic life.)
- e. At what rate of return will the project attract money?  
(Capitalization rate.)

It is not the purpose here to discuss all considerations that enter into the appropriate capitalization factors in a given case. Suffice it to say that the greater the risks presented by a proposed project the higher the capitalization rate. Thus a combination of rentals well below the

market, good neighborhood with prospective desirable growth, presumably low vacancy percentage, and well designed structure may prompt assumption of a capitalization rate as low as 6%, whereas adverse conditions may warrant a rate as high as 10%. As an example: The assumption of the most favorable premise of declining income, an economic life of 50 years, a capitalization rate of 6½% and a deferment of 40% of income during the first year of operation, is an indication that appraisers consider the project highly desirable.

Tables, based on the elements listed above, give factors which, multiplied by estimated net income, indicate value of the project. They also allow for depreciation, so that in practice, net income before depreciation and fixed charges is capitalized into value.

So much for determination of value. What the architect wants to know above all is how much can be spent for improvements. With these he deals directly; when value has been determined by capitalization and the assumption made that cost and value are the same, how much will be available to spend under his direction for land improvements, buildings, landscape work and professional fees? Obviously this amount equals value, minus cost of land, minus carrying charges. That's all there is; if it isn't enough to permit him to design buildings appropriate to the intended use, he may as well drop the deal at once.

As value determines the total to be spent, it becomes evident at once that, as more is attributed to land cost, less can be spent on buildings; indeed when land cost absorbs too large a part of value, no buildings can be built at all. The importance of land cost and land taxation becomes evident in our method of analysis. The higher land cost goes the more it drives the architect into a corner, until at a certain land cost he cannot function. Because land cost is so important, it has been made a variable in our analyses. These start always with what is perhaps the most rigid element in the financial setup—the rental that can be obtained for a given type of accommodations in a given neighborhood.

It is our purpose to show by two examples a method of analysis by graphs which can be applied in advance to housing projects and which will enable architects to avoid some of the pitfalls into which we have seen them stumble. While the method is a close approximation of appraisal technique, it does not pretend to mathematical precision. Minor factors in appraisal have been ignored, e.g., garage incomes. On the other hand, it is close enough to the truth to indicate when a project is in the danger zone of economic soundness.

Since the accompanying graphs represent resultants of whole series of surrounding circumstances, each project will have a graph of its own. As a matter of convenience the projects discussed have been analyzed on the basis of a single room—hence it is of prime importance to determine how much land is attributable to each room in the project.

# BY GRAPHS

## CASE 1

### CONDITIONS OF THE PROBLEM

**Location.** This project is to be erected in New York City, under jurisdiction of the New York State Division of Housing. Hence rental per room may not exceed \$12.50 per rental room per month, or \$13.52 per construction room per month; further, gross area of habitable space may not exceed 2.7 times net land area.

New improvements will not be taxed for a number of years. Taxes will be levied in a predetermined amount and, as improvements are not taxed, will approximate present land taxes—2.98 per cent of assessed valuation.

Present assessed valuation (land) is \$5.00 per sq. ft. and the project must show a return that justifies an assessment between \$4.00 and \$5.00 per sq. ft. High land cost makes it necessary to erect elevator buildings at least six stories high, perhaps higher.

A study of apartment units appropriate to this rental indicates that area of habitable portions of the structure will equal 221 sq. ft. per room.

To operate buildings of this type will cost about \$61.00 per room per annum, including reserves for non-recurring replacements (refrigerators, ranges, etc.).

Since rentals are distinctly lower than similar neighboring accommodations, a low vacancy allowance—7 per cent—is assumed, instead of the usual 10 per cent. It may also be assumed that the project will achieve maximum earning power at the end of the first year, and will earn 50 per cent of the maximum during the first year.

For projects of this type carrying charges during construction average 3½ per cent of the cost of physical improvements.

Can an economically sound project be produced under these circumstances?

### ANALYSIS BY THE ARCHITECT

"I have a double limitation—maximum rental and maximum coverage. Can I design a building that will justify a land value between \$4.00 and \$5.00 per sq. ft.?"

"Starting with available rental, I must investigate the effect of varying land costs starting with zero, to determine the residual amount for improvements. Hence I must determine area of land per room, its cost and taxation at various valuations. Suppose I try successively \$0, \$1, \$2, \$3, \$4 and \$5.

"Since my average area per room is 221 sq. ft., and this may not exceed 2.7 times land area per room, minimum land area per room is 81.8 sq. ft. The following tabulation results:

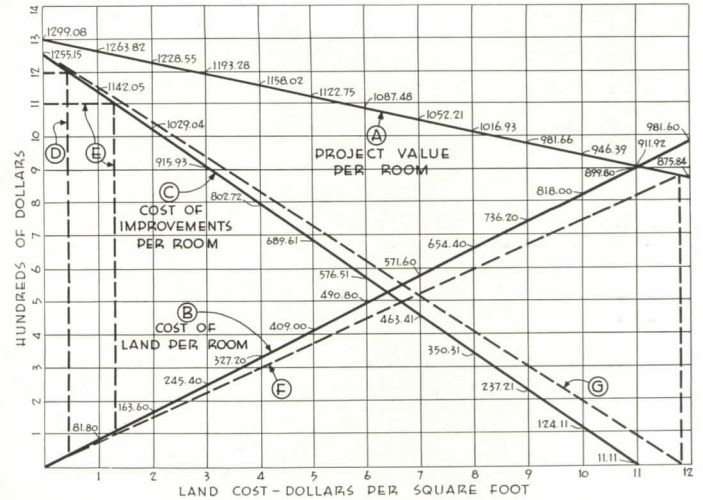
CASE	LAND PRICE PER SQ. FT.	PER ROOM	TAXES PER ROOM @ 2.98
A	\$1.00	\$81.80	\$2.44
B	2.00	163.60	4.88
C	3.00	245.40	7.32
D	4.00	327.20	9.76
E	4.00	409.00	12.20

"With these data I can determine value of project in each case.

CASE	A	B	C	D	E	F
	0	\$1	\$2	\$3	\$4	\$5
Rent per annum @ \$13.52 p. m. . . . .	\$162.24					
Less 7% vacancy equals . . . . .	150.88					
Less operating expense \$61 per an. . . . .	89.88	\$89.88	\$89.88	\$89.88	\$89.88	\$89.88
Deduct taxes on assumed land value . . . . .	0.00	2.44	4.88	7.32	9.76	12.20
<b>AVAILABLE FOR DEBT SERVICE (Net Income)</b>	<b>89.88</b>	<b>87.44</b>	<b>85.00</b>	<b>82.56</b>	<b>80.12</b>	<b>77.68</b>

"Money available for debt service in each case is the amount capitalized to obtain value. No deductions have been made for taxation on improvements; sole variant has been taxation on land. The higher the land price, the greater the deduction and hence the less the net income. Thus it is evident that, other factors being the same, the more the land is valued, the less the project as a whole may be valued.

"Low rental, willingness of bankers to lend on this project at low interest, desirability of the neighborhood, and prospects of continued desirability warrant a very favorable rate of capitalization. I shall therefore assume a 6% rate, 50-year economic life, the most favorable premise of declining income. My appraisal tables indicate a factor of 13.982 times net income, if full income is deferred one year, to which value I must add



the present value of half a year's income. (50% x net income x 0.943).

Cap. factor 6% 50 yrs.	A	B	C	D	E	F
A premise 1 yr. def.	13.982 x availables . . . . .	\$1,256.70	\$1,222.59	\$1,188.47	\$1,154.35	\$1,120.24
Add 50% x .943 x availables	42.38	41.23	40.08	38.93	37.78	36.63
Capitalized value per room	1,299.08	1,263.82	1,228.55	1,193.28	1,158.02	1,122.75

"At this point I can start preparing my graph. I note that each dollar increase in land cost forces a reduction in capital value per room of \$35.27 per room. I can therefore readily project my graph beyond assumed land values. Line 'A', Figure 1, is the plating of the descending total value of the project per room as land value increases.

"If capitalized value equals summation, to obtain possible value of improvements I must deduct land value and carrying charges.

CASE	A	B	C	D	E	F
	0	\$1	\$2	\$3	\$4	\$5
Capitalized value per an. . . . .	1,299.08	1,263.82	1,228.55	1,193.28	1,158.02	1,122.75
Land value . . . . .	0.00	81.80	163.60	245.40	327.20	409.00
Available for improvements and carrying charges . . . . .	1,299.08	1,182.02	1,064.95	947.88	830.82	713.75

"Assuming 3½% carrying charges, divide above results by 1.035 and the following amounts are available for improvements:

A	B	C	D	E	F	
	\$1,255.15	\$1,142.05	\$1,029.04	\$915.83	\$802.72	\$689.61

"I may now complete my graph, showing the ascending line of land cost (B) and the descending line of improvement cost per room (C).

### THE ARCHITECT'S INTERPRETATION OF THE GRAPH

"I have been asked to design structures to justify a land value between \$4.00 and \$5.00 per square foot. My analysis tells me that I must produce them to cost between \$690.00 and \$802.00 per room to include land improvements, landscape work, buildings and fees. Not a chance! I know perfectly well that I can't produce elevator buildings for that. There's something wrong; let's look a little further. To have a proper allowance, land must be valued much less than \$4.00 per sq. ft. Examining the chart again, I find that even if the land is worth nothing my costs may not exceed \$1,255.15 per room, and if the land were worth a little over \$11.00 per square foot there would be nothing left for buildings!

"Let's try to see if we can do anything from the other end. I believe I can design an elevator building to cost \$1,200 per room all told. Line D on the graph indicates that land may not cost more than 44 cents per sq. ft.! This is a far cry from what my associates anticipated; they paid more in cash! I must reduce building cost. If I use three-story walk-up buildings, I can bring it down to \$1,100 per room; we'll try that! Since E indicates that land may cost as much as \$1.35 per square foot, perhaps they may accept this valuation. Originally I was counting on nine-story elevator buildings with 30 per cent coverage. If I use three-story buildings and wish to hold the land price per room down to the same amount, I must triple the coverage—but 90 per cent coverage won't pass code requirements. Hooked again!

"How can I get out of this deadlock? I might assume a higher rental; that will give me more net income to capitalize. When I do that, however, improvements won't be tax-exempt, and taxes reduce net income more than the increase of rental, unless I assume a rental so high that the buildings in this

**ANALYSIS OF RENTAL HOUSING PROJECTS BY GRAPHS (continued)**

neighborhood cannot command it. So I wouldn't be any better off; besides, the added risk would incur a less favorable capitalization rate.

"If I increase the number of stories, I lose tax exemption, because of excessive coverage. I must also consider that I may need more elevators and my open areas will be inadequate.

"I might try a smaller room size; perhaps an average gross area of 200 sq. ft. would give me a plan whose rooms could still rent at \$13.52 P.R.P.M. If I do this my land cost per

room would be  $\frac{200}{221}$  of the costs shown on line B. Plating this line to the point where nothing remains for the buildings gives me lines F and G, the latter being a new series of amounts available for improvements. But now land costs increase only a few cents.

"I cannot therefore avoid the conclusion that, with the necessary rental and area limitations, it is impossible to do a job on this site. Either we must find less costly land, or there is no deal. Cancel that ad in the Times for draftsmen."

**CASE 2**

**CONDITIONS OF THE PROBLEM**

This project is to be erected in a large southern city; the neighborhood is distinctly residential. Growth of the neighborhood has been orderly and there is every prospect that it will retain its desirable character for years.

Land cost is 11 cents per sq. ft. This low price will permit erecting two-story apartments with central heat and hot water. Buildings more than normal dwelling height would not suit the neighborhood. Coverage of 22 per cent is sufficient. This means about 483 sq. ft. of land per room.

Tax rate applicable to both land and building is 0.9125 per cent.

In this desirable section of town a rental of \$12.75 per room per month can be obtained, provided the rooms are of good size.

Sponsors believe this rental can be obtained for the accommodations shown in rough sketches; unit plans indicate an average of 212.4 sq. ft. This type of unit can be erected for about \$1,000 per room including fees and landscape work.

Operation and reserve allowance in this case should be \$45.50 per room per year.

A 10 per cent allowance should be made for vacancies, etc. Carrying charges during construction will run about 3½ per cent of the cost of physical improvements.

This example is somewhat more difficult than Example I, but the basic principle is the same. That is, the graph starts with a land value of zero and covers successively all land costs to the point where there is nothing left with which to build. The added difficulty is the fact that we cannot proceed directly to capitalized value of the project, because improvement cost (and consequently taxes on improvements) are variables. Eventually a deduction from capitalization must be made equal to the capitalized value of this tax.

**ANALYSIS BY THE ARCHITECT**

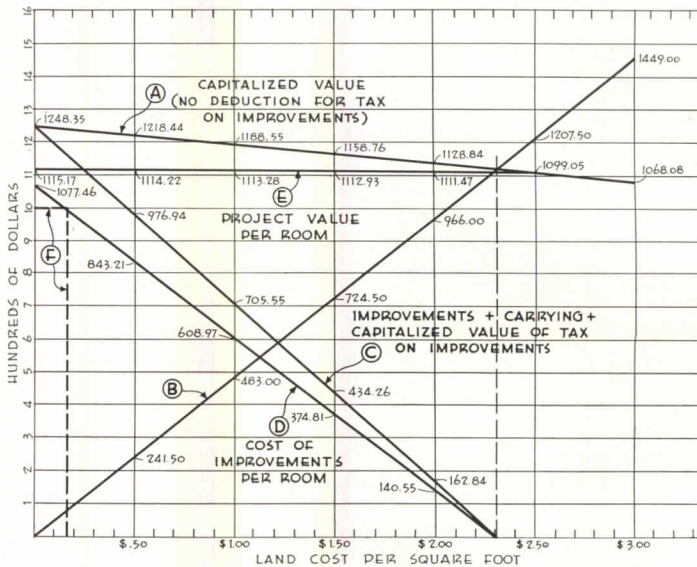
"My analysis is concerned first with variants in land cost and taxation. Unlike Example I, I am dealing with a low land cost, so I'll plot successive steps of 50 cents in land cost per sq. ft. instead of \$1.00. Here, too, I'll work on the basis of a single room. The following tabulation results:

CASE	LAND PRICE PER SQ. FT.	PER ROOM (483 sq. ft.)	LAND TAX PER ROOM (0.9125%)
A	—	—	—
B	\$0.50	\$241.50	\$2.20
C	1.00	483.00	4.41
D	1.50	724.50	6.61
E	2.00	966.00	8.82
F	2.50	1,207.50	11.02
G	3.00	1,449.00	13.23

"Again, the capitalization starts with obtainable rental, with allowances for vacancies, operating costs and reserves, followed by deductions for land taxes. (Taxes on improvements are considered later.)

"As proposed rentals are consistent with the market, not below it, my capitalization rate will not be as favorable as in the previous instance, but I can assume a 50-year economic life. Because the neighborhood is excellent I may assume the most favorable premise of declining income. My tables show a factor of 13.069 for income deferral of one year to which I add 50 per cent of a year's income discounted at 0.939. Here are the results:

	A	B	C	D	E	F	G
Rent per an. @ \$12.75 p.m.	\$153.00						
Less 10% vacancy equals	137.70						
Less operating exp. \$45.50	92.20	92.20	92.20	92.20	92.20	92.20	92.20
Land taxes (bldg. taxes later)	—	2.20	4.41	6.61	8.82	11.02	13.23
Bal. to be capitalized	92.20	90.00	87.79	85.59	83.38	81.18	78.97
Capitalization factor (6½% 50 yrs. "A" premise, 1 yr. deferral) 13.069 x balance	1,204.96	1,176.18	1,147.33	1,118.58	1,089.69	1,060.94	1,031.00
50% income x discount factor .939	43.39	42.26	41.22	40.18	39.15	38.11	37.08
Capitalized value (no deduction for bldg. tax)	1,248.35	1,218.44	1,188.55	1,158.76	1,128.84	1,099.05	1,068.08



"Now I can start my graph, showing lines A and B, the capitalized results obtained and increasing land cost per room. Intersection of these two lines determines the point where land and land taxes absorb everything and nothing is left for improvements: approximately \$2.30 per sq. ft. Again that curious anomaly: when land cost equals capitalized income, I can't build anything to earn that income!

"How much can I spend? First, let's deduct land cost. This gives me line C, a series of values composed of improvement cost, capitalized improvement tax and carrying charges.

"I now determine improvement cost, considering these three elements. Taxes on improvements per hundred dollars of cost are \$0.9125. This is capitalized as follows:

6½%, "A" premise 50 yrs., 1 yr. deferral 0.9125 x 13.069	=	\$11.93
Discounted income 1st yr., 0.9125 x ½ x 0.939	=	0.43
For each \$100 Improvement Cost, deduct from capitalization P.R.		\$12.36

"As \$3.50 must be allowed for carrying charges for each \$100 of building cost as well as \$12.36 for capitalized taxes, the values determined on line C must be divided by 100 + 3.50 + 12.36 (115.86) to obtain improvement cost.

CASE	A	B	C	D	E
Amount on Line C	\$1,248.35	\$976.94	\$705.55	\$834.26	\$162.81
Div. by 1.1586 equals	\$1,077.46	\$843.21	\$608.97	\$374.81	\$140.55

"These values are shown on line D. Finally, to obtain project value we must add improvement cost, carrying charges of 3½ per cent and land cost.

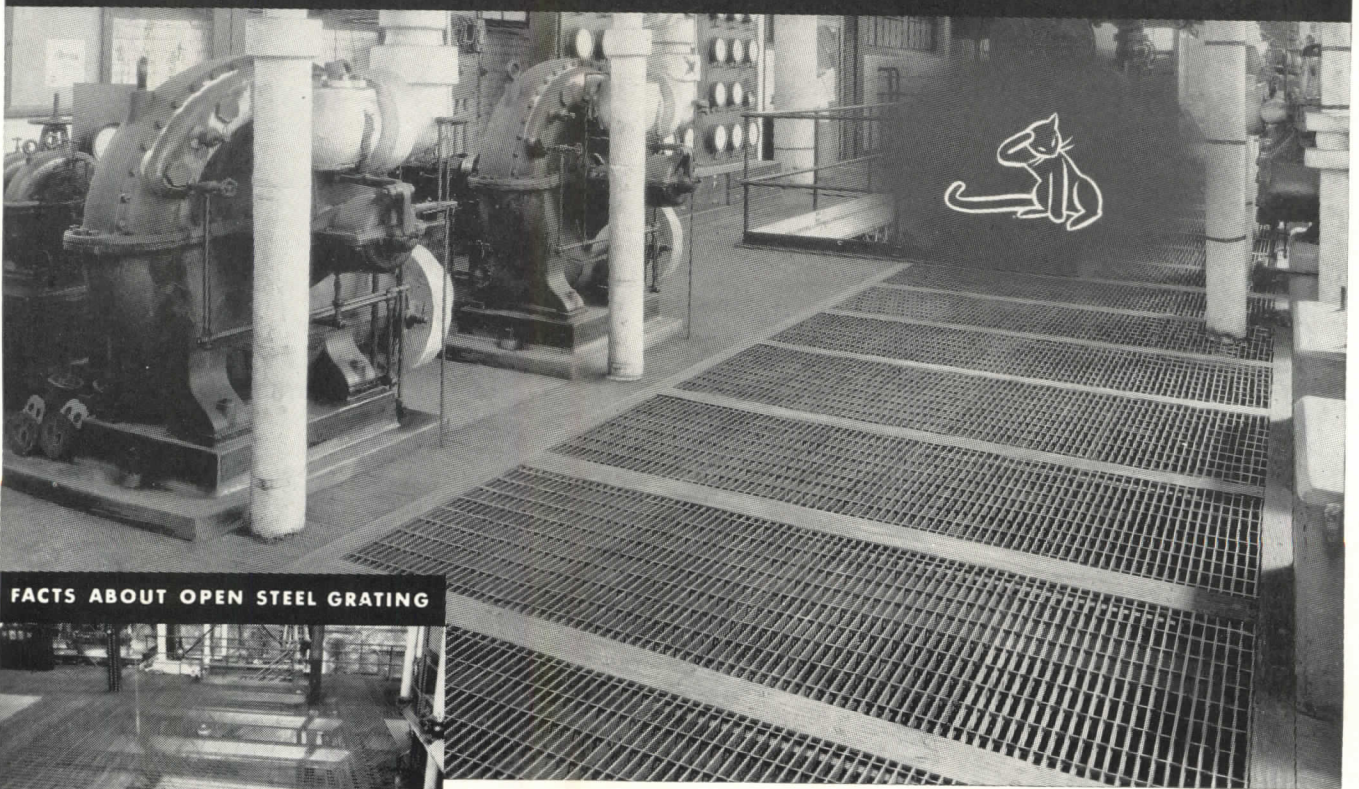
CASE	A	B	C	D	E
Improvement Cost	\$1,077.46	\$843.21	\$608.97	\$374.81	\$140.55
Carrying Charges	37.71	29.51	21.31	13.12	4.92
Land Cost	.00	241.50	483.00	725.00	966.00
Project value P. R.	\$1,115.17	\$1,114.22	\$1,113.28	\$1,112.93	\$1,111.47

"Line E is a plot of these amounts. My graph is now complete. Let's test improvement cost of \$1000 per room. Line F shows me that a cost of \$1000 is consonant with a maximum land cost of about 17 cents per square foot. As our land cost is only 11 cents per square foot we can do the project, in fact there appears to be about \$25.00 per room leeway. We've got a job in the office!"

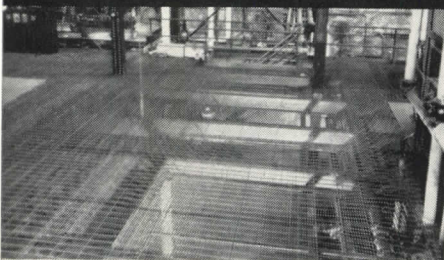
It will be noted that these analyses have been made without plans, without any reference to total area of the land and without any regard to the exact number of apartments, based only on very generalized assumptions of average room area. As stated before, it is only an approximation, but the method is valid and affords a rapid graphic means of testing variable factors between extreme limits.



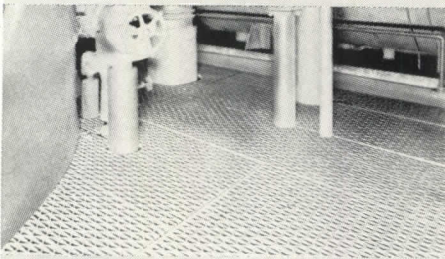
# THIS FLOOR CLEANS ITS OWN FACE



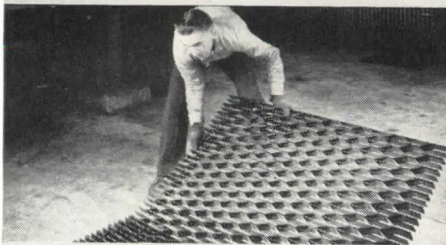
## FACTS ABOUT OPEN STEEL GRATING



**FREE CIRCULATION OF LIGHT AND AIR.** Because of its construction, Open Steel Grating lets light through to spaces above and below—gives free ventilation and escape for fumes and gases.



**ECONOMICALLY INSTALLED.** Every section of Open Steel Grating is built to the requirements of the individual job. This factory layout insures speedy installation and perfect fit.



**LIGHT WEIGHT.** Every pound of material is used, with maximum efficiency to carry or distribute loads—meaning less dead weight lighter supports, reduced erection costs.

FLOORS of Open Steel Grating differ radically from ordinary, old-fashioned floors. They are factory fabricated from a combination of structural members rigidly connected by riveting, welding or interlocking. Though strong and rigid, their weight is the minimum necessary to carry and distribute a given load with an ample factor of safety.

Being open in construction, Open Steel Grating floors and steps do not accumulate dust, dirt, grease, oil or moisture on their bar edges.

Used for outside walks, they do not collect snow, ice or water. *They are virtually self-cleaning—clean their own face.*

This self-cleaning feature is but one of the many you'll find in Open Steel Grating floors and steps. If you are confronted with a problem of securing rigid, durable, non-slip, firesafe floors that can be installed quickly—that will provide maximum air circulation, you'll find the answer, together with detailed specifications, in this new free booklet. Write today for your copy.

*This seal is your assurance of a quality product*



## OPEN STEEL FLOORING INSTITUTE, INC.

**Open Steel Flooring Institute, Inc.**  
Dept. A-5, American Bank Bldg.  
Pittsburgh, Pennsylvania

*Send me, without obligation, your new booklet, "New Ideas in Functional Floor Design."*

Name .....

Address .....

City.....State.....



**NON-SLIP SAFETY.** Open steel gratings cannot accumulate skid-inducing substances—provides an even, non-slipping, stumble-proof surface.



## Flame-Proof Cotton Insulation

RESEARCH into new uses for the surplus cotton in the United States has produced a flame-proof insulating material, the fire-resistant qualities of which are obtained through a process which the manufacturer developed in collaboration with the U. S. Department of Agriculture. Other advantages stressed are the natural repulsion of cotton to water, resiliency and extremely light weight. The material will be supplied in blanket rolls of various widths and thicknesses, which can be cut. It will be sold alone or with asphalt-impregnated paper backing, or in combination with reflective metal insulation, and the largest use is expected to be for walls, roofs and partitions of residential and industrial buildings. Five of the six types are produced in mounted form, with flanges for fastening to rafters, joists or studs of buildings. The flanges, according to the manufacturer, hold the cotton blankets in the center of the wall construction, providing space on either side for the circulation of air, which is said to increase the efficiency of the insulation in resisting heat and to provide for the dissipation of any condensation. Reynolds Metals Company, Richmond, Va.

## Pre-Insulated Concrete Roof Deck

AN INSULATED concrete roof deck, laid up in one operation from pre-cast, pre-insulated concrete slabs is a recent development. The slab is made by inserting a  $\frac{5}{8}$ -in.-thick backing of cane fibre insulation board, having a special asphalt treatment, into a steam jacketed mold for the concrete, which is vibrated at a high frequency, resulting in a high density slab with the insulation board bonded to the upper side. After laying in place on the roof beams, the joints are sealed with a mastic grout, and the insulated deck is ready for application of the built-up roofing. One such deck, 18,



Figure 1

000 sq. ft., is said to have been exposed to the elements all during January 1941 without injury. Cementstone Company, First National Bank Building, Pittsburgh, Pa. (See fig. 1.)

## Self-Sanitizing Cement Contains Copper

RESULTS of a comprehensive investigation upon a new self-sanitizing cement, with applications in public health, and also as a floor surfacing in explosives plants, have been reported by Dr. Michael A. Farrell, head of the Department of Bacteriology at the Pennsylvania State College. This cement, developed at Mellon Institute, contains small amounts of copper and is said to have the ability to prevent the growth of molds and other micro-organisms on its surface. Although relatively insoluble, and washable, it is claimed the minute traces of copper compound that are put into solution when the cement is washed or dampened are sufficient to prevent the growth of micro-organisms. Its use in hospitals and food preparation rooms is indicated, also in shower and locker rooms and barracks.

The growing nuisance of contagious skin troubles, such as "athlete's foot," prompted Dr. Farrell to devote main attention to the molds held to be responsible. He found them particularly susceptible to the new cop-

per-bearing cement and quickly killed by contact with it. The material can be spread in large areas over concrete or wood. While voltages used for lighting and power tools will not travel through it, it will drain away static charges and prevent their accumulation to sparking potentials. Moreover, it is claimed, it cannot give rise to "struck" sparks. These qualities adapt the new product to use as a floor surface where explosive or inflammable liquids are handled. H. H. Robertson Company, Pittsburgh, Pa.

## New Steel Window Well

HEAVY gauge steel makes a new window well, recently announced. The well is reinforced by a steel rod welded to the top edge, and its smooth inside surface is designed to reflect the light and to remain sightly. It is claimed that the fill around the well does not have a tendency to pull the well away from the foundation. Straight and round types and different sizes. 20-year guarantee of replacement. Majestic Company, Huntington, Ind. (See figure 2.)

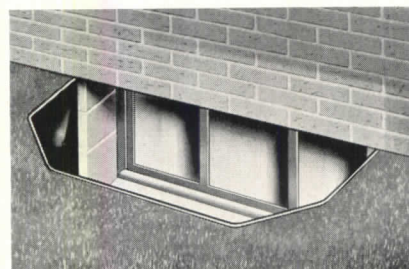


Figure 2

## Wax-Fortified Maintenance Paints

A NEW LINE of maintenance paints for factories, hospitals and public buildings are impregnated with wax particles, producing a finish said to be difficult to mar and easy to clean. S. C. Johnson & Son, Inc., Racine, Wis.

(Continued on page 116)